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A Study of Correlation Between Depression, Fatigue and Intelligence in Parkinson’s Patients

Phansalkar Archana A', Iyer Saraswati2
1Neurology, 2Prof and Guide, Department of Physiotherapy, G.S. Medical College, Parel, Mumbai

ABSTRACT

Purpose of the Study: To evaluate depression, fatigue, intelligence in Parkinson patients and find if correlation exists between them and the disease severity.

Material and Methods: 30 patients with idiopathic Parkinson’s disease (PD) on conservative treatment and who could answer various questionnaire by themselves were selected. Patients with any other neurological disorder or complications were excluded. Patients were assessed on the UPDRS, Hoen and Yahr scale and Schwab and England scale and then were asked questions from the Beck Depression Inventory (BDI) which gave a total score of depression. The patients were assessed for intelligence by the MMSE. The patients were then asked questions from the ‘Fatigue Severity Scale’.

Results: Data were analysed by the statistical test of “Correlation coefficient” and results were obtained as follows:

- Positive correlation between depression and disease severity.
- Negative correlation between intelligence and disease severity, between depression and intelligence and fatigue and activities of daily living.
- 63.3% patients severely affected on BDE.
- 40% mild to moderately affected on MMSE.

Conclusion: There is a definite non motor / Psychological affection in idiopathic Parkinson’s disease have a significant impact on the lives of the patient.

They reduce the interest of the patient in rehabilitation which further increases the bodily (motor) symptoms thus reducing the ‘Quality of Life’.

It is a very unfortunate situation when the psychological aspects of the disease are de-emphasized, not gaining attention in the treatment as the motor symptoms in PD.

Aim:

To evaluate depression, fatigue and intelligence and PD patients and to find if a correlation exists between them and the disease severity.

Depression

It is described as sadness of mood, loss of interest and pleasure in almost all activities. Depression in PD is usually characterized by dysphoria pessimism, somatic symptoms and mild intellectual impairment and is classified as

- Endogenous and Reactive depression
Endogenous depression is due to various neuropathological processes occurring in the disease.

Reactive depression is a mental reaction to motor disability occurring in the disease.

A biological basis explained is:

**MONOAMINE HYPOTHESIS**

The first major theory about biological etiology of depression hypothesized that it was due to a monoamine neurotransmitter deficiency notably Norepinephrine (NE) and serotonin (5HT). 5HT production is analogous to NE and DA except for a requirement of a different amino acid – tryptophan. Thus, these neurotransmitters are very important and their formation if stopped at any stage - Depression.

**NEUROTRANSMITTER RECEPTOR HYPOTHESIS:**

According to this, an abnormality in the functioning of the receptors leads to depression.

**INTELLIGENCE**

The prefrontal cortex is the locus of higher intellect in human beings,

Ablation of the frontal lobes would lead to
1. Inability to solve complex problems, sequencing tasks
2. Loss of ambition,
3. Inability to do several parallel tasks at one time.

The above problems are also seen in our patients. The explanation for this pattern of impairment has been sought by the close anatomical associations between the striatum and the frontal cortex. Delong et al (1984) described two ‘neuronal loops’ connecting the striatum and frontal cortex via the discrete regions of thalamus:

1. Motor loop linking the putamen with the supplementary motor cortex.
2. A ‘complex loop’ linking the caudate with prefrontal cortex.

The intimate functional as well as anatomical association between prefrontal cortex and head of the caudate has been shown causing equivalent impairments following lesions to either region. Also lesions to the nuclei involved in the caudato prefrontal loop had a significant effect on cognitive function, unlike those lesions placed in the thalamic nuclei, involved in the motor loop. (Fig. 1)

The connections between the striatum and the prefrontal cortex also described as Dorsolateral prefrontal circuit., Lateral orbitofrontal circuit., Anterior cingulate circuit. (Alexander et al 1986)

**Fatigue:**

Fatigue is described as a lack of energy, sense of tiredness and feeling of exhaustion which can be due to peripheral mechanism and central mechanism.

Fatigue occurs in any physical or mental illness. Inactivity due to any reason would lead to “stress” and increased fatigability.

Akinesia often feels like fatigue in PD. Muscles fatigue is also due to stiffness, cramps and tremors. Loss of muscle strength reduces stamina and endurance leading to fatigue.

**Integrated scheme of potential mechanism between physical illness and fatigue**

**MATERIAL AND METHODS**

1. Unified Parkinson’s disease rating scale (UPDRS)
2. Beck depression inventory (BDI)
3. Fatigue severity scale (FSS)
4. Mini mental status (MMSE)

**Inclusion Criteria:**

1. Patients with idiopathic PD on conservative Rx.
2. Patients who are able to answer the various questionnaire by themselves.
3. Patients who understand at least one of the 3 languages – English, Marathi, Hindi.

**Exclusion Criteria:**

1. Patients with any other neurological disorder than idiopathic PD.
2. Patients with a history of any surgical intervention for the Rx of PD.
3. Patients having PD secondary to any other cause e.g., Parkinson’s plus syndrome.

**Methodology:**

Patients were first assessed for the severity of the disease using the UPDRS and intelligence by the MMSE. Then they were asked questions from the BDI where the scale was explained before. Lastly, they were asked questions from the ‘Fatigue Severity Scale’ for PD.

**RESULTS**

All the subjects could answer the questions on all 3 scales. The data was analysed by statistical test of correlation-coefficient as follows;

**Table 1.** UPDRS and BDE

<table>
<thead>
<tr>
<th>Samples size</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPDRS</td>
<td>30</td>
<td>25.37±5.14</td>
<td>0.79</td>
<td>22.28</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>BDE</td>
<td>30</td>
<td>9.02±3.18</td>
<td>0.39</td>
<td>2.24</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Correlation was obtained and t-test were observed for correlation-coefficient

**Table 2. UPDRS and MMSE**

```
<table>
<thead>
<tr>
<th>Samples size</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>t</th>
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<td>0.39</td>
<td>2.24</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
```

A direct correlation of Disease severity (UPDRS) and depression (BDE) is seen.

**Table 3. UPDRS and MMSE**

```
<table>
<thead>
<tr>
<th>Samples size</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
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<td>30</td>
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<td>0.39</td>
<td>2.24</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
```

The above table shows negative correlation between UPDRS and MMSE suggesting, intelligence reduces with increase in disease severity.

**Table 4. Hoen and yahr and MMSE**

```
<table>
<thead>
<tr>
<th>Samples size</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoen &amp; Yahr</td>
<td>30</td>
<td>2.28±0.79</td>
<td>-0.70</td>
<td>5.84</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MMSE</td>
<td>30</td>
<td>58.33±14.36</td>
<td>9.14</td>
<td>143.46</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
```

A negative correlation between HOEN & YAHR and MMSE indicates severity increases as intelligence decreases.

**Table 5. BDE and MMSE**

```
<table>
<thead>
<tr>
<th>Samples size</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDE</td>
<td>30</td>
<td>25.37±5.14</td>
<td>0.79</td>
<td>22.28</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>MMSE</td>
<td>30</td>
<td>9.02±3.18</td>
<td>0.39</td>
<td>2.24</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
```

A significant negative correlation between BDE and MMSE is seen indicating depression increases as intelligence reduces.

**Table 6. SCHWAB and England and FSS**

```
<table>
<thead>
<tr>
<th>Samples size</th>
<th>Mean</th>
<th>SD</th>
<th>R</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHWAB &amp; ENGLAND</td>
<td>30</td>
<td>58.33±14.36</td>
<td>9.14</td>
<td>143.46</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>FSS</td>
<td>30</td>
<td>143.46±34.47</td>
<td>9.14</td>
<td>143.46</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
```

The correlation between scale for activities of daily living with the FSS is negative indicating Fatigue level increases as ADLs reduce.

**Table 7. Percentage Afection for Depression**

```
<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>20.1%</td>
<td>16.6%</td>
</tr>
</tbody>
</table>

Hence we see that 40% of our patients were mild to moderately affected on the mini mental status examination.

**Table 8. Percentage Afection for Intelligence**

```
<table>
<thead>
<tr>
<th>Normal</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

<table>
<thead>
<tr>
<th>Normal</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>60.71%</td>
<td>26.16%</td>
<td>13.13%</td>
</tr>
</tbody>
</table>

Hence we see that 40% of our patients were mild to moderately affected on the mini mental status examination.

**Table 9. Percentage Afection For Fatigue**

```
<table>
<thead>
<tr>
<th>Questions from 6.7.9.14</th>
<th>3</th>
<th>4.30</th>
<th>10.17</th>
<th>20.23</th>
<th>10-19</th>
<th>0-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>83.3%</td>
<td>60%</td>
<td>73.3%</td>
<td>70%</td>
<td>66.6%</td>
<td>63.3%</td>
</tr>
</tbody>
</table>
```

Each question of the FSS was evaluated to find percentage affection.
DISCUSSION

From the above results, significant depression (63.3%) is seen in our patients.

A significant correlation is also seen between severity of disease (UPDRS) and depression (P<0.05) as well as scores of intelligence and depression (P<0.01).

The explanation for the severity of depression can be given as

The Serotonin Hypothesis

Depression has been related to the altered nor epinephrine (NE) and serotonin (5HT) metabolism which occurs in pathogenesis of PD. Serotonin hypothesis proposed by ‘Van Praag’ suggests a major role of 5HT in mood regulation based on:

1) Reduced content of 5HT in postmortem cases of depressed patients.
2) Reduced CSF concentration of 5HIAA a principal metabolite of 5HT. Horny kiewicz attributed the reduction in 5HT in PD to “Down Regulation” compensating for the loss of dopamine from nigrostriatal neurons.

The Monoamine Hypothesis

Another explanation given is on the basis of ‘monoamine hypothesis’. A neuropathological co-relation of depression through the involvement of the ventral tegmental area, hippocampus and the entorhinal cortex is discussed. Ventral tegmental area being the source of dopaminergic projections again suggest a role of dopamine loss in depression. (Torrack and Morris)

Neuronal Loss And Lewy Body Formation

Neuronal loss and Lewy body formation was found in Hypothalamus, particularly in the nondopaminergic pathway of the tuberomamillary posterior and lateral nuclei in depressed patients with PD as compared to the non-depressed PD patients. The location of the metabolic changes differed from that observed in idiopathic depression.

The Reward Stress Mechanism

Febiger described the reward – stress mechanism. Dopaminergic neurons of the ventral tegmental area are referred site for self-stimulation in animal experiment suggesting a role of dopamine system in reward and reinforcement. Abnormalities in these systems, diminish the effectiveness and contribute to the loss of motivation and apathy.

The dysfunction of reward -oriented systems contribute to the dysphoric experience constituting the ‘Clinical syndrome of depression’.

A significant co-relation is also seen between depression and intelligence (P< 0.01) and there were about 40% of patients who were scored as mild to moderately affected on the mental status examination.

Charcot Vulpian in 1861 first drew attention to the occurrence of mental changes in PD. Ball & Walshe also opined that PD is accompanied more often than thought by intellectual difficulties

Mjones stated that certain parallelism between the motor and intellectual deficits exists and as the severity of motor deficits increase the degree of mental symptoms also increase which is very well seen in our study with a significant correlation.

A close anatomic association between striatum and the prefrontal cortex is described by Delong suggesting 2 possible mechanisms whereby cognitive loss in PD can be explained:

First is via one or both the lateral orbito frontal and dorsolateral prefrontal circuits where dopamine depletion would disrupt the caudate functions to impair the basal ganglia input to the cortex.

Second mechanism is the direct depletion of dopamine in the areas of frontal cortex which are innervated by ventral tegmental area. (Brozoski et al 1979)

Herve Simon stated that the prefrontal cortex and anterior striatum so called the ‘prefrontal system’ are functionally and anatomically related.

From the results derived for the severity of fatigue we realize that 83.3% patients are fatigued due to depression, long periods of inactivity and heat; 80% patients are less motivated when fatigued , whereas 70% patients experience prolonged fatigue after work / exercise.About 63.3% patients complained of easy fatiguability loosing their patience and feeling drowsy, 50% agreed that fatigue was amongst their 3 most disabling symptoms but only 20% said that it was the most disabling symptom of all.

Fatigue in our patients are due to the effect of mental factors like depression.

Easy fatiguability is also attributed to the increased efforts required by the patients to move and constant attention required to perform any voluntary task which is done subconsciously by a normal person.

One interesting explanation given is the mitochondrial dysfunction observed in PD.
Mitochondria are intracellular powerhouses and produce most of the energy used by the mainly by 2 processes:

- Citric Acid or the Krebs cycle.
- Oxidative phosphorylation (OXPHOS).

The OXPHOS mechanism produces about 10 times more energy than Krebs cycle & more than 90% of ATP synthesis takes place in the respiratory chain by OXPHOS³.

Even a slightest reduction in the mitochondrial output leads to weakness and fatigue.

Reports suggest a linkage between PD pathogenesis and mitochondrial dysfunction where defects in OXPHOS is seen.

CONCLUSION

- A definite non motor/psychological affection in idiopathic Parkinson’s disease is seen.
- A direct correlation between severity of the disease, depression and reduction in intelligence is observed. A negative correlation between the two shows that as depression increases intelligence reduces.
- 63.35% of our patients are severely depressed, indicating Depression as a major factor in clinical findings of PD.
- 60% patients were mild to moderately affected on MMSE and a strong negative correlation between disease severity and intelligence proved it to be an important factor while evaluation of disease process.
- Fatigue was evaluated using the FSS for PD. Every question on the scale was evaluated and %age affection for each revealed that the questions relating to heat, inactivity, exercise increases fatigue by 83.3%
- Fatigue reduces patients motivation and increases other motor symptoms, hampering their physical activities.

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in Parkinson disease
32. Abnormalities of the electron transport chain in
Teliopathic Parkinson Disease and Williams
33. Generalized mitochondrial dysfunction in
Parkinson’s disease detected by magnetic reasons
spectroscopy of muscle
34. Reduced glucose metabolism in the frontal cortex
and basal ganglia of multiple sclerosis patients
with fatigue
INTRODUCTION

Menopause is an adaptation process during which women go through a new biological state. This process is accompanied by many biological and psychosocial changes. During menopause, loss of skin flexibility, a decrease in libido, sexual dysfunction, and an increase in the risk of cardiovascular diseases, urinary tract infections, incontinence, bone loss, and somatic and vasomotor symptoms may appear. Depressed mood, sleep disorders, and other psychological problems reduce the quality of life in postmenopausal women.1 Hormonal therapy has shown to be first line therapy for many of these symptoms. Although hormone replacement therapy (HRT) remains the most effective treatment for menopause symptoms, acceptance and long duration continuation of HRT use is low. HRT may be linked to an increased risk of particular diseases including certain cancers. It is important to therefore investigate alternative interventions to alleviate these symptoms such as ‘exercise’.2 This is particularly relevant today, HRT may not provide post menopausal women, with all the protective health benefits that previously it was thought to provide and because large number of women are now choosing not to take HRT. In mean time, despite the potential difficulties of getting middle aged symptomatic women to exercise regularly as there are no apparent long term adverse effects of exercise in this population and there is good evidence that exercise can benefit other menopausal related symptom as well as a non-pharmacological approach in preventing or treatment of complaints of post menopausal women.3 Lotta Lindh-Åstrand et al study concluded that apart from many other health benefits regular physical exercise may decrease vasomotor symptoms and increase quality of life in postmenopausal women.4 Healthy postmenopausal women gain significant psychological benefit from moderate-intensity exercise. However, exercise participation must continue to maintain improvements in psychological well-being and quality of life.5 Comparably to HRT, exercise affects a multitude of systems and, therefore, may be an alternative option for early menopausal women.6

The role of exercise is important in post menopausal

Role of Aerobic and Resistive Exercises in Postmenopausal Women

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ABSTRACT

Objective of the Study: Menopausal symptom can affect woman’s health and well being. The role of exercise is important in post menopausal women and in the present study we compare the effects of resistive versus aerobic exercises in improving the quality of life and decreasing the menopausal symptoms.

Study Design: Experimental

Methodology: 20 women who had menopause naturally selected, randomly divided into 2 groups, Group A(N=10) aerobic exercises(cycling or walking) & Group R(N=10) resistive exercises(with theraband) for 4 days/week for 6 weeks. Pre-test measures at start and Post-test measures at commencement of 6 weeks were done by Menopause Rating Scale, weight and BMI.

Results: statistically significant improvement in scores of MRS (p<.05), weight reduction (p<.05) and improvement in BMI (p<.05) in both the groups by exercises.

Conclusion: Exercises play an important role in reducing the symptoms of menopause on the MRS.

Key Words: Menopause Rating Scale, Aerobic Exercises, Resistive Exercises.
women and in the present study we compare the effects of resistive versus aerobic exercises for improving the quality of life and decreasing the menopausal symptoms.

Aerobic exercise training is an augmentation of the energy capacity of the muscle by means of an exercise training program.7 Resistive exercise is any form of active exercise in which a dynamic or static muscle contraction is resisted by an outside force. The external force maybe applied manually or mechanically.8

The total score of MRS (Menopause Rating Scale) ranges between 0(asymptomatic) and 44(highest degree of complaints). The scores vary between three dimensions depending on the number of complaints allocated to respective dimension of symptoms, Somato-vegetative-0 to 20, Psychological—0 to 16, Urogenital-0 to 8. The composite score is sum of dimension scores.9

SAMPLE 20 subjects(n=20) included in the study. Subjects were randomly assigned in two groups i.e. Group A (n=10, Aerobic Exs.), Group R (n=10, Resistance Exs.).

Inclusion Criteria- Women 45-60 years age, experienced menopause naturally.

Exclusion criteria- Severe metabolic and endocrine disease; have undergone menopause surgically; receiving hormone replacement therapy; selective estrogen receptor agonists (raloxifene, evista); receiving chemotherapy or radiotherapy; history of antidepressants or antipsychotics; subjects not able to exercise; history of subjects exercising regularly for past six months.

Design: Experimental design. Dependent variable is Postmenopausal symptoms in women; Independent variable is Aerobic and Resistance Exercises.

Procedure: Twenty women fulfilling the inclusion criteria were informed as to the purpose, method, content, usefulness, duration of the study and were included after a written consent. Randomly divided into two groups, Group A, Aerobic Exercise(n = 10) and Group R, Resistance Exercise(n = 10). Details of subjects were recorded: name, age, height, weight, profession, personal history, age when they went through menopause, their most serious health complaint and medications they were using regularly. The Body Mass Index recorded as per formula = weight(kg)/height(m)². Before and after the study of both the groups, menopausal symptoms evaluation was carried out with the help of MRS, as a face to face answer to the questionnaire.

### TREATMENT PROTOCOL

The exercise program designed for 4 days/week for 6 weeks.

In Group A (Aerobic) Prior to the exercise training, a submaximal test on an ergonomic bike was done on the subject in order to determine the instructional workload.

Exercises used in this group were Cycling & Walking(depending on comfort level of individual). Following warm up exercises, 5 subjects trained on ergonomic bike (once a day) and other 5 subjects instructed to walk (twice a day) for 4 days/week for 6 weeks duration.

The progression in exercise protocol was done after every 2 weeks interval of exercise training.

<table>
<thead>
<tr>
<th>Week</th>
<th>Ergonomic bike Group</th>
<th>Walking group-walking duration in each session (2sessions a day)*</th>
<th>Group-cycling duration (once day)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 and 2</td>
<td>20minutes</td>
<td>15minutes</td>
<td></td>
</tr>
<tr>
<td>Week 3 and 4</td>
<td>25minutes</td>
<td>20minutes</td>
<td></td>
</tr>
<tr>
<td>Week 5 and 6</td>
<td>30minutes</td>
<td>25 minutes</td>
<td></td>
</tr>
</tbody>
</table>

In Group R (Resistance) Prior to resistance training Borg’s Perceived Exertion Scale was used to determine elastic resistance regime of individual subject. Each individual subject made to perform exercises on therabands of moderate and maximum strength of resistance to decide for grade of resistance training as per comfort and capacity of each subject. Therabands of moderate grade was found to be appropriately used for all subjects.

The following 10 exercises performed with help of therabands once a day.

**Standing chest press**
- Attach theraband to secure object at shoulder.
- Hold theraband in hands, arms out from side, elbows bent.
- Push forward, straightening elbows.

**Strengthening muscles of back**
- Attach theraband to secure object at shoulder level while sitting on a stool.
- Grasp theraband in hands and hold close to chest.
- Pull backward, straightening the trunk.

**Strengthening of trapezius muscle, both sides by shoulder shrug**
- Stand with arm at sides.
- Stand on theraband, holding band in hand.
- Raise shoulder upwards towards ears and roll backwards.
- Keep elbows straight.
**Strengthening forward flexion both shoulders**
- Stand on theraband.
- Begin with arm at side, elbow straight, thumb up.
- Grasp the band.
- Raise arm in front over head (elbow straight)

**Strengthening abduction both shoulders**
- Stand on theraband.
- Begin with arm at side, elbow straight, holding band, palm forward.
- Raise arm upward, out to side, overhead.

**Strengthening of elbow flexion both sides.**
- Stand on theraband.
- Grasp the theraband in hand, palm up, arm straight.
- Pull up, bending at elbow.

**Strengthening of elbow extension both sides.**
- Attach theraband to secure object at waist level.
- Grasp theraband, thumb up, elbow bent.
- Straighten elbow, keeping elbow at side.

**Strengthening of knee flexors both sides.**
- Attach theraband to secure object.
- Sit in chair, attach theraband to ankle of leg to be exercised.
- Pull heel under chair through full range.

**Strengthening of knee extensors both sides.**
- Secure theraband behind the chair.
- Attach theraband to ankle of the leg to be exercised.
- Sit with legs bent to 90 degrees.
- Straighten the knee.

**Strengthening of ankle dorsiflexors both sides.**
- Sit on a couch with leg in front.
- Attach theraband to secure object in front of foot.
- Attach other end of theraband to forefoot.
- Pull foot backward towards shin.

In each exercise slowly return to starting position and repeat.\(^1\)

Progression in exercise protocol after every 2 weeks interval of exercise training.\(^{12,13}\)

<table>
<thead>
<tr>
<th>Week</th>
<th>Set/exercise</th>
<th>Repetitions/ exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 and 2</td>
<td>1</td>
<td>8reps</td>
</tr>
<tr>
<td>Week 3 and 4</td>
<td>1</td>
<td>10reps</td>
</tr>
<tr>
<td>Week 5 and 6</td>
<td>1</td>
<td>12reps</td>
</tr>
</tbody>
</table>

**RESULTS**

SPSS-8 used for data analysis. The mean pre-test scores for MRS, weight & BMI were nearly same for both groups indicating both groups same at starting point. Details of subjects depicted in Table 1.1, Mean(SD) of MRS, BMI and weight depicted in Table 1.2 and Mean(SD) of MRS scores in three subgroups at baseline and post intervention in Table 1.3 & graphs 2.1, 2.2 & 2.3.

Paired T-Test, Table 1.5 applied within group to compare pretest (Base line score)0 sessions) and post test (after completion of treatment. Unpaired T-Test, Table-1.4 applied between groups. Level of significance p-value<0.05. Within group statistically significant improvement seen.

**Table 1.1 Details of Subjects**

<table>
<thead>
<tr>
<th>Total Number</th>
<th>Subjects in Group A</th>
<th>Subjects in Group R</th>
<th>Age(yrs) Mean (±S.D) Group A</th>
<th>Age(yrs) Mean (±S.D) Group R</th>
<th>Menopause Age(yrs) Group A</th>
<th>Menopause Age(yrs) Group R</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>10</td>
<td>10</td>
<td>50.3(2.9)</td>
<td>50.7(2.0)</td>
<td>47.6 (1.27)</td>
<td>47.4 (1.51)</td>
</tr>
</tbody>
</table>

**Table 1.2 Mean (SD) of MRS, BMI, Weight**

<table>
<thead>
<tr>
<th>Group Name</th>
<th>Pre Exercise MRS Score Mean (±S.D)</th>
<th>Post Exercise MRS Score Mean (±S.D)</th>
<th>Pre Exercise Weight Score Mean (±S.D)</th>
<th>Post Exercise Weight Score Mean (±S.D)</th>
<th>Pre Exercise BMI Score Mean (±S.D)</th>
<th>Post Exercise BMI Score Mean (±S.D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>22.3(2.49)</td>
<td>10.3(1.64)</td>
<td>64.50(7.52)</td>
<td>62.80(7.44)</td>
<td>25.85(3.57)</td>
<td>25.14(3.38)</td>
</tr>
<tr>
<td>GROUP R</td>
<td>21.9(2.77)</td>
<td>13.3(4.16)</td>
<td>68.90(5.49)</td>
<td>65.65(5.54)</td>
<td>26.37(2.67)</td>
<td>24.55(2.46)</td>
</tr>
</tbody>
</table>

**Table 1.3 Mean And SD of Mrs Score at Baseline and Post Intervention**

<table>
<thead>
<tr>
<th>Group Name</th>
<th>Somatic Symptoms of Postmenopause Mean(±S.D) Pre test</th>
<th>Psychological Symptoms of Postmenopause Mean(±S.D) Pre test</th>
<th>Urogenital Symptoms of Postmenopause Mean(±S.D) Pre test</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>7.2(1.40)</td>
<td>11.7(1.57)</td>
<td>3.4(1.089)</td>
</tr>
<tr>
<td>GROUP R</td>
<td>7(0.50)</td>
<td>11.2(1.87)</td>
<td>3.6(1.35)</td>
</tr>
</tbody>
</table>
Table 1.4 Independent Samples Test (Between Groups)

<table>
<thead>
<tr>
<th></th>
<th>T-VALUE</th>
<th>SIG.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT (Pre)</td>
<td>1.495</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>WT (Post)</td>
<td>0.972</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>MRS (Pre)</td>
<td>.339</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>MRS (Post)</td>
<td>2.12</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>BMI (Pre)</td>
<td>.368</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>BMI (Post)</td>
<td>.451</td>
<td>&gt;.05</td>
</tr>
</tbody>
</table>

Table 1.5 Paired T- Test

<table>
<thead>
<tr>
<th></th>
<th>T-VALUE Group A</th>
<th>SIG.</th>
<th>T-VALUE Group R</th>
<th>SIG.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEIGHT</td>
<td>7.965</td>
<td>&lt;.05</td>
<td>19.03</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>MRS</td>
<td>18.974</td>
<td>&lt;.05</td>
<td>10.012</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>BMI</td>
<td>6.536</td>
<td>&lt;.05</td>
<td>4.053</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

Fig. 2.1 Pre- and Post- Test Mean (SD) - Somatic Symptoms of Postmenopause

Fig. 2.2 Pre- and Post-Test Mean (SD) Psychological Symptoms of Postmenopause

DISCUSSION

Until recently, HRT was a popular treatment for menopausal symptoms especially hot flushes and night sweats but the evidence reporting adverse effects of HRT and negative media reports have raised important questions about its use.3

In light of this, our study uses exercises and compares effects of aerobic and resistance training on postmenopausal women using MRS (except for sexual symptoms as no subject reported complaints of sexual symptoms). Women in resistance exercise group had Borg’s Rating of Perceived Exertion scale reading between 11 to 14, while in aerobic training showed the 3 minute step-test response of average, above average and good on heart rate. These readings helped design a comfortable exercise protocol for postmenopausal subjects in study.

Our study shows that both exercise regimes improve the menopausal symptoms. Various authors have also reported the positive effect of exercises in post menopausal women. Physically active lifestyle can reduce the perceived intensity of menopausal symptoms and increase the state of being psychologically fine.1 Study by Grant S etal states exercise sessions of 40-min of aerobic and strength exercises, improved Life Satisfaction Index score in overweight postmenopausal women.14 American college of sports medicine(1998) states that adults should exercise 3-5 days/week at 40/50-80% of their maximum oxygen reserve continuously for 20-60 min or accumulate the same amount of exercise in several daily bouts for a minimum of 10 minutes. Regular brisk walking can produce training effects in postmenopausal women if the total amount of exercise is sufficient. Exercises can be divided into two daily bouts without compromising the training effects16 as done in our study too. Moriyama CK et al study also shows that physical exercises can reduce menopausal symptoms and enhance HRQOL, independent of whether hormone therapy is taken or not17 as seen in our study.

In our study somatic complaints such as hot flush, cardiac problems, sleep disorders and muscle-joint problems decreased in both groups as supported by findings of Ayşegül Aşşıl et al. Resistance training exercise programs also have secondary general health
benefits including reversal of functional decline due to age, prevention of osteoporosis and relief from arthritis.\textsuperscript{15}

A comparison of exercisers and nonexercisers, showed that exercisers' moods were significantly more positive than sedentary women's moods, regardless of menopausal state.\textsuperscript{16} Women who were depressed had more menopausal symptoms than women who were not depressed, and women who exercised regularly were less depressed and less symptomatic than women who did not exercise.\textsuperscript{16} Resistance training exercises has psychological advantages such as alleviation of feelings of depression, loneliness and isolation and improvement in cognitive function.\textsuperscript{17} In our study too psychological symptoms on MRS like depressive mood, irritability, anxiety, mental and physical exhaustion, sexual problems showed improvement in both groups.

In addition to menopausal symptoms other benefits are observed. In study by Brown et al, weight-bearing exercise designed to stimulate aerobic metabolism and bone mass increased fat-free mass and muscle strength in 60±72year-old women. However, HRT with exercise did not produce additive effects on muscle strength,\textsuperscript{20} Regular weight bearing exercises have great benefits on bone mineral density. Walking, which is an easy and safe form of weight bearing exercise that does not require any special equipment, also improves muscle strength, balance, coordination, proprioception and reaction time; and eventually improving postural balance; exercise might contribute to reduce incidence of falls.\textsuperscript{21} Exercise training is strongly recommended in postmenopausal women to reduce coronary artery disease risk;\textsuperscript{22,23} to counter the effects of osteoporosis and to improve body composition and overall health. In addition, regular aerobic exercise is linked to enhanced vascular function, including decreased arterial stiffness and improved endothelial function\textsuperscript{24}; reduces risk of development of cardiovascular problems and hypertension occurring frequently in menopausal period.\textsuperscript{23}

CONCLUSION

Aerobic and Resistance exercises have positive effects on reducing postmenopausal symptoms and improving quality of life.

FUTURE RESEARCH

1. Variations in Aerobic Exercises like swimming, jogging, brisk walking and varied progression in Resistance Exercises in terms of intensity and volume of muscle contractions.

2. Role of yoga and breathing exercises in Menopausal symptoms.

Conflict of Interest: Authors reports no conflict of interest.

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INTRODUCTION

Quality of life is an individuals’ perception of their position in life in the context of culture and value system in which they live and in relation to goals, expectations, standards, and concerns. At patient’s level, quality of life is the result of a complex process of interaction between personal traits, medical outcome, coping behaviour, social support and the quality of received health care. Data derived from quality of life measures are useful in gaining better understanding of patients’ reaction to illness, for developing therapeutic processes and monitoring the efficacy of medical care. It is also used to inform economic analyses and resource allocation as well as to influence health-care policy.

Many studies have reported significantly lower quality of life in stroke survivors than in apparently healthy controls. Others have reported a strong association between physical disability, dependency in activities of daily living and quality of life. Dependency in activities of daily living has been reported to be negatively associated with physical functioning and general health domains of quality of life, but not with the psychological and socioeconomic aspects. A study however, concluded that quality of life depends on much more than one’s level of physical function. Many authors have reported that quality of life is independent of gender. Anderson et al. however, showed that women had better stroke outcome in terms of social functioning and mental health than men.

Quality of Life, Disablement, Comorbidity and Socio-Demographics of Stroke Survivors in South-Western Nigeria

Aderonke O. Akinpelu, Caleb A. Gbiri, Fatai A. Maruf

Objective: The aim of this study was to determine the QOL of SSV in South-western Nigeria and identify factors influencing it.

Methods: Seventy five SSV attending physiotherapy out-patient clinics of all tertiary health institutions in South-western Nigeria between April and July 2004 were recruited consecutively into this survey. Socio-demographic data, duration of stroke, side affected, and co-morbidity were obtained. QOL and motor performance were measured using the WHOQOL-BREF and Modified Motor Assessment Scale respectively. Data were analysed using Mann-Whitney U and Kruskal-Wallis tests at 0.05.

Results: The SSV (45 males and 30 females) were aged 58.8±11.9 years and 14 of them had co-morbidities. Their mean QOL scores varied between 45% and 53% in all domains except the environment domain where it was 28%. Male SSV with co-morbidity scored significantly lower than those without co-morbidity in the physical health and psychological health domains of QOL. Socio-demographic variables, duration of stroke, motor performance and sides affected had no significant effect on any of the domains of QOL.

Conclusion: Our data suggest that co-morbidity reduces QOL in physical health and psychological health domains of male SSV in South-Western Nigeria.

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Conclusion: Our data suggest that co-morbidity reduces QOL in physical health and psychological health domains of male SSV in South-Western Nigeria.
Studies on quality of life of stroke survivors from developed countries are readily available for referencing. Some of the studies compared quality of life of stroke survivors with that of non-stroke individuals. Others reported quality of life of stroke survivors as outcome measure of rehabilitation programme. However, published data on quality of life of stroke survivors in Nigeria are not common. The aim of the present study was to determine the influence of socio-demographic variables, functional disability and co-morbidity on the quality of life of stroke survivors in south-western Nigeria. We hypothesized that each of socio-demographics (age, gender, occupational class, and educational attainment), side affection, duration of stroke, motor disability and co-morbidity would have significant influence on quality of life of participants.

MATERIAL AND METHODS

Seventy-five stroke survivors (40 males and 35 females), recruited over a four month period from physiotherapy outpatient clinics of all tertiary health institutions in South-Western Nigeria participated in the study. Participants have had stroke for minimum of 3 months and had been discharged home for at least one month from hospital admission. Patients who have had more than one episode of stroke and those with aphasia or cognitive impairments were excluded.

Information on duration of onset of stroke, limb side affected and co-morbid conditions were obtained from the hospital files of participants and through interview. Quality of life was measured using the World Health Organization Quality of life measure short-form (WHOQOL-BREF) through interview. A validated Yoruba version was used for participant who did not understand English. Participants’ level of motor disability was rated by one the authors, using Modified Motor Assessment Scale. Occupations were grouped using the GROS classification of occupational status and their highest educational attainment, using the International Standard Classification of Education. Data were analysed using Spearman rank order correlation, Kruskal-Wallis and Mann Whitney U-test.

FINDINGS

Participants (40 male and 35 females) were aged 58.8±11.89 years (33-90 years) (Table 1). Twelve (16%) participants had no formal education, 10 (13%) had primary education, while 31 (41%) had secondary (high school) education as their educational attainment (Table 1). Almost half of the stroke survivors were

Table 1. Frequency Distribution of Socio-demographics and Clinical Characteristics of Participants.

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<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
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<td></td>
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<tr>
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<tr>
<td>&gt;60 years</td>
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<tr>
<td>Age at the Time of Study:</td>
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<tr>
<td>&lt;50 years</td>
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<td>21</td>
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<tr>
<td>50-59 years</td>
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<td>28</td>
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<tr>
<td>&gt;60 years</td>
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<td>51</td>
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<td>47</td>
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<tr>
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<td>34</td>
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<td>Delayed Union of fracture</td>
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<td>7</td>
</tr>
<tr>
<td>Vision Problem</td>
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<td>7</td>
</tr>
</tbody>
</table>

3. Adenoke nigeria 7 th/note 11 (13-18).pmd 14 10/16/2012, 2:40 PM
unskilled workers (47%). Skilled workers and professionals accounted for 34% and 19% of the stroke survivors respectively (Table 1). Sixty-one (81%) had stroke for less than 5 years while the remaining 14 had stroke for 5 years and above (Table 1).

Forty-six had deficit on the dominant side while 29 (39%) of them had deficit on the non-dominant side (Table 1). Almost half (45%) of the stroke survivors had mild disability while 21 (28%) had moderate and severe disability (Table 1). Fourteen had co-morbidities. The most frequent co-condition was diabetes, followed by osteoarthritis and headaches in equal proportion. The mean overall quality of life and overall health items were 3.71±0.98 and 2.61±1.24 respectively while their mean scores in physical health, psychological health, social relationship and environment domains were 44.7±20.1, 49.1±17.5, 53.3±26.8 and 27.8±15.1 respectively (Table 2).

<table>
<thead>
<tr>
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<th>PH</th>
<th>SD</th>
<th>X</th>
<th>PSH</th>
<th>SD</th>
<th>X</th>
<th>SR</th>
<th>SD</th>
<th>X</th>
<th>EV</th>
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<td>Female(n=30)</td>
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<td>43.6</td>
<td>14.2</td>
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<td>25.0</td>
<td>57.3</td>
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</table>

| Post-Stroke of Stroke (Months). |    |    |   |     |    |   |    |    |   |    |    |
| <60 (n=22) | 44.8 | 20.6 | 49.6 | 17.3 | 52.9 | 27.5 | 58.4 | 15.3 |
| >60 (n=31) | 44.2 | 18.9 | 46.6 | 19.2 | 54.9 | 24.03 | 55.0 | 4.1 |
| Test Statistics | | | | | | | | | | | |
| U-Value | -0.08 | -1.00 | -0.19 | -0.74 |
| p-Value | 0.94 | 0.32 | 0.85 | 0.46 |

| Limb Affected. |    |    |   |     |    |   |    |    |   |    |    |
| Domt(n=46) | 40.1 | 13.7 | 46.9 | 14.4 | 51.9 | 24.6 | 55.0 | 13.1 |
| NDomt(n=29) | 51.9 | 26.1 | 52.5 | 21.4 | 55.5 | 30.2 | 62.1 | 17.0 |
| Test Statistics | | | | | | | | | | | |
| U-Value | -1.57 | -0.80 | -0.35 | -1.62 |
| p-Value | 0.12 | 0.43 | 0.73 | 0.11 |
| p<0.05 |

Key: PH = Physical Health Domain Scores, PSH = Psychological Health Domain Scores, SR = Social Relationship Domain Scores, EV = Environmental Domain Scores, Domt = Dominant Limb, NDomt = Non-Dominant Limb

Generally, participants in all educational categories scored lower in the physical and psychological health domains than in social relationship and environment domains (Table 3). There was no significant difference in quality of life scores across educational categories in all domains (Table 3). There was no significant difference in quality of life across different occupational categories in all domains (Table 3). Those with less than 60 months duration of stroke had non-significantly higher quality of life than those with more than 60 duration of stroke (Table 3). Those with non-dominant limb side affected had non-significantly higher quality of life scores, in all the domains than those with dominant limb affected (Table 2). Participants with moderate level of motor disability had the highest quality of life scores in all the domains (Table 4). However, there was no significant difference in the quality of life across the motor disability levels. Those without co-morbidity had higher quality of life than those with co-morbidity in social relationship and environment domains (Table 4).

**DISCUSSION OF FINDINGS**

The finding that males had significantly higher quality of life on physical and psychological health, than their female counterpart may indicate that male stroke survivors are less disturbed about their physical capability relative to the female. The possibility of stroke survivors in this study being more affected in their upper limbs than their lower limbs might put females, who may have to carry domestic chores, at disadvantage compared to males who, once able to move around, may feel less worried about their...
Table 3. Age Group, Highest Educational Attainment, and Occupational Comparison of Quality of Life of Stroke Survivors.

<table>
<thead>
<tr>
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<th>PH</th>
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<th>PSH</th>
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<th>SR</th>
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<td>54.9</td>
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<td>17.8</td>
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<td>17.1</td>
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</table>

Key:
PH = Physical Health Domain Scores, PSH = Psychological Health Domain Scores, SR = Social Relationship Domain Scores, EV = Environmental Domain Scores, NF/P = Non formal/ primary education, Profess = Professional.

Table 4. Comparison of Quality of Life Scores of Stroke Survivors across Levels of Motor Disability and Co-morbidity.

<table>
<thead>
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<td>48.9</td>
<td>19.4</td>
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<td>15.1</td>
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<td>15.6</td>
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</table>

p<0.05.

Although, there was no significant difference in quality of life across different age groups in all the domains, lower age groups tend to have a higher quality of life. This means that age of stroke survivors does not influence their quality of life. However, quality of life has been shown to decline with increasing age, but some authors showed no
differences between younger and older patients. Age distribution of SSv varied across the studies and, also, many of the studies had more than two groups as opposed to this study. Educational attainment, against expectations, did not have significant influence on quality of life of stroke survivors in all quality of life domains. However, those with higher educational attainments tend to have a higher quality of life. The quality of life of stroke survivors across various occupations showed no significant difference in all the domains. This implies that job placement, earning capacity, and social status do not determine quality of life of stroke survivors. The fact that there was no significant difference in quality of life of those with less than 60 months and those with more than 60 months duration of stroke suggests that quality of life fails to change with time even when there is improvement in functional ability. Despite the finding that side of limb affectation does not influence quality of life of stroke survivors, stroke survivors with non-dominant limb side affected consistently had higher quality of life in all the domains. This agrees with that of Ryerson who opined that stroke survivors with right hemiplegia are cautious and disorganized in solving given task while those with left hemiplegia tend to be fast and impulsive. This difference in attitude towards functional activities may hence be expected to bring about significant difference observed in the quality of life.

There was no significant difference in quality of life across levels of motor disability. However, there was a unique trend in the finding with the ‘moderate’ group having the highest quality of life in all the domains followed by the ‘mild’ group except in the environment domain. This finding is in contradiction to a study which indicated a significant difference in the quality of life of dependent and independent stroke survivors in respect to activity of daily living, as well as for with or without hemi-paresis, in the physical activity and social relationship domains of quality of life. The finding in the present study might be due to the fact that the majority of stroke survivors were independent in functional activities. It may also be due to the fact that quality of life usually fails to improve with time as activity of daily living does. The quality of life of stroke survivors with and those without co-morbidity showed a significant difference in the physical and psychological health domains. This contradicts that of Niemi et al. that the quality of life of stroke in the physical health domain is independent of the presence of co-morbidity. This result can be explained in the light of the fact that some co-morbid conditions can compound physical disability and psychological problems with consequent multiplying effects on the physical health psychological health domains of quality of life.

Furthermore, there was no significant difference between the score of stroke survivors with co-morbidity and those without co-morbidity in the social relationship and environment domains. However, those without co-morbidity had higher quality of life in the two domains. The analysis of difference in this study was among different groups of patients as opposed to the same group of patients employed in the previous study. Also, gender and co-morbidity had significant effect only on the physical and psychological health of quality of life of the stroke survivors. It is, hereby, recommended that questions on co-morbid health problems be asked when planning for stroke patient’s rehabilitation.

**CONCLUSION**

Quality of life of Nigeria stroke survivors is low. Co-morbidity reduces quality of life in physical health and psychological health domains of stroke survivors in South-Western Nigeria.

**INTEREST OF CONFLICT**

There is no conflict of interest.

**REFERENCES**


Efficacy of Mesh Glove Sensory Stimulation on Spasticity Control in Hemiplegic C.P.

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ABSTRACT

Objectives: The aim of this work was to show the effect of mesh glove sensory stimulation on spasticity control in hemiplegic C.P children.

Method: Thirty children were enrolled in this study and randomly assigned into two groups; group A(mesh glove sensory stimulation plus traditional physiotherapy program) and group B(traditional physiotherapy program only). Modified ashworth scale was used to detect and follow spasticity control. This measurement was taken before initial treatment and after 12 weeks post treatment. The children parents in group A were instructed to complete 3 hours of home routine program.

Results: Data analysis were available on 30 spastic hemiplegic C.P children and the mean values of the modified ashworth scale grading pre and post treatment in both groups were non statistical significant difference (p >0.05). Mean values of the modified ashworth scale grading in study group pre and post treatment were highly statistical significant differences p<.0001 while the mean values of the modified ashworth scale grading in the control group pre and post treatment were statistical significant difference p<.05 .The improvement of the spasticity control according to modified ashworth scale value in the study group more pronounced than the improvement of the control group.

Conclusion: The combined effect of physiotherapy training plus mesh glove sensory stimulation are recommended to overcome the lack of hand sensory feed-back and lack of its representation in brain.

Key words: mesh glove sensory stimulation, hemiplegic C.P.

INTRODUCTION

Cerebral palsy (C.P) is a non progressive motor disorder caused by pre-natal , peri-natal and post-natal central nervous system(CNS) damage. This disorder is characterized by impaired voluntary movement , possibly perceptual, intellectual and language deficits and convulsive seizures. Children with cerebral palsy suffer from a wide range of motor disturbance.⁵

An acute cerebro-vascular accident (CVA) lead to an initial loss of motor functions followed by abnormally active proprioceptive responses that are clinically recognized as exaggerated tendon reflexes and increased resistance to passive stretch. Recovery of voluntary movements occurs gradually, accompanied by an improvement in motor control and a progressive decrease of spasticity. Movements of distal limb joints and independent finger movements are the last to be recovered. Motor recovery is a progressive process that may cease at any time and patients can be categorized in different functional performance groups according to the level of motor improvement.²³

Major recovery in arm motor functions occurs within the first 3 months slowly reaching a plateau during the sixth month after the onset of hemiplegia.
However, specific training procedures can result in the further improvement of sensory and motor functions by whole hand electrical afferent stimulation “mesh-glove”. The application of mesh-glove stimulation to the affected hand after stroke resulted in the reduction of muscle tone and facilitation of volitional finger movements.4

Beneficial effects of mesh-glove stimulation are suppression of muscle hypertonia, augmentation of residual volitional movement, increased awareness of the affected hand, and decrease of spatial hemi-neglect. The most relevant effects have been suppression of muscle hypertonia, augmentation of residual volitional movement, increased awareness of the affected hand, and decrease of spatial hemi-neglect. This form of whole-hand electrical stimulation is feasible for the restoration of arm and hand functions which impaired by upper motor neuron dysfunction.8

Patients with incomplete recovery of arm and hand function have a wide variety of sensory or motor deficits that manifest clinically as altered muscle tone, exaggerated tendon jerks, and absent or impaired ability to perform volitional movements. Impaired control of parallel and sequential components of previously highly integrated planning, setting, and executing mechanisms of motor control results in the clinical observation of gross pattern movement, incomplete skillful movement, and sometimes only traces of movement of the arm and hand.1

MATERIAL AND METHODS

Subject: 30 hemiplegic C.P with age ranged between 4-7 years at the time of recruitment. The degree of spasticity was evaluated according to modified ash worth scale. Patients were excluded from the study if they had any dermatological problems, seizures and patients on muscle relaxing medication, no botulinum toxin treatment for six months previously.

The thirty subjects that met the study criteria were randomly assigned into two groups:

Group A: Consists of 15 patients (6 females and 9 males) and were treated by traditional physiotherapy program plus mesh gloves stimulation at sensory level.

Group B: Consisted of 15 patients (10 female and 5 male) and were treated by traditional physiotherapy program only.

Outcome measurements:

Modified ash worth scale: The study was a comparative experimental design with a baseline therapeutic procedure of traditional physiotherapy program. The effect of mesh gloves electrical stimulation on hand motor control was compared between study and control group. Skin sensation assessment was carried out on the extensor and flexor compartments of the forearm, intrinsic muscles of the hand of all subjects to ensure that none of them had defective skin sensation. The Ashworth scale is one of the most widely used methods of measuring spasticity, due to its simplicity and reproducible method.

The assessment of spasticity using modified ash worth scale for wrist flexors were carried out prior to the commencement of the treatment sessions (pre-treatment). These assessments were also carried out at the end of the 12th week (post-treatment) on all the subjects. The child keep the elbow as straight as possible. Passively extend and flex the wrist to the point of catching or resistance. Record a score for muscle hypertonia in this position according to the modified ash worth scale grading description.

Intervention

For all children, the programs were conducted three times weekly, for 12 weeks. Each session lasted 45 minutes manual and 40 minutes electrical in addition to 3 hours of home program, day after day three times a week during the treatment period.

Both groups (A and B) received a traditional physiotherapy program, as the following:

1. Hot packs to improve circulation and relax muscle tension applied on the wrist flexors for 10 minutes
2. Facilitation of anti-spastic muscles (wrist extensors): tapping followed by movement, quick stretch, triggering mass flexion, biofeedback, weight bearing, clenching to toes, compression on bone prominence, rapping the muscle, approximation, vibration, irradiation to weak muscles by strong muscles, ice application for brief time
3. Prolonged stretch to wrist flexors to gain relaxation via (positioning, night splint, reflex inhibiting pattern, Bo bath technique) for 10 minutes
4. Passive stretching was performed to tight muscles (wrist flexors) to destruct adhesions in muscles and sheath. For 10 minutes
5. Graduated active exercises were performed for upper limb muscles.
6. Gait training using aids in closed environment using obstacles, side walking then by pass walking to stimulate protective reaction for the hand
7. Balance training program which include static and dynamic training

The experimental group (group A) received specialized mesh glove stimulation at sensory level as following:

The subjects received mesh glove whole hand electrical afferent stimulation with two rubber electrodes placed over the dorsal and ventral aspects of the forearm in two channel stimulator. The electrical stimulation consists of a dual-channel devise with pulse set between 30-40 HZ to produce tickling sensation without visible nor palpable contraction at threshold sensory stimulation but in some children it was necessary to start with 20 HZ. The intensity required to achieve sensory awareness varied from 2 to 10mA. Pulse duration was fixed at 300 micro-second. The electrical stimulation was applied for duration of 40 minutes day after day stimulation for a period of 12 uninterrupted weeks.

The subject was enrolled in a day after day mesh-glove stimulation program which consisted of 20 min continuous synchronous two-channel stimulation just below the sensory threshold then 20 min continuous synchronous two-channel stimulation at the sensory threshold. The first 20 minutes of sub-threshold sensory stimulation would be used throughout the treatment in attempt to further enhance motor functions, 2nd 20 minutes of stimulation at sensory level added cutaneous and kinesthetic input.

RESULT

Patients Characteristics

Table 1 shows the demographic and clinical characteristics of all patients. There were 14 patients (46.7%) are boys and 16 patients (53.3%) as girls. Right hand dominance reported in 18 patients (60%), while 12 patients (40%) were left hand dominance. There was no significant difference between both groups in terms of age (p=0.4317), sex (0.1534), hand dominance (0.4734).

<table>
<thead>
<tr>
<th>variables</th>
<th>Control group n=15</th>
<th>Study group n=15</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>5.67±1.05</td>
<td>5.33±1.23</td>
<td>0.4317</td>
</tr>
<tr>
<td>Sex N(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>5(33.3%)</td>
<td>9(60%)</td>
<td>0.1534</td>
</tr>
<tr>
<td>girls</td>
<td>10(66.6%)</td>
<td>6(40%)</td>
<td></td>
</tr>
<tr>
<td>Hand dominance N(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>8(53.3%)</td>
<td>10(66.6%)</td>
<td>0.4734</td>
</tr>
<tr>
<td>left</td>
<td>7(46.7%)</td>
<td>5(33.3%)</td>
<td></td>
</tr>
</tbody>
</table>

Changes in modified ash worth scale grading:

Mean test scores and standard deviations for both groups are shown in the Table 2. The mean value of spasticity in both groups at baseline measurement (pre-treatment) was insignificant (p>.05). Both groups had a significant improvement in spasticity post-treatment. The average improvement of spasticity tend to being highly significant in the study group (2.53±0.99 versus 1.80±0.94, P=0.0003) than in the control group (2.53±0.99 versus 2.2±1.15, P=0.01). The percentage of improvement of spasticity was (28.85 %) in the study group compared to the control group (15%).

<table>
<thead>
<tr>
<th>Average test of modified ash worth scale grading</th>
<th>Study group</th>
<th>Control group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>Study group</td>
<td>Control group</td>
<td>(Between group)</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>2.53±0.99</td>
<td>2.53±0.99</td>
<td>1.00</td>
</tr>
<tr>
<td>Post-treatment</td>
<td>1.80±0.94</td>
<td>2.2±1.15</td>
<td>0.305</td>
</tr>
<tr>
<td>% improvement</td>
<td>28.85%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>p-values (Within group)</td>
<td>0.0003</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

There are two types of sensory stimulation produced by NMES distal sensory stimulation(mesh glove stimulation) activate sensory cortex and proximal sensory stimulation at infra-spinatus and common extensor wrist which may improve motor skills.

There is not only a lack of movement but also a loss of sensory input from muscle, joint, and skin receptors. It therefore appears that all these factors are likely to play an important part in the construction of motor plans in both C.P and other conditions. The favorable effect of our combination of stimulation at sensory level can be explained by signal increase took place in the primary and secondary motor and somato-sensory areas.

The primary goal of our intervention was to improve awareness and thereby function, and in this respect it differs from most other studies of electro-stimulation in children with C.P, as their main goal has been to improve muscle contraction. As the therapeutic goal in most of these studies of electro-stimulation in children with C.P has been improved muscle contraction, the underlying assumption has been that the sequential function of the muscles of the child can be improved by firing the agonist muscles of the fingers by means of electro-stimulation. Firing of the agonist poly-synaptically inhibits the antagonist or spastic muscle in the reflex arc, thereby reducing the abnormal co-contraction.
NMES at sensory level improved sensory awareness of the impaired upper limb, coordination and the spontaneous use of the limb. Sensory stimulation aims to provide feedback to the brain about the muscles that are activated during therapy. Stimulation at sensory level helps the child to ‘localize’ the muscle he/she is trying to use. The feedback information from the child’s own movements facilitates motor learning. Electrical stimulation applied transcutaneously at an intensity sufficient to evoke a perception analogous to a ‘tapping’ or ‘tickling’ feeling is presumed to activate sensory nerve fibers. The stimulation is applied so that the child is able to detect a sensation, but a muscle contraction is neither visible nor palpable. It is hypothesized that this kind of sensory stimulation increases the awareness of the involved extremity, thereby improving function. Distal sensory stimulation (glove electro-stimulation) below the level needed to feel the stimulus (sub-sensor level) caused sensory evoked potentials. This was interpreted as an activation of the sensory cortex. So sensory stimulation in children with C.P in conjunction with physiotherapy may improve motor skill.9,10

The arm and hand are subject to more complex neuronal control. Before initiating a purposeful motor act such as grasping an object, the nervous system needs information. Vision describes the shape of the object, its location, and its distance from the body. Proprioceptive input defines the condition of the inner world and the position of the limbs and trunk. The brain searches for stored memories of similar situations. Once the object is touched, cutaneous proprioceptive sensation updates the recorded memories of weight, surface, and shape.

The neuro-physiological characteristics of the hand include:
1. Had greater number of muscle spindle and GTO which provide hand with great control
2. Great representation in sensory area via great number of tactile receptors
3. Broad tips of finger to increase exposed area for distinguishing between materials
4. Presence of the web space between thumb and index provide freely movement of thumb to occupy 50% hand function
5. Purely supplied by 15-20% of directly pyramidal tracts on alpha , gamma motor neuron.

one of the major obstacles to the restoration of extensor movement of the fingers by neuromuscular electrical stimulation of the extensor muscles of the forearm has been that successful wrist extension is often accomplished while the fingers remain in partial flexion. To overcome this difficulty, we wanted a surface stimulation approach that would elicit independent finger extension without wrist extension. The objective was to stimulate the whole hand, and we found that this could be achieved with a mesh glove made of conductive wires. This form of whole-hand electrical stimulation is feasible for the restoration of arm and hand functions impaired by upper motor neuron dysfunction.8,10

Diminished afferent input to the brain from the affected hand is a common deficit after stroke. Patients become less aware of their affected upper extremity because of sensory loss and partial paralysis. As a consequence, they use that extremity less and less, learning to use the unaffected arm in its place. Over time, disuse weakens muscles and most likely reduces the representation area of the affected part in the cortex. Stimulation with the mesh glove at levels below sensory perception can diminish the extent of deficit from deafferentation of the hand.3,4

Mesh glove sensory stimulation used to restore arm and hand motor functions after stroke. After 40 minutes of whole-hand stimulation below and at the threshold for sensation, the results are (1) suppression of muscle hypertonia and (2) a decrease in the extent of neglect of the affected side of the body. Prolonged and repetitive mesh glove stimulation below and at the sensory threshold for 40 minutes a day over a period of 12 weeks induces (3) enhanced residual volitional activity of the hand and arm. The responses indicate that, under these stimulating conditions, we can selectively depolarize large diameter muscle afferent fibers and externally increase kinesthetic input to the posterior column nuclei, thalamus, and sensory and motor cortex. Suppression of hypertonia, probably by inhibitory mechanisms related to muscle afferent volleys, is not restricted to the hand but also affects the muscles of the forearm and shoulder. We believe the effect is mediated through an extended spinal-brain mechanism rather than being restricted to segmental reflex mechanisms. Therefore we anticipate that it is the result of synaptic reorganization, changes in connectivity, and probably an increase in the contribution of the unaffected motor structures to the restoration of volitional activity.

The purpose of mesh-glove stimulation is to simultaneously depolarize large diameter afferent fibers of the entire volar and dorsal aspects of the hand. At a stimulation level below and at the threshold for sensory perception, awareness it is likely that primary activation occurs in musculotendinous and joint afferents that are known to mediate kinesthetic
sensation. In general, afferent stimulation was a common feature in all subjects regardless of the actual current intensity. Considering supraspinal and peripheral afferent convergence onto spinal inter-neurons, depolarization of large diameter afferent fibers (primarily activated by electrical stimulation) has been found effective in modifying the segmental and supra-segmental excitability levels and might be responsible for increased pre-synaptic inhibition, if pre-synaptic inhibition is indeed diminished after stroke. Plasticity of the CNS has been recognized as a part of the structural and physiological substrate for recovery of function after brain injury.

Neuro-physiological evidence that cortical reorganization may ensue as a consequence of prolonged sensory input as consequence motor representation areas for evoking a wrist extension movement receive cutaneous input from wide receptive fields located over the volar aspect of the fingers. The evidence for cortical plasticity, in the presence of such functional organization, may provide some insight into the neurophysiological basis for improved hand motor control following a daily program of mesh-glove stimulation.6,7

CONCLUSION

The combined effect of physiotherapy training plus mesh glove sensory stimulation are recommended to overcome the lack of hand sensory feedback and lack of its representation so improve motor control of upper extremity in hemiplegic C.P children after 12 weeks follow up. Mesh gloves stimulation at sensory level can be used as an adjunct to physiotherapy and/or occupational therapy in children with spastic hemiplegia

REFERENCES

Rehabilitation of a Patient with Post Traumatic Triple Nerve Palsy of the Upper Limb

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ABSTRACT

Post traumatic triple nerve palsy in the upper limb is rare and usually follows the unregulated use of a tourniquet, severe proximal limb injuries and near total amputations. This paper describes a peculiar case of triple nerve palsy complicating a closed humeral fracture and a low median and ulnar nerve palsy in the same limb due to a mid forearm level glass-cut injury. The challenges in rehabilitation included: lack of extensors and intrinsic muscle function initially that made flexor tendon rehabilitation difficult; a wrist drop and finger drop deformity that became more apparent after the flexor tendon rehabilitation; gradual onset of intrinsic minus deformity as the radial nerve spontaneously recovered. The orthotist had to make special splints and the rehabilitation team had to tailor the therapy at every stage of nerve recovery to provide optimal function without the development of contractures.

Key words: Triple Nerve palsy, Cock up Splint, Opponensplasty

INTRODUCTION

Multiple nerve palsies usually follow neuropathic conditions. The term triple nerve palsy was used in the past with regard to multiple nerve palsies involving the radial, median and ulnar nerves; encountered in Hansen’s disease. Following trauma however the incidence of dual nerve injury is common, especially involving ulnar and median nerves in wrist or forearm level trauma. Published literature on a combination of radial, ulnar and median nerves are very few. This report endeavours to describe the management and rehabilitation of a peculiar case of trauma that present with paralysis of all these three nerves.

MATERIAL AND METHODS

The patient in this study is a 24 year old male who had sustained a closed trauma to the right arm and a penetrating injury at the mid forearm level by broken glass pieces of the rear view mirror following a road traffic accident. Clinical evaluation revealed an isolated closed fracture of the right humerus with a radial nerve palsy and multiple flexor tendon injuries and median and ulnar nerve palsy at the mid forearm level of the same limb.

Surgical compression plating of the humerus was done the same day during which the radial nerve was inspected and found to be continuous. The mid forearm laceration was debrided and the injured flexor tendons, median, ulnar nerves and the ulnar artery were repaired. The tendons were repaired using a four strand 3-0 braided, polyester core sutures (described by Mc Larney et al and 6-0 nylon running epitenon sutures). Both nerves and the ulnar artery were repaired under a microscope with interrupted 9-0 nylon micro sutures. The wound was primarily closed and the forearm and hand was supported by dorsal and volar slabs allowing early wound inspection.

FINDINGS

The presence of a radial, median and ulnar nerve palsy in the early stages of rehabilitation meant no active extension of the interphalangeal (IP) joints were possible. This prevented the use of the active -passive modified Klienert’s protocol of flexor tendon rehabilitation.

In the first stage of the flexor rehabilitation an all passive regimen of flexion and extension of the IP joints
was started. The forearm and hand were supported by an extension block splint. The therapist took particular care to avoid flexion contractures at the IP joints. At the end of four weeks and the commencement of the second stage, the patient was allowed supervised active flexion, while the fingers were passively extended by the therapist. A broad padded Velcro strap kept the fingers extended at the IP joints and supported on to the dorsal extension block when they were not mobilized. The patient was allowed passive flexion and extension of the IP joints at home. The dorsal extension block was gradually extended at the MCP joint level from the fifth week to allow gradual extension at the MCP joint level.

By the end of the sixth week and the commencement of the third stage of flexor tendon rehabilitation the MCP joints could be brought to neutral by passive extension. Since the patient had an associated radial nerve injury at the level of the arm, following removal of the plaster, the patient demonstrated a finger drop deformity at the MCP joint level. The lack of functioning intrinsics prevented active extension at the IP joints. A modified dynamic cock up splint (orthosis) was provided (figure: 1). An additional volar resting splint keeping the wrist in neutral, MCP in 60 deg of flexion and IP joints extended was given for use at night.

At the end of the tenth week the flexor tendon rehabilitation was stopped the traction outrigger of the orthosis was removed and the remaining volar splint was used as a cock up splint to prevent a wrist drop. The patient was asked to passively extend the MCP and IP joints regularly to keep the joints supple.

The patient began to show wrist extension and finger extension between the 12th and the 14th week indicating a late recovering neuropraxic injury of the radial nerve. The volar splint which is usually discarded at the tenth week in the standard flexor tendon rehabilitation, was in this case was used till the finger and wrist extensors began to show grade three power.

As the finger extensors regained power beyond grade four, (around four months after surgery) the fingers began to demonstrate a clawing tendency and the patient was then given a knuckle bender and thumb abduction splint (fig. 2). He was allowed to use the hand for limited activities with care since the hand was anaesthetic.

By the seventh month of surgery the patient began to show demonstrable hypothenar muscle function and over the next five months progressive intrinsic muscle recovery indicative of recovering ulnar palsy...
(fig. 3). He was started on resistive exercises to increase intrinsic muscle strength. The knuckle bender splint was discarded at the 12th month after surgery.

Perceptible finger tip sensation was first seen around the 11th month after surgery which gradually improved to a protective sensation level by the 15th month demonstrated by Semmes-Weinstein monofilaments testing. The 18th month postoperative evaluation showed grade four power of the intrinsics (interossei) and grade four power of the hypothenar muscles. This recovery was confirmed by a good interference pattern seen by EMG evaluation of the intrinsic and hypothenar muscles. The wrist and long extensors demonstrated grade four power. The thenar muscles supplied by the median nerve however had not shown any recovery with no motor unit action potentials demonstrable on EMG. The sensory recovery in the median nerve innervated area, however was adequate.

At the 18th month an opponensplasty using a FDS (flexor digitorum superficialis) tendon of the ring finger was done using the Campbell Thompson technique (fig. 4). The humeral implant was removed in the same sitting as the humerus fracture had healed well.

Rehabilitation for the tendon transfer was started after three weeks of surgery. The patient showed rapid improvement and was able to regain palmar abduction and demonstrable opposition by the sixth week of surgery (fig. 5).

**CONCLUSION**

Kouyoumdjian, identifies the incidence of multiple nerve injuries involving three nerves at 3% (13 cases out of 437). The peculiarities of this case include a radial nerve palsy associated with a low median and ulnar nerve palsy preventing extension of all IP and MCP joints in early flexor tendon rehabilitation. To prevent adhesions from developing a total passive regimen was initially instituted without the use of traction devices. In stage two of the same therapy where supervised active flexion is initiated, the same passive protocol was continued to bring the patient’s fingers back into extension. An extensor traction device was given in the third stage of rehabilitation to keep the fingers extended at the MCP & IP joints while allowing all the above joints to actively flex to 90 deg. A standard dorsal orthotic device for finger drop with padded loops around the proximal segments of the fingers was not given since the patient had an additional intrinsic palsy, preventing extension of the IP joints. The radial nerve injury demonstrated combined neuropraxic and axonotomic components with most of the wrist extensors and finger extensors recovering simultaneously although a little late for neuropraxic recovery. The recovery of the ulnar nerve innervated intrinsics was significant in decreasing the morbidity and disability following the injury, since the claw hand deformity gradually corrected and pinch improved with time. Median and Ulnar nerve sensory recovery that occurred would go a long way in preventing trophic changes. The only component of triple nerve injury that did not recover was the motor component of the median nerve which was subsequent addressed by the FDS-opponensplasty. Tailoring of the rehabilitation at every stage of nerve recovery with appropriate orthotic devices and modified therapy allowed this patient with a rare triple nerve palsy to achieve a good functional outcome.
ACKNOWLEDGEMENT

I am extremely grateful to:

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2. Smt. Liya P Mathew, hand therapist, for her motivation and professionalism in this case and all other hand therapy cases coming to our hand centre.

3. Sri. Shaju Cherian, orthotist whose skills are unsurpassed in making perfect and quick orthosis for the numerous patients undergoing hand therapy.

CONFLICT OF INTEREST

NIL

REFERENCES


The Effectiveness of Iontophoresis Over Conventional Therapy in Relieving Pain, Improving Rom and Functional Skills in Adhesive Capsulitis

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ABSTRACT

Background: Adhesive capsulitis is a common problem affecting the middle aged people. In the second stage of Adhesive capsulitis, the pain and limitation of the ROM will restrict the patients in their functional activities. Iontophoresis with Lidocaine is rarely used as an effective treatment for adhesive capsulitis in our country.

Objective: To study the effectiveness of iontophoresis with lidocaine as an adjunct to the conventional treatment for relieving pain and improving ROM and functional skills in phase II adhesive capsulitis.

Design: An experimental approach was used and study design is pre test–post test group design.

Method: Population included 30 patients with phase II adhesive capsulitis. 15 patients each were taken in the experimental and control group. The control group has given the conventional treatment and the experimental group has iontophoresis in addition. Outcome measures taken for the study were shoulder pain using Visual Analogue Scale (VAS), abduction and external rotation Range of Motion (ROM) using Goniometry and shoulder function score using Shoulder Pain and Disability Index (SPADI). Analyzed statistically with students’ t test.

Results: It was found that iontophoresis with lidocaine along with the conventional treatment causes significant reduction of pain, improvement of abduction and external rotation Range of Motion (ROM) and improvement of shoulder function.

Implications: A follow up study could ensure the long term effectiveness of treatment given. Study can be done using other ionic medications.

Conclusions: Results of this study provide evidence that iontophoresis with lidocaine provide better results when used as an adjunct to ultrasound therapy, passive joint mobilization, exercises and home programme. There was significant reduction of pain which is one of the chief complaints in patients with phase II Adhesive capsulitis and hence should be a part of the treatment regimen for the same.

Key words: ROM – Range of Motion, SPADI – Shoulder Pain and Disability index, VAS – Visual Analogue Scale, Iontophoresis.

INTRODUCTION

Adhesive capsulitis is a common clinical entity, which mainly affects the middle aged people between 40-60 years. It is characterized by spontaneous onset of shoulder pain accompanied by progressive limitation of both active and passive gleno humeral movements. In the early stages, the capsule becomes contracted with loss of the inferior capsular fold. In the later phases, increased capsular fibrosis occurs. Abduction and external rotation are the gross movements that would be restricted mostly (A I Binder et al, 1984)¹.

During the phase II of Adhesive capsulitis, pain will...
limit the glenohumeral motion and later lead to the complication of joint and soft tissue contractures. The painful limitation of ROM will cause functional limitations and disabilities.

Iontophoresis is the introduction of topically applied, physiologically active ions into the epidermis and mucous membranes of the body by the use of continuous direct current. Even today, Iontophoresis is not considered as a first choice of treatment in Adhesive capsulitis. But there has been a recent resurgence in its use and literature review suggests Iontophoresis offers the promise of therapeutic efficacy and cost effectiveness (Liliana L Jorge, 2011).

Even today, iontophoresis is not considered as a first choice of treatment for pain relief in adhesive capsulitis. Different studies had been conducted to evaluate the effects of iontophoresis in the management of pain (Kezban Yigister et al, 2002). Such studies did not give significance to the improvement on functional capacities of the patients.

This study was conducted to detect the effectiveness of Iontophoresis with lidocaine over conventional treatment of Adhesive capsulitis for pain relief, improving ROM and functional abilities of the patients.

MATERIAL AND METHODS

This study used experimental research approach. The study was conducted in the Physiotherapy department of Chazhikkattu Hospital, Thodupuzha. Thirty patients referred to the Physiotherapy department with a diagnosis of shoulder pain were selected for the study after the evaluation based on inclusion criteria. They were divided into two groups by convenient sampling method, where 15 patients each were taken in control and experimental groups.

The inclusion criteria was, patients diagnosed with primary adhesive capsulitis referred by Orthopedician, 4-8 months of symptomatic duration, age between 50 & 60, patients with 50% reduction of total ROM in external rotation and 25% reduction of total ROM in abduction. Any other pathologies of the shoulder joint, patient with history of recent trauma were excluded from the study.

The materials used in the study were,

A diagnostic and therapeutic muscle stimulator with visual / audio indicators, 2% lidocaine, a therapeutic ultrasound machine with electronic timer with digital display and audio alarm, a plastic half circle goniometer, Visual Analogue Scale (VAS), Shoulder Pain And Disability Index (SPADI), recording sheets, consent form, data collection sheets etc.

Consent was taken from the patients prior to the study. Assessment was taken on the first day and treatment was given for five days. Assessment was again done using an assessment form after five days on completion of treatment. For the patients in the control group, conventional treatment methods were given and for the experimental group, iontophoresis was given in addition to the conventional methods.

The patients in control group were treated with therapeutic ultrasound in continuous mode with an intensity 1.5 Watts/cm² for six minutes, passive joint mobilization which included anterior and inferior glides, active assisted gleno humeral exercises which included codman’s exercises, overhead pulleys, finger ladder and wand exercises and instructions on home programme.

The patients in the experimental group were treated with conventional treatment and in addition iontophoresis with 2% lidocaine solution. For iontophoresis, continuous direct current was used with an intensity 2 mA for 20 minutes. The patient was in sitting position with the shoulder abducted to 90 degrees and positioned conveniently. The active electrode (anode) was placed over the gleno humeral joint and the dispersive electrode (cathode) at distal end of arm. The cathode size was twice that of the anode. The medication of 2 % lidocaine was taken in the wet gauze and used under the anode. The stimulator was turned on and slowly advanced the control unit until 2 mA is reached on the milliammeter and the patient feel a slight tingling sensation. The treatment was continued for 20 minutes duration.

The outcome measurements used were Goniometer for measuring abduction and external rotation ROMs (Hayes et al, 2001), Visual Analogue Scale for measuring shoulder pain (Michelle H Cameron,1999) and Shoulder Pain and Disability Index for assessing shoulder function (Bicer et al, 2010).

Control and experimental groups’ responses to the treatment were analyzed using paired ‘t’ test. For comparing experimental group response over control group towards treatment, unpaired ‘t’ test was used.

RESULTS

The experimental and control groups had 15 patients each. Before the treatment session an
evaluation of all patients were taken and documented.

Study sample characteristics of control and experimental groups were as follows.

Table 1. Sample characteristics on age, sex and dominant side.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age in years</th>
<th>Sex</th>
<th>Dominant side</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50-55</td>
<td>55-60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Involved Rt</td>
</tr>
<tr>
<td>Experimental</td>
<td>8</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Control</td>
<td>9</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

On analysis of active ROM in experimental group, the ‘t’ values of abduction and external rotation were 14.63, 19.78 respectively. They were found greater than table value for ‘t’ at 0.05 level of significance (t=1.7). This implicates that there was significant difference between the pre and post treatment values of abduction and external rotation in experimental group.

On analysis of active ROM in control group, the ‘t’ values of abduction and external rotation were 9.13 and 18.5 respectively and they were found greater than table value for ‘t’ at 0.05 level of significance (t=1.7). This implicates that there was significant difference between the pre and post treatment values of abduction and external rotation in control group.

On analysis of active ROM after the treatment for 5 days between the experimental and control groups showed ‘t’ value for abduction and external rotation were 4.33 and 6.02 respectively. As these values were greater than the table value for ‘t’ at 0.05 level of significance, it can be concluded that there were significant difference between two groups after treatment and hence the null hypothesis is rejected.

Table 2. Sample characteristics on duration of disease in weeks.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Duration of disease in weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16-20 wks</td>
</tr>
<tr>
<td>Experimental</td>
<td>2</td>
</tr>
<tr>
<td>Control</td>
<td>3</td>
</tr>
</tbody>
</table>

Analysis of shoulder pain of experimental and control groups were done as follows.

Table 6. Mean values of pre and post treatment VAS

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean pre treatment VAS</th>
<th>Mean post treatment VAS</th>
<th>Gain in % reduction of VAS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>8.066</td>
<td>3.13</td>
<td>4.936</td>
</tr>
<tr>
<td>Control</td>
<td>7.866</td>
<td>4.933</td>
<td>2.933</td>
</tr>
</tbody>
</table>

Analysis of shoulder pain of experimental and control groups were done as follows.

Table 7. Results of statistical testing of VAS values

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre test initial</th>
<th>Independent t test value</th>
<th>Post test after 5 days</th>
<th>Independent t test value</th>
<th>Dependent t test value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>6.066</td>
<td>0.817</td>
<td>3.13</td>
<td>4.936</td>
<td>23.26</td>
</tr>
<tr>
<td>Control</td>
<td>7.866</td>
<td>level of significance</td>
<td>level of significance</td>
<td>level of significance</td>
<td>level of significance</td>
</tr>
</tbody>
</table>
On analysis of VAS score of experimental group, the ‘t’ value (23.26) found to be greater than table value, which implicates that there was significant difference between pre and post treatment values of VAS score in experimental group. On analysis of VAS score of control group, the ‘t’ value (13.82) was found greater than table value, which showed significance difference between pre and post treatment values of VAS score in control group.

On analysis of VAS score between experimental and control groups post treatment, the calculated value of ‘t’ was found to be 6.02 at 0.05 level of significance. It can be concluded that there was significant difference between two groups after treatment, rejecting the null hypothesis.

Analysis of shoulder function score of experimental and control groups were done as follows.

Mean values of pre and post treatment shoulder function score.

Table 8. Percentage gain in shoulder function score

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean pre treatment score</th>
<th>Mean post treatment score</th>
<th>Gain in shoulder function score</th>
<th>% increase in shoulder function score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiental</td>
<td>8.04</td>
<td>3.19</td>
<td>4.85</td>
<td>48.5</td>
</tr>
<tr>
<td>Control</td>
<td>7.73</td>
<td>4.44</td>
<td>3.29</td>
<td>32.9</td>
</tr>
</tbody>
</table>

Fig. 3. Percentage gain in shoulder function score

Table 9. Results of statistical testing of shoulder function score

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre test initial</th>
<th>Independent ‘t’ test value</th>
<th>Post test after 5 days</th>
<th>Independent ‘t’ test value</th>
<th>Dependent ‘t’ test value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiental</td>
<td>8.04</td>
<td>1.105 at 0.05</td>
<td>3.19</td>
<td>4.22 at 0.05</td>
<td>27.59</td>
</tr>
<tr>
<td>Control</td>
<td>7.73</td>
<td>level of significance</td>
<td>4.44</td>
<td>level of significance</td>
<td>17.49</td>
</tr>
</tbody>
</table>

On analysis, there were significant difference between pre and post treatment scores in both control and experimental groups. On analysis of independent ‘t’ value post treatment between the experimental and control groups showed significant changes in the scores, rejecting the null hypothesis.

### DISCUSSION

This study was conducted with the aim of identifying the effect of lidocaine iontophoresis in pain relief, improvement in ROM and shoulder function. The tools used in the study to measure the outcome measures were, Visual Analogue Scale, Goniometry and Shoulder Pain and Disability Index. These tools are widely used, easy to administer and yield measurements that have known reliability and validity.

On statistical analysis using paired ‘t’ test, both groups showed significant difference in pre and post treatment scores. The analysis within the groups showed that both groups had significant gain in abduction and external rotation ROMs, reduction of pain and gain in shoulder function.

On statistical analysis using unpaired ‘t’ test, the calculated ‘t’ value of VAS score (6.02), active abduction ROM (4.33), active external rotation ROM (6.02) and SPADI score (4.22) were found to be greater than the table value, rejecting the null hypothesis.

Lidocaine iontophoresis is primarily used for an analgesic effect. Lidocaine, which is a positive ionic solution, is applied at the positive electrode, so that the ions will pass through the skin by electro repulsion (S D N Guptha, 2005)7.

The possible causes for the gain after the conventional treatment may be, the thermal effects of ultra sound which increase the temperature of deep tissue with a high collagen content, and thus increase the tissue extensibility and / or control pain (M Dyson, 1982)8. The increase in the extensibility will help to decrease the joint stiffness.

The passive joint mobilization may have an inhibitory effect on perception of painful stimuli by repetitively stimulating mechanoreceptors and used to stretch the joint structures and thus increase joint play (Carolyn Kisner, 1996)9.

Active assisted exercises like finger ladder, wand exercises etc can provide the patient with objective reinforcement and therefore motivate for performing shoulder range of motion exercises. Home exercises are advised to maintain the mobility gained during the treatment sessions (Dickon P Crawshaw et al, 2010)10.

The patients from experimental group, who received lidocaine iontophoresis, showed significant relief of pain compared to control group. Lidocaine is
a standard local anesthetic drug. Iontophoresis with lidocaine can provide deeper levels of analgesia with a much shorter time span (Louis P Gangarosa et al, 1981)\textsuperscript{11}.

A current of 2 mA for 20 minutes duration has been given so that the dosage of entire treatment would be 40 mA minutes. This enabled the penetration of ions through the stratum corneum which is the most resistant layer of the skin (Kalbitz J et al, 1996)\textsuperscript{12}.

Iontophoretically driven lidocaine can be transferred into all tissue layers underlying the active electrode including tendons and cartilages (Massimiliano Nino et al, 2010)\textsuperscript{13}. More than that, the duration and depth of anesthesia produced by lidocaine iontophoresis is significantly high (Charles T Costello et al, 1995)\textsuperscript{14}.

The better reductions in pain after lidocaine iontophoresis motivated patients to co operate with the further treatment sessions. This enabled them to relax and actively participate in the exercise program. The following sessions of passive joint mobilization and active assisted exercises further added the improvement in shoulder ROMs (Gert J D Bergman et al, 2010)\textsuperscript{15}. The better reduction of pain and improvement in ROMs gained by lidocaine iontophoresis enhanced shoulder function considerably.

From this discussion, it can be concluded that lidocaine iontophoresis can be added with the conventional treatment of adhesive capsulitis for better improvement in reduction of pain, ROMs and shoulder functions.

**REFERENCES**

Comparison of Dynamic Balance Between Flat Feet and Normal Individuals Using Star Excursion Balance Test

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ABSTRACT

Objectives: 1) To compare dynamic balance between flat feet and normal individuals using Star Excursion Balance Test (SEBT). 2) To determine the most affected excursion distance.

Research Design: Cross sectional study.

Method: 30 subjects with bilateral flexible flat feet as assessed by sit to stand navicular drop test and 30 subjects with normal feet both in the age group 18-25 years were chosen for the study.

The sample size therefore was 120 feet (60 flat feet and 60 normal arched feet). The outcome assessed were sit to stand navicular drop test, calcaneum angle, width of the foot, great toe extension range of motion and SEBT.

Data analysis: Unpaired ‘t’ test using Graph Pad Instat software system was used.

Results: Extremely significant mean differences in sit to stand navicular drop test, calcaneum angle, width of the foot, great toe extension range of motion and SEBT was found in individuals with flat feet. Also the lateral excursion distance was least in these individuals (p<0.0001)

Conclusion: Dynamic balance is affected in flat feet individuals

Key words: Flat Feet, SEBT, Pronation, Navicular Drop.

INTRODUCTION

The foot is the most distal segment in the lower extremity chain and represents a relatively small base of support on which the body maintains balance (particularly in single-leg stance). It is likely that deficits in foot posture, flexibility, strength, or sensation impair the support function of the foot and predispose to loss of balance.

Although it seems reasonable that even minor biomechanical alterations in the support surface may influence postural-control strategies. When the arch starts collapsing, balance is broken at the feet, & therefore the balance throughout the entire body is also broken.

Taking into consideration effect of flat feet on body alignment, the implication of flat feet on balance have received little attention to date. Hence this study was done to find if subjects of flat feet have balance problem using star excursion balance test which is designed to measure dynamic postural.

Methodology

Research design: Cross sectional

Sample size: 120 Flat Feet

Group1 (Experimental group) - 60 flat feet.

Group2 (Control group) - 60 normal arched feet.

Material:

1) Half Goniometer
2) Ruler
3) Marker
4) Measuring tapes
5) Weighing Machine
6) Graph Pad Instat software
Outcome measures-
1) Sit to stand navicular drop test (SSNDT)
2) Calcaneum angle
3) Width of the foot
4) Great toe extension range of motion
5) Star Excursion Balance Test (SEBT)

Inclusion criteria-
1) Flexible flat foot
2) Girls in the age group of 18-24 years

Subjects Exclusion criteria -
1) Symptomatic and stiff flat feet.
2) Flexible flat foot with neuromuscular involvement.
3) Any past history of injury or treatment of the affected lower limb.
4) Any other associated congenital abnormality.
5) Limb length discrepancy.
6) Pregnancy
7) Body Mass Index (BMI) > 30

Exclusion criteria for performing SEBT-
Individuals were excluded if they reported any
1) Somatosensory condition that could impair balance.
2) Previous head injury resulting in a loss of consciousness.
3) Lower extremity injury or feelings of ‘giving way’ that resulted in any time loss of physical activity from practice or competition within the past year.
4) Feelings of either ankle giving way at the time of the study and unrelated to previous injury.
5) Flu-like or cold-like symptoms within the past weeks, which could impair balance.
6) Lastly, volunteers were excluded if they were unable to perform the SEBT during the practice session.

Procedure
All the participants with normal arched feet and flat feet diagnosed on basis of SSNDT were screened and selected as per the inclusion and exclusion criteria. They were briefed about the nature of the study and their informed written consent was taken. The demographic data like age, gender, height, weight and limb length were noted.

Following this the foot was assessed for sit to stand navicular drop test, measurement of calcaneum angle, width of the foot, great toe extension in resting standing foot posture.33

a) To diagnose flat feet by SIT TO STAND NAVICULAR DROP TEST (SSNDT)

The SSNDT test is performed by calculating the difference between the height of the navicular from the floor when the subtalar joint is positioned in neutral and the height of the navicular from the floor when in relaxed stance in a full weight bearing position (Brody 1982).34

b) To measure CALCANEUM ANGLE (CA)

Calcaneum Angle is defined as the number of degrees the posterior midline of the calcaneum deviates from being perpendicular to the level floor. To obtain the posterior mid line of the calcaneum, the subject was positioned prone with bare foot over the edge of bed. Opposite limb was flexed, abducted, externally rotated with knee flexed, this will internally rotate the limb to be measured placing the calcaneum in horizontal orientation. With skin marker, a line bisecting the idle 1/3 of posterior surface of calcaneum was drawn and subsequently measured with a goniometer with the patient in standing position.

c) To measure GREAT TOE EXTENSION

The subject is in standing position. The great toe is extended actively and assisted passively without dorsiflexing the 1st ray. The range of motion is measured with the goniometer.

d) To measure the WIDTH OF THE FOOT

A piece of blank paper is placed on a hard floor. The subject sits with the foot firmly on the paper. The outline of the foot is traced and the distance between the two widest points on the tracing is measured. This number will help determine the foot width.

e) To measure the LIMB LENGTH: The subject is in supine position. A tape measure was used to quantify the distance from the anterior superior iliac spine to the centre of the ipsilateral medial malleolus.

f) HEIGHT was measured with a standard height chart.

STAR EXCURSION BALANCE TEST

The SEBT was performed with the participants standing in the middle of a grid formed by eight measure tapes extending out at 45° from each other. The participant was asked to reach as far as possible along each of the eight measure tapes, make a light touch on the tape, and return the reaching leg back to
the center, while maintaining a single-leg stance with
the other leg in the center of the grid. When reaching
in the lateral and posterolateral directions, participants
must reach behind the stance leg to complete the task.

They began with the anterior direction and
progressed clockwise around the grid. All participants
began with a right stance leg in the center of the grid.
After completion of the three trials in the eight
directions and another 5-min rest period, the test
continued with a left stance leg. The investigator
recorded each reach distance with a mark on the tape
as the distance from the center of the grid to point of
maximum excursion by the reach leg.2

Data analysis:

Unpaired t test using Graph Pad Instat software
system was used for comparison of dynamic balance
between flat feet and normal individuals using SEBT.
On analysis, there was an extremely significant mean
difference in sit to stand navicular drop test, calcaneum
angle, width of the foot, great toe extension range of
motion and SEBT found in individuals with flat feet.
Also the lateral excursion distance was least in these
individuals (p<0.0001)

RESULTS

Various statistical measures such as mean, standard
deviation and test of significance such as unpaired‘t’
test were utilized for this purpose. Unpaired‘t’ test was
utilized to compare the height, limb length, SSNDT,
calcaneum angle, width of the foot, great toe extension range of
motion and excursion distance using
SEBT,(Table 1)

A total of 120 feet were evaluated in the study of
which 60 were flat (experimental group) and 60 were
normal arched (control group). The age range was
between 18-25 years in both the group with all female
participants. The mean age of the subjects in control
group was 21.4±1.33 and mean age of experimental
was 21.36±1.43.

| Table 1. Comparison of Normal Arched Feet and Flat Feet for following parameters |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Control Group   | Experimental Group | P value | Inference |
| Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Age | 21.4 | 1.33 | 21.36 | 1.43 | 0.925 | NS* |
| Ht | 159.76 | 5.98 | 159.33 | 6.10 | 0.075 | NS* |
| LimbLength | 88.21 | 3.19 | 87.93 | 3.24 | 0.734 | NS* |
| SSNDT | 0.51 | 0.09 | 1.03 | 0.05 | <0.0001 | S** |
| Calcaneumangle | 5.28 | 2.53 | 9.68 | 4.19 | <0.0001 | S** |
| Width of foot | 8.22 | 0.38 | 8.48 | 0.59 | 0.0045 | S** |
| Great toe ROM | 59.33 | 7.18 | 52.21 | 7.54 | <0.0001 | S** |

NS* = Not significant
S** = Significant

| Table 2. Comparison of Normal Arched Feet and Flat Feet for Excursion Distance |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Control Group   | Experimental Group | P value |
| Mean | SD | Mean | SD | Mean | SD |
| Anterior | 57.9 | 5.262 | 54.66 | 5.055 | <0.0008* |
| AntLateral | 55.22 | 5.043 | 51.05 | 4.942 | <0.0001* |
| Lateral | 47.02 | 8.444 | 41.8 | 6.854 | <0.0003* |
| Post Lateral | 52.85 | 8.555 | 46.63 | 5.923 | <0.0001* |
| Poste-rior | 53.63 | 7.307 | 47.15 | 4.722 | <0.0001* |
| Post Medial | 55.3 | 7.174 | 50.06 | 4.825 | <0.0001* |
| Medial | 55.95 | 6.995 | 50.18 | 4.942 | <0.0001* |
| Ant Medial | 58.02 | 4.914 | 53.52 | 4.616 | <0.0001* |

* P value is extremely significant.

DISCUSSION

The results of the present study showed that
balance is affected in flat feet individuals.

In flat feet individuals, the angle is increased
indicating that the foot is pronated. Since in flat feet,
the medial longitudinal arch of the foot appears
flattened, this causes the foot to roll inwards in order
to gain contact with the floor and support the weight
of the body and is the main clinical feature of
pronation.31 Thus calcaneus lies in valgus and external
rotation relative to tibia and talus faces medially and
downwards. There may also be associated midfoot sag
due to dorsal subluxation of navicular on talus.29,30

Also width of the foot is comparatively greater in
flat feet. The possible reason being splaying of the
forefoot, a condition where the intermetatarsal
ligament is soft and loose, allowing the foot to spread.
As the foot pronates and the longitudinal arch
collapses, the transverse arch of the foot also will
collapse. Once this happens, the metatarsal heads are
aligned and this causes them to spread to make room.32
The decrease in the great toe extension range of motion in flat feet is supported by the “ineffective windlass mechanism” resulting from the IFM during static standing and during gait (Gray et al 1968) to compensate for lax ligaments and general foot hypermobility.

Although investigators found static and dynamic balance to be adversely affected by changes in peripheral input secondary to joint injury and changes in the stability of the surface on which one is standing, far less attention has been focused on whether more subtle alterations in the surface, stability, or peripheral input of the support foot may also affect balance in those with different foot types. Other than the work by Hertel et al., we are not aware of any other studies that have examined balance as a function of foot type. Understanding this relationship is important since these measures can be used to assess potential deficits related to injury mechanism e.g. ankle injury.

In our study dynamic balance was assessed since most activities an individual participates in are functional or dynamic as opposed to static. The SEBT is a relatively new assessment tool, described as a functional test that emphasizes dynamic postural control, which has been defined as the extent to which a person can reach or lean without moving the foot and still maintain upright posture. Hence, this test requires a combination of foot, ankle, knee, and hip motion and imposes greater demands on strength and joint range of motion, in addition to proprioception and neuromuscular control within the stance leg to maintain balance while reaching with the opposite leg.

Since significant correlations were revealed between height and excursion distance and leg length and excursion distance with leg length having the stronger correlation, control participants who were matched to experimental participants according to leg length were taken.

Our study revealed that the reach distance on the SEBT was significantly less in individuals with flat feet than in normal feet ad these results were found across all reach directions and were not direction dependent.

Lateral direction was most affected. Excessive pronators tend to collapse toward the medial aspect of the foot and have a reduced ability to maintain a rigid support in full weight bearing. This medial deviation plus greater foot mobility may account for pronators’ reduced dynamic reach in the lateral direction. Thus our study supports the work of Karen P Cote, who established that excursion is most affected in lateral direction. Further, researchers should investigate the effect of foot type on muscle activity patterns and joint forces during these balance tasks to better understand potential neuromuscular and biomechanical compensations for altered structural stability.

CONCLUSION

From the study it is concluded that balance is affected in individuals with flat feet.

Therefore correction of flat feet is necessary to improve balance in these individuals to prevent further musculoskeletal injuries in terms of ankle sprains, plantar fasciitis etc and also to prevent compensatory adjustments in the proximal segments of the lower limb.

Conflict of Interest: None.

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Evaluation of 6 Minute Walk test Parameters in Normal Indian Pediatrics age Group between 6-11yrs

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ABSTRACT
The 6 minute walk test is a practical simple test that is very commonly used to assess the submaximal functional capacity of patients with pulmonary dysfunctions. This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes ie the 6 minute walk distance (6MWD). It is widely administered in adults as well as paediatrics groups. Though there are reference values of the 6MWD available for adult group, no such values are available for Indian paediatric groups. This study aims to find the reference values for 6 minute walk test for Indian paediatric group.

Methodology: The 6 minute walk test was administered on 300 school children of both sexes. The distance covered and the pre and post test basal parameters were assessed or each subject.

Conclusion: The distance covered by the subjects was found to be 599.47±81 mtrs with little difference between the two sexes.
Key words: 6 Minute walk test, Children

INTRODUCTION
Assessment of functional capacity has traditionally been done by merely asking patients the following: “How many flights of stairs can you climb or how many blocks can you walk?” However, patients vary in their recollection and may report overestimations or underestimations of their true functional capacity. Objective measurements are usually better than self-reports.

In the early 1960s, Balke developed a simple test to evaluate the functional capacity by measuring the distance walked during a defined period of time.¹ A 12-minute field performance test was then developed to evaluate the level of physical fitness of healthy individuals.²

In an attempt to accommodate patients with respiratory disease for whom walking 12 minutes was too exhausting, a 6-minute walk was found to perform as well as the 12-minute walk.³

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The self-paced 6MWT is a practical simple test to assess the submaximal level of functional capacity and requires a 100-ft hallway but no exercise equipment or advanced training. Walking is an activity performed daily by all but the most severely impaired patients. This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes (the 6MWD). Because most activities of daily living are performed at submaximal levels of exertion, the 6MWD may better reflect the functional exercise level for daily physical activities.⁴

6 min walk test is widely used in adult as well as paediatric age groups. Reference values for adult groups are available in literature.⁵ However despite its frequent use, there are no normal values available for children under 11 years of age in Indian population. Thus this study aims to provide reference values for 6 minute walk test in children between 6 to 11 years of age group.

MATERIAL & METHODOLOGY
The study design was prospective cross sectional study. A sample size of 300 normal, healthy children including equal number of males and females in the age group 6 to11 yrs were selected. BMIs in all age groups were, on average, within the normal range as
outlined by the Center of Disease Control Growth charts for Children.6

Subjects with history of any cardio-respiratory, musculoskeletal or neurological disorders in the last 6 months were excluded from the study.

The study was approved by the ethics committee and school as well as parental consent was obtained.

Procedure

Comfortable clothing and appropriate shoes were worn by the participants.

The test was carried out as per American Thoracic Society guidelines.4

A 30mts flat, straight, hard surface corridor was used. The turnaround points were marked with a cone.

The subject was made to sit and rest in a chair, located near the starting position, for at least 10 minutes before the test starts. During this time, basal parameters i.e. pulse rate, blood pressure and respiratory rate were measured.

Subjects were instructed- “the object of this test is to walk as far as possible for 6minutes. You will walk back and forth in this hallway. 6 minutes is long time to walk, so you will be exerting yourself. You are permitted to slow down, to stop, and to rest as necessary, but resume walking as soon as you are able. Remember that the object is to walk as far as possible for 6 minutes, but don’t run or jog.”

Instructions were given in the language that they could easily understand. The verbal instructions were encouraging and standardized statements- “You’re doing well” or “Keep up the good work,” but no other phrases were used.

After the 1st minute of the test instructions like “You are doing well. You have 5 minutes to go.” were given

At the end of 2 minutes instructions like: “Keep up the good work. You have 4 minutes to go.” were given

At the end of 3 minutes instructions like: “You are doing well. You are halfway done.” were given

At the end of 4 minutes instructions like: “Keep up the good work. You have only 2 minutes left.” were given

When only 1 minute was remaining instructions like: “You are doing well. You have only 1 minute to go.” were given

The grading of the test was based on the distance covered in 6min.. At the end of 6minutes, the basal parameters and RPE by Borg scale were measured and the recovery was taken after 3 and 6 minutes.

During the study, none of the subjects needed to prematurely terminate the test and none of them required rest.

RESULTS

Graph 1. Mean distance covered by the subjects

The mean distance covered by the subjects was 599.47±81 mtrs

Graph 2. Mean distance covered by males and females

The mean distance covered by males was 605.2±73.382 mtrs and by females was 593.73±87.941mtrs. The difference in the distance covered by both sexes was found to be statistically insignificant.

Graph 3. Interpretation of pre and post walk Pulse Rate between Males and Females

The change between pre and post Pulse Rates were within normal limits in both the sexes.
DISCUSSION

The 6MWT, which is easy to perform and cost-effective, has been proposed as the best indicator of functional capacity among all submaximal exercise tests. The 6-min walk test has been validated by high correlation with workloads, heart rate, and SaO2, the dyspnea responses when compared with standard bicycle ergometry and treadmill exercise tests.

The distance achieved within 6 minutes allows an estimation of individual response to incremental maximal exercise and has been found to accurately reflect physical capacity of patients with pulmonary disease.

As no reference values for 6MWT distance have been available in younger children, quantification of exercise intolerance in this population is largely based on data extrapolated from older individuals and is prone to error.

The current study thus attempted to establish the normal values for 6WMT distance in children between 6 and 11 years of age in Indian population. It was found that the mean distance covered by children between 6 and 11 years was 599.47±81 mtrs.

It was observed that the mean distance covered increased with an increase in age.

Graph 4. Interpretation of pre and post Blood Pressure between Males and Females

Graph 5. Interpretation of pre and post Respiratory rate Males and Females

Graph 6. Interpretation of Average Rate of Perceived Exertion amongst Males and Females

Graph 7. Age wise distribution of mean distance covered in meters.

The changes in pre and post systolic and diastolic blood pressures were seen to be within normal limits in both the sexes.

The change between pre and post Respiratory Rates were within normal limits in both the sexes.

The average reported Rate of Perceived Exertion on BORG’s Scale was found to be same in males and females i.e. 2- Slight.

The distance achieved within 6 minutes allows an estimation of individual response to incremental maximal exercise and has been found to accurately reflect physical capacity of patients with pulmonary disease.

As no reference values for 6MWT distance have been available in younger children, quantification of exercise intolerance in this population is largely based on data extrapolated from older individuals and is prone to error.

The current study thus attempted to establish the normal values for 6WMT distance in children between 6 and 11 years of age in Indian population. It was found that the mean distance covered by children between 6 and 11 years was 599.47±81 mtrs.

It was also seen in this study that the basal parameters like Blood pressure, heart rate and respiratory rate and rate of perceived exertion were within normal limits before and after the test and were not significantly different in males and females.

Also the distance covered increased as the age increased. This can be attributed to increase in mean height with age. A taller height is associated with a
longer stride, which makes walking more efficient, probably resulting in a longer distance walked with elder age group students.

CONCLUSION

The mean distance covered by children in the age group between 6-11 years is about 599.47±81 mtrs with an average of 605.2±73.382 in males and 593.73±87.941 in females.

Also the basal parameters were within normal limits of exercise and recovered on an average within 3 minutes after stopping of the test.

Conflict of Interest: None.

FUTURE RESEARCH

The study can be extended to compare for the distances covered by children with different socio-economic status, children from urban and rural areas, etc.

Declaration

This study is an original study and has been done by the above mentioned authors. Also it has not been sent to any other journal for publication.

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Effect of Posterior Tibial Nerve Stimulation and Trospium Hydrochloride in Treatment of Overactive Bladder Syndrome: A Randomized Controlled Study

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ABSTRACT

Objective: To compare the effects of long term posterior tibial nerve electrical stimulation and trospium hydrochloride on urodynamic parameters, bladder diary and severity of urgency in patients with overactive bladder syndrome.

Design: Randomized controlled trial.

Subjects: Thirty-seven patients were divided into either posterior tibial nerve electrical stimulation (Group 1) or trospium hydrochloride (Group 2).

Main outcome measures: All patients were assessed at the beginning of the treatment, at week 12 (end of treatment), 18 and 24 according to urodynamic parameters, voiding diary parameters and severity of urgency (visual analogue scale VAS).

Results: Statistically significant improvements were observed in both groups according to some urodynamic parameters, voiding diary parameters, VAS urgency severity at the end of the treatment. During the 24-week follow-up period, deteriorations were observed in many parameters in both groups although improvements in the volume at first desire to void, frequency of urgency and VAS urgency severity in group 1 persisted. Significant differences were not detected between groups at the end of the treatment or during the post treatment follow-up controls.

Conclusion: No difference was detected in long term of posterior tibial nerve electrical stimulation and trospium hydrochloride in the treatment of patients with overactive bladder syndrome. Discontinuation of both treatments caused deterioration in most of the symptoms of overactive bladder syndrome.

Key words: Posterior Tibial Nerve Stimulation, Trospium Hydrochloride, Overactive Bladder

INTRODUCTION

Overactive bladder syndrome is defined as urgency, with or without urgency incontinence, usually with frequency and nocturia. Overactive bladder syndrome affects individuals adversely, both physically and psychosocially, and worsens their quality of life. It also causes infection, sleep disorders and depression and places a significant burden on health economics1.

Overactive bladder syndrome is a common disorder, which can have a significant negative impact on quality of life, impairing several areas, including emotional well-being, productivity at home and at work, social relationships, sexual intimacy and physical functioning2.

Pharmacological treatment comprises the main therapeutic modality in overactive bladder syndrome. However, the adverse effects of antimuscarinic therapy can influence a patient’s quality of life and result in suboptimal dosing, poor patient compliance and even drug discontinuation. Trospium chloride, which was approved for overactive bladder syndrome recently and is gaining popularity, improves urodynamic
parameters and symptoms markedly with fewer side-effects (anticholinergic and central nervous system side-effects) than other anticholinergics\(^3\).

The most commonly used non-drug treatment modalities include bladder training, pelvic floor muscle training and electrical stimulation. Electrical stimulation has been suggested to permit an effective inhibition of detrusor activity and reported as safe and effective for urinary incontinence\(^4\).

Posterior tibial nerve stimulation is a minimally invasive neuromodulation system designed to deliver retrograde electrical stimulation to the sacral nerve plexus through percutaneous electrical stimulation of the posterior tibial nerve\(^5\).

So the present study was carried out to compare long term posterior tibial nerve electrical stimulation and trospium hydrochloride on urodynamic parameters, bladder diary and VAS urgency severity in patients with overactive bladder syndrome.

**MATERIAL AND METHODS**

**Subjects**

The study was conducted on 37 patients (male and female) who presented to Almatorya National Institute of Urology with urge incontinence and had overactive bladder or mixed type urinary incontinence with predominantly overactive bladder symptoms. **Exclusion criteria** were history of pelvic surgery, post-voiding residual volume 4100 mL, neurological deficit or peripheral neuropathy that may cause neurogenic bladder, presence of a medical condition that may preclude anticholinergic drug use, pregnancy or suspicion of pregnancy, cardiac pacemaker, genitourinary infection or haemorrhage, and deterioration in cognitive or intellectual functions. None of the patients were on anticholinergics or tricyclic antidepressants, and none had been treated by pelvic floor exercise, bladder training or pelvic surgery before entry into the study. All subjects gave written informed consent to participate in the study.

Fifty patients were selected initially for this study. Eight patients did not fulfil the criteria and were therefore excluded from the study. Five patients refuse to participate in the study. The patients who consented to participate were initially assessed by the third author. Then the researcher randomized each patient into one of the two groups by opening sealed envelopes. The randomization list was generated by a blinded researcher (The second author) using a table of random numbers. The randomization results were kept in sealed envelopes, one for each patient. There was no complete blindness in the study, since stimulation was applied by a separate researcher, while examination and data collection were carried out by a different researcher.

Thirty-seven patients were randomized to the posterior tibial nerve electrical stimulation group (Group 1, n=19) and medical treatment (trospium hydrochloride) group (Group 2, n=18) by sealed envelope. Three patients in group 1 and one patient in group 2 could not complete the study. Sixteen patients in group 1 and seventeen patients in group 2 completed the study (Figure 1).

Detailed histories related to incontinence (type of incontinence and duration of incontinence) of patients before treatment and patient demographics (age, gender and body mass index) were gathered by face-to-face interviews. Urological and neurological examinations, urinalysis and urine culture were performed. The patients in group 1 did not take placebo tablets, and the patients in group 2 did not have sham PTNS. Accordingly, the treatment was planned to cover twelve weeks period. All patients were evaluated using the following methods at baseline, week 12 (end-of-treatment), 18 and 24.

**Urodynamic examination**

Urodynamic examination was performed with the Dantec Duet system (Dantec, Denmark). Urodynamic examination was performed after appropriate antimicrobial treatment when infection was diagnosed by urine culture. A double-lumen cystometry catheter was used to fill the bladder with 0.9% saline solution at a rate of 20 mL/min. Volume at first desire to void and maximal detrusor pressure during filling phase.

**Voiding diary**

Before each assessment, patients were asked to fill in a three-day voiding diary that included daily voiding frequency (n/day) and frequency of urgency before voiding (n/day).

**Visual analogue scale (VAS)**

In addition to voiding diary parameters, patients were asked to show the severity of urgency. A 10-cm visual analogue scale (VAS) was used to assess the severity of urgency in the patients. The VAS used a 10 cm line oriented vertically with ‘no urgency’ corresponding to the bottom of the line and ‘worst
imaginable urgency 'to the top of the line. Patients were instructed to place a mark on the 10 cm vertical line that corresponded to their severity of urgency. Moreover, before treatment, all patients were given an instructional leaflet showing behavioral modifications to get incontinence and urgency attacks under control.

**Treatment procedure**

Patients in group 1 underwent posterior tibial nerve electrical stimulation for twelve weeks, three times a week, for 30 minutes each. PTNS was applied unilaterally with 26-gauge stainless steel needles (disposable concentric needle Medtronic, Minneapolis, Minn) inserted 5-cm cephalad from the medial malleolus and posterior to the edge of the tibia, placing the ground electrode on the ipsilateral extremity. Electrical stimulation (Medtronic Key Point Net, Medtronic) was applied unilaterally by using charge-compensated 200 microsecond pulses with a pulse rate of 20 Hz. Intensity level was then chosen as the intensity immediately under the threshold determining motor contraction. Before the start of urodynamic recording electrical stimulation was triggered with a push button to determine the appropriate stimulation amplitude and to confirm correct needle placement. The stimulation amplitude was set at the maximum tolerable level according to the subject under investigation, which was usually 1.5 times the threshold for evoking plantar flexion of the toes and/or toe fanning (range: 1 to 5 mA).

Patients in group 2 were given trospium hydrochloride (Spasmex 30-mg tablet) for twelve weeks at a dose of 45 mg/day, 30 mg in the mornings and 15 mg in the evenings. Compliance was calculated at weeks 12, 18 and 24 by subtracting the number of medication capsules returned by each subject from the number originally dispensed.

**STATISTICAL ANALYSIS**

Data were analyzed using SPSS for Windows version 10.0 statistical package (SPSS Inc., Chicago, IL, USA). Mann—Whitney U-test was used to compare the urodynamic parameters, voiding diary and VAS measurements between groups. Comparisons between pre- and post-treatment within groups were tested by the Wilcoxon test; a level of 0.05 was accepted as significant.

**RESULTS**

Prior to the training period, there is no statistically significant differences were found in the demographic characteristics when the two groups were compared for any variables as in (Table 1). Similarly, both groups were comparable with respect to urodynamic parameters (volume at first desire to void, maximal detrusor pressure during filling phase), voiding diary parameters (daily voiding frequency (n/day) and the frequency of urgency before voiding (n/day), VAS (severity of urgency).

**Results of Urodynamic Parameters**

There are significant increases in volume at first desire to void at the end of the treatment (week 12) in both groups (Table 2). Even though there was a decrease in maximal detrusor pressure in both groups at the end of treatment (week 12), only that in group 1 was statistically significant (Table 2).

<table>
<thead>
<tr>
<th>Table 1. Subject Characteristics (Mean ±SD) for both groups.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1 (Posterior tibial nerve stimulation + Pelvic floor exercise)</strong></td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
</tr>
<tr>
<td>Duration of incontinence (years)</td>
</tr>
<tr>
<td>Type of incontinence (Urge/Mixed)</td>
</tr>
<tr>
<td>Gender (Male/Female)</td>
</tr>
</tbody>
</table>

During the follow-up visits following treatment (week 12). In both groups, the volume at first desire to void tended to decrease at week 18, reaching a level at week 24 that was statistically significantly different from baseline (P<0.05, Table 2). Increase in maximal detrusor pressure was observed after treatment in both
groups, but the difference between the baseline and week 24 was not significant (P<0.05). There were no significant differences between groups during all controls after treatment in terms of urodynamic parameters (P<0.05).

### Voiding diary

With regard to the voiding diary parameters, frequency of urgency voiding improved at the end of treatment (week 12) in both groups (P<0.05, Table 2). During the follow-up evaluations after treatment (week 12), the frequency of urgency in Group 1 increased from the end of treatment (week 12) until week 24 and the frequency of urgency at week 24 were significantly lower than the baseline (P<0.05, Table 2). In Group 2, on the other frequency of urgency decreased at week 18 and frequency of urgency were lower at week 24 compared to the baseline (P<0.05, Table 2). Improvement in the voiding frequency continued at a significant level until week 18 in both groups, but at week 24, the difference compared to baseline was not significant (P<0.05, Table 2). Comparisons between groups after the treatment did not reveal any significant differences in terms of urgency severity (P<0.05).

### VAS urgency severity

VAS urgency severity decreased significantly in both groups after treatment (week 12) (P<0.05, Table 2). During the follow-up assessments, even though the VAS urgency severity gradually increased after treatment (week 12) until week 24 in group 1, the VAS urgency severity was still significantly lower than the baseline (P<0.05, Table 2). In group 2, on the other hand, the decrease persisted after the end of treatment (week 12) and was significantly lower than the baseline at week 18 (P<0.05, Table 2). Comparisons of the groups after treatment did not reveal any significant differences in terms of urgency severity (P<0.05).

### DISCUSSION

This study conducted to examine the effect of posterior tibial nerve electrical stimulation and trospium hydrochloride on urodynamic parameters, voiding diary, and severity of urgency in patients with overactive bladder syndrome. The results of our study revealed improvements in urodynamic parameters, voiding diary parameters, and severity of urgency with treatment in both groups. Even though there were deteriorations in many of these parameters with the cessation of treatment, improvements in the volume at first desire to void, frequency of urgency and VAS urgency severity continued in the electrical stimulation group.

Application of various forms of electrical stimulation is considered as therapeutic option to manage different types of lower urinary tract dysfunction. Detrusor muscle overactivity was suppressed by electrical stimulation without reducing its contractile force, also there was increased beta adrenergic activity in the detrusor muscle after pelvic floor electrical stimulation, whereas cholinergic receptor activity was reduced.

The main treatment goal of overactive bladder syndrome is to inhibit detrusor overactivity and thus to increase functional bladder capacity. Previous studies showed that in overactive bladder syndrome, trospium hydrochloride leads to improvement in urodynamic parameters compared to placebo.
studies have explored the effects of electrical stimulation on urodynamic parameters, and these studies presented evidence that it causes improvements.

Posterior tibial nerve electrical stimulation was chosen as the physiotherapeutic method because it is an interesting alternative for the treatment of overactive bladder, which is effective and without side effects, despite the fact that pharmacological treatment is currently the first option for the treatment of patients with clinical symptoms of overactive bladder, adherence to treatment is low, especially due to side effects which lead to discontinuation in 60% of cases. Posterior tibial nerve electrical stimulation is considered to be a simpler, less invasive and easy to apply form of peripheral sacral stimulation that is well tolerated by patients and more affordable.

Pelvic floor muscle exercises increase muscle volume and strength, so it is recommended as a treatment for men with urinary frequency, terminal dribbling, and urinary incontinence, pelvic floor exercises seem to help in reducing symptoms and provides better psychological and social quality.

The psychological well-being of patients with overactive bladder syndrome is important for the quality of life; no studies have investigated the effects of anticholinergic and electrical stimulation treatments on the psychology of patients. Our result indicates that both anticholinergic treatment and electrical stimulation markedly improved the depressive symptoms. This was attributed to the decrease in symptoms and consequent psychological well-being. Moreover, this effect continued even after the termination of the electrical stimulation treatment.

Our result is consistent with previous studies which stated that PTNS produce improvement in bladder instability, voiding frequency and bladder capacity by urodynamics evidence, also effect of PTNS on patients with over active bladder symptoms (urgency, frequency) had a good results and urodynamics parameters were improved after treatment and statistically significant decrease in leakage episodes, frequency and nocturea.

In this study, we found that patients were satisfied with both treatments. This indicates that both treatments can be used in clinical practice. However, when side-effects are considered, electrical stimulation caused fewer side-effects than anticholinergic treatment. The side-effects observed with electrical stimulation and anticholinergic treatment is similar to those in the literature.

Voiding diary is an objective tool to assess urodynamic parameters in patients with overactive bladder. In our study, significant improvements were observed in the voiding diary and urgency severity in both treatment groups. Improvements in voiding habits as a result of treatment observed in the electrical stimulation and anticholinergic treatment groups are in agreement with the literature. A study that investigated the effects of electrical stimulation and anticholinergic treatment on overactive bladder syndrome found electrical stimulation was more effective than anticholinergic treatment

In the week 20 follow-up period, although there was no difference between the treatment groups in terms of the examined variables, we observed declines in voiding parameters and urgency severity following the termination of treatment in the trospium hydrochloride group whereas improvements in voiding parameters and urgency severity continued in the electrical stimulation group. Because of this favourable effect of electrical stimulation, we are of the opinion that studies with longer follow-up periods are needed.

In this study, we found that patients were satisfied with both treatments. This indicates that both treatments can be used in clinical practice. However, when side-effects are considered, electrical stimulation caused fewer side-effects than anticholinergic treatment. The side-effects observed with electrical stimulation and anticholinergic treatment is similar to those in the literature.

CONCLUSION

Finally, both posterior tibial nerve stimulation and trospium hydrochloride were similarly effective in patients with overactive bladder syndrome, and thus the continuation of these two treatments is important because the discontinuation of these treatments would cause a relapse of most of the symptoms of overactive bladder syndrome. However, further studies are needed to compare the effects as well as the treatments’ superiority over one another in long-term use.

ACKNOWLEDGEMENT

I would like sincerely to thank all staff working in Almataryia National Institute for Urology for their technical assistance and effort, also many grateful to
Urologist staff for their generous assistance in sample collection.

REFERENCES

Pulse Rate Response to Footwear in Rehabilitation Phase of Coronary Artery Bypass Graft Surgery (CABG) Patients – A Clinical Trial Study

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ABSTRACT

Introduction: Cardiac rehabilitation is a well-established treatment in patients with coronary artery disease. However, no research has intervened the implementation of the footwear immediately after CABG surgery or during the rehabilitation phase.

Aims & Objectives: To find the effect of walking with running shoes and without running (with slippers) shoes on pulse rate of rehabilitating CABG subjects and to compare the effects produced after walking with running shoes and without running shoes.

Methodology: On fifth postoperative day CABG, subjects were asked to cover a distance of 100 meters with slippers and with running sports, shoes with a rest time of one hour between the two sessions. Pulse rate was measured after covering the 100-meter distance with both types of footwears.

Results and Analysis: Students t-test & f-test were applied to find out the relevance among the attained values of pulse rate after walking 100 meter distance without running shoes (with slippers) and with running shoes to that of the resting pulse rate.

Conclusion: The study concluded that incorporation of footwear that is comfortable running shoes is physiologically important to include in the rehabilitation protocol of Coronary artery by pass graft subjects, as it will not risk the patients with abrupt increment in the pulse rate that may be a risk factor for them.

Key words: CABG, Rehabilitation, Pulse Rate, Resting Pulse Rate, Running Shoes(WS), Slippers (WOS).

INTRODUCTION

Cardiac rehabilitation is a well-established treatment in patients with coronary artery disease. Regular physical activity is required to maintain these training effects. Only exercise and fitness protocols have been studied till date. Indeed, although it is recognized that the typical cushioned running shoes may alleviate actual joint contact forces, the authors hypothesize that certain attributes of running shoe design increase the relative distribution of these forces. The design of modern running footwear is most favorable to promote long-term health in runners. It is recognized that the typical cushioned running shoes may alleviate actual joint contact forces, the authors hypothesize that certain attributes of running shoe design increase the relative distribution of these forces. Until date, these studies have only focused on walking and shown that altering the AP rocker of the shoe produces the greatest adaptations at the ankle joint. The footwear industry has recognized this importance and has been developing shoes which try to attend the demands of each single activity/sport for example running shoes, soccer shoes, trying to consider the specific aspects of each activity in order to improve the performance of the athletes. Besides athletic performance, footwear can be also developed as a therapeutic strategy against diseases known to cause
motor impairments, like Diabetes Mellitus and Parkinson’s disease, focusing on the comfort properties of the shoes but no footwear has been incorporated in Cardiac rehabilitation.\textsuperscript{11-14} It is unfortunate that individualized studies on footwear mechanics without or with respect to orthopedic studies have taken place since so many decades while the effect of footwear on rehabilitation of cardiac patients or CABG patients is not even touched. The Nike Zoom Vomero + 5 with enhanced fit, smoother ride and lighter weight benefits best for under pronators to neutral-gait runners snug, secure, seam-free fit, elastic mesh panels for lockdown and an adaptable fit lightweight, responsive cushioning (five layered ) weight 329 grams make it a physiologically low cost foot wear. Stretch mesh work with other parts of the shoe to keep the middle of your foot locked down while stretching and flexing with it for comfort and support. In addition, an external heel counter wraps the heel for a snug, secure fit, boost the comfort factor is an inner-sleeve, or bootie, for a plush fit and feel.\textsuperscript{15-16} Lee et al gave positive results of walking for Hypertensive patients.\textsuperscript{17} Friedrick et al put forward that cushioning effect in running shoes maximizes performance.\textsuperscript{18} Helen Braithwaite did a correlation study on foot comfort and heart rate.\textsuperscript{19} Blackstone et al proved positive effect of Cardiac rehab on heart rate of CABG subjects.\textsuperscript{20}

**MATERIAL AND METHODS**

The design of the study was quasi-experimental. One fifty CABG rehabilitating subjects participated in the study were recruited through non-probability convenient sampling method. Male subjects in the age group of 50-70 years both smoker and non-smoker under cardiac Rehabilitation Protocol were included in the study while the subjects with unstable angina, exercise induced asthma, acute illness with fever, in the study while the subjects with unstable angina, under cardiac Rehabilitation Protocol were included. One fifty CABG rehabilitating subjects participated thereafter. Subject’s usual medical regimen was incorporated in Cardiac rehabilitation. \textsuperscript{11-14} It is unfortunate that individualized studies on footwear mechanics without or with respect to orthopedic studies have taken place since so many decades while the effect of footwear on rehabilitation of cardiac patients or CABG patients is not even touched. The Nike Zoom Vomero + 5 with enhanced fit, smoother ride and lighter weight benefits best for under pronators to neutral-gait runners snug, secure, seam-free fit, elastic mesh panels for lockdown and an adaptable fit lightweight, responsive cushioning (five layered ) weight 329 grams make it a physiologically low cost foot wear. Stretch mesh work with other parts of the shoe to keep the middle of your foot locked down while stretching and flexing with it for comfort and support. In addition, an external heel counter wraps the heel for a snug, secure fit, boost the comfort factor is an inner-sleeve, or bootie, for a plush fit and feel.\textsuperscript{15-16} Lee et al gave positive results of walking for Hypertensive patients.\textsuperscript{17} Friedrick et al put forward that cushioning effect in running shoes maximizes performance.\textsuperscript{18} Helen Braithwaite did a correlation study on foot comfort and heart rate.\textsuperscript{19} Blackstone et al proved positive effect of Cardiac rehab on heart rate of CABG subjects.\textsuperscript{20}

**RESULTS**

<table>
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<td>14.07</td>
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</table>

**DISCUSSION AND CONCLUSION**

Student t test was applied to find out the relevance among the attained values after walking 100 meters distance without running shoes (with slippers) and with running shoes to that of the resting pulse rate (Table 1&2). The percentage of increase in the pulse rate after running without shoes (with slippers) is 15\% while after walking with running shoes is 30.71\%. It is physiologically related to afferent input from the feet provided by mechanoreceptors located in the skin, which are able to perceive different forms of mechanical stimulation, e.g. vibration and touch.\textsuperscript{21-27} Skin temperature and blood flow are reciprocal influence factors.\textsuperscript{28-31} Therefore, changes in foot temperature are likely to evoke changes in the blood flow at the foot area.\textsuperscript{30-33} The relation between skin temperature and foot sensitivity have shown non-conclusive and often controversial results.\textsuperscript{34, 35} While this indirect relation between foot sensitivity and footwear is becoming an important tool in the evaluations of different kinds of footwear the direct influence of footwear on foot sensitivity is yet little investigated.\textsuperscript{36-40} The perception of mechanical stimuli is possible through the activation of cutaneous mechanoreceptors located in the skin, both hairy and glabrous.\textsuperscript{41, 42} On the other hand, the rapid adapting receptors respond to either the velocity (meissnercorpuscles) or the acceleration of the deformation caused by mechanical stimulation (vater-pacini corpuscles). While the meissner corpuscles fire as long as the deformation velocity of the skin remains constant, the vater-pacini corpuscles react to the changes in this velocity, firing intensively at the onset and offset of the stimulus.\textsuperscript{43} The distribution of the mechanoreceptors in foot sole divides a skin layer cut in thirty nine zones found a much higher number of mechanoreceptors in the human foot sole. These mechanoreceptors get stimulated through cushioned

<table>
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<th>Parameters</th>
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</table>

### Table 1. Test for Pulse Rate

### Table 2. f Test for Pulse Rate between the groups
layered shoe sole hence enhance a better circulation leading to sufficient venous return. At the same time walking with slippers is equivalent to high intensity exercise therefore the pulse rate should increase proportionately but this is not happening in the CABG subjects in the present study, which indicates that the demand is not being fulfilled by the working heart. However, when the subjects are walking with running shoes the circulatory system of their body is proving to be sufficient. The footwear industry has recognized this importance and has been developing shoes, which try to attend the demands of each single activity/sport, e.g. running shoes, soccer shoes, trying shoes, which try to attend the demands of each single activity/sport, e.g. running shoes, soccer shoes, trying to consider the specific aspects of each activity in order to improve the performance of the athlete.

Till date the footwear implementation in the rehabilitation protocols is applied to greater percentage of ankle foot deformities, muscle weaknesses in lower extremities, osteoarthritis conditions etc. However, this study strongly recommends the implementation of running shoes in postoperative phase of Coronary artery by pass graft subjects specifically when they walk on hard terrain like hospital corridors. Hence, the running shoes should be included therapeutically in the rehabilitation protocol of CABG subjects.

ACKNOWLEDGEMENTS

I am highly thankful to my statistician Dr. V.K Tiwari for his valuable guidance and professional inputs.

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Effect of Passive Pelvic Fixation on Non-Specific Lumbopelvic Pain: A Case Report

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ABSTRACT

The purpose of this study was to evaluate the efficacy of passive pelvic fixation in a patient with lumbopelvic pain. A 35 year old male patient (Mr. A. T) came to the Physiotherapy Department with the complaint of lumbopelvic pain and difficulty in forward bending since 30 days. He experienced severe pain which was 7.1/10 on Visual Analogue Scale on active lumbar flexion. On physical examination, paraspinal muscle spasm was present in the lumbopelvic area. Range of active lumbar flexion was 2cm as per Schober’s method. Active Straight Leg Raising (ASLR) on right side was painful and range was 70 degrees. Hence, an attempt was made to find out an immediate effect of passive pelvic fixation on intensity of pain and active range of lumbar flexion. Pelvis was stabilised manually and patient performed active lumbar flexion 10 times. Patient was re-evaluated after every set of 10 repetitions. Total three sets of the above were given. There was remarkable relief of pain by 3.2/10 and 0.5cm increase in lumbar forward flexion range as per Schober’s method. ASLR on right side increased to 85 degrees after the treatment. Hence, it was concluded that passive pelvic fixation can be used as an adjunct to routine physiotherapy interventions for immediate relief of low back pain and increase in spinal mobility.

Key words: Active Lumbar Movements, Lumbopelvic Pain, Passive Pelvic Fixation.

INTRODUCTION

Whether it’s a dull, nagging ache or sharp shooting pain, low back pain is a condition that plagues millions of lives all over.¹ Low-back pain is a substantial health problem. The incidence of low back pain in India is quite alarming affecting 60 per cent of the population at some time or the other in their lives.² It is the most frequent cause of limitation of activity (work, housekeeping, or school) in individuals younger than 45 years.³ Low back pain may manifest in the form of lumbago, low back pain with buttock pain, low back pain with sciatica and lumbopelvic pain. Lumbopelvic pain is one of the major components of low back pain.

Lumbopelvic pain is the pain around lower lumbar segment, sacrum with coccyx and posterior aspect of pelvis. Lumbopelvic misalignment/malalignment is the leading factor for the same. These may be due to the abnormal positioning of the pelvis.⁴ Ligaments and muscles surrounding lumbar and pelvis area helps in maintaining position and stability of this area. Any dysfunction of these anatomical structures will result in lumbopelvic pain.⁵ So in order to maintain the stability of this area, any external corrective forces other than muscles and ligaments may be helpful.

Few studies regarding the effect of scapular repositioning in shoulder impingement syndrome have been documented suggesting its effectiveness in decreasing pain and increasing shoulder strength.⁶ The evidence for the relative benefit of this concept in pelvic girdle is limited & questions concerning about passive pelvic fixation an innovative technique use frequently by the authors for treating lumbopelvic pain and to find out the need of lumbosacral corset remain unanswered. Hence the present case study was an attempt to find the efficacy of passive pelvic fixation on lumbopelvic pain.
Case Description: The patient (Mr. A. T.) was a 35 year old computer professional. He was referred for low back pain by an Orthopaedic surgeon. The case was attended by physiotherapist and enrolled on daily treatment basis.

Patient history: Mr. A.T. complained of low back pain for 30 days that started gradually. There was no history of trauma. Pain was dull aching, precipitated by forward bending activity and relieved by rest in supine lying position. The temporal variation included increase in his lumbopelvic pain during night. He rated his pain as 7.1 on a 0 to 10 centimetre Visual Analogue Scale (VAS). He had no history of similar problem in the past.

Physical examination: On physical examination, it was found that the patient had increased lumbar lordosis, grade one tenderness over L4, L5, S1 spinous processes, paraspinal muscle spasm at lower lumbar area, painful restriction of active lumbar spinal flexion. Lumbar spine flexion range was 2cm as measured by Schober’s method. Active Straight Leg Raising (ASLR) on right side was 70 degrees. Strength of abdominals was 3° and that of back extensors was 4 as per manual muscle testing. Thomas test was positive bilaterally. He rated the pain on active movement as 7.1/10 on visual analogue scale. Lumbar spine radiograph revealed no bony abnormality. The quantity of pain felt by the patient on forward bending was considered as an asterisk sign.

Treatment methods: The patient was informed about the study and his consent was taken. Outcome measure in terms of quantity of pain on VAS and active range of lumbar spine flexion by Schober’s method were used. Prior to the treatment his pain and active lumbar flexion range was noted. Patient was then educated about his condition and the possible treatment to be given. Initially the patient was treated with continuous short wave diathermy for 10 minutes in supine position with pad electrodes placed in coplanar arrangement at the lumbopelvic region. The manual treatment given was in form of passive pelvic fixation (PPF) along with active spinal flexion movement. The starting position of the patient was standing. The procedure was performed with the therapist standing behind the patient. The therapist held the pelvis in neutral position at the anterior superior iliac spine level bilaterally with the thumb and index finger (Figure 1) while the patient performed the offending painful spinal flexion movement (Figure 2). It was repeated 10 times. Patient was re-evaluated after every set of 10 repetitions. Total three sets of the above were given. Immediately after the intervention, outcome measures were reassessed.

RESULTS

Immediately after the interventions, it was found that his pain on active lumbar flexion got decreased from 7.1/10 to 3.9/10 (45.1%) on VAS (Figure 3) and...
active spinal flexion improved by 0.5 cm (25%) as measured by Schober’s method (Figure 4). It was also found that ASLR on the right side also increased from 70 to 85 degrees (21.4%).

DISCUSSION

The results of the study suggest that passive pelvic fixation technique may be an effective technique for patients with non-specific lumbopelvic pain with limited and painful active lumbar flexion range of motion. This might be due to the direct effect of this technique like neurophysiological or mechanical effects or increased stability that may reduce the load on pain sensitive structures and thereby relief of pain and inhibited muscle function which in turn may increase active range of lumbar flexion. Further, this effect could be due to effects like placebo or psychological effect directly or indirectly by minimizing protective muscle guarding. However, the cause and effect relationship was not investigated in the present study. Since there is hardly any similar study, the results of this study could not be interpreted in terms of the available literature. However, it has been reported that there may be decreased sagittal sacroiliac joint rotation in cadaver specimens by pelvic compression using a belt. 

Obvious limitation of this study included difficulty in generalizing the results for other patients and hence future research may be done with case series in specific and nonspecific lumbopelvic pain.

CONCLUSION

Passive pelvic fixation can be used as an adjunct to routine physiotherapy interventions for immediate relief of low back pain and increase in lumbar spine mobility.

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A Prospective Experimental Study of Effects of Cognitive Tasks on Balance In Stroke Individuals

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ABSTRACT

Background: Load of cognitive task increases the demands on postural control and balance in stroke patients making patients more susceptible to falls. So assessing balance under dual task conditions become important aspect of rehabilitation of stroke patients.

Aims: To see the effect of cognitive task on balance in chronic stroke patients.

Settings and design: Prospective experimental study carried out at tertiary care hospital, Mumbai.

Materials and Methods: 30 Chronic stroke patients (>6 months duration) above 50 years of age were assessed for balance with modified Clinical Test of Sensory Integration of Balance (mCTSIB) scale with and without cognitive task of calculation. Outcome measure was the balance score under four different conditions of the scale with and without cognitive task.

Statistical analysis: Wilcoxon Signrank test and paired t- test were used to analyze the difference between the balance scores with and without cognitive task.

Results: Balance decreased significantly with cognitive tasks in all four conditions of the mCTSIB scale. Condition 1- EOFI: (20.4 ±7.32 - 17.5 ±9.099) (p <0.001). Condition 2- ECFI: (12.7±7.29 - 9.25 ±7.196) (p <0.001); condition 3- EOFO: (11±7.87 – 10±9.099) (p <0.001); condition 4- ECFO: (3.4±4.95 – 2.1±4.65) (p <0.001).

Conclusion: Balance decreases under different conditions with concurrent cognitive task in chronic stroke patients. Hence treatment under dual task conditions in different environments should be an integral part of balance rehabilitation in stroke patients.

Key words: Stroke, Cognition, Postural Control, Modified CTSIB.

INTRODUCTION

Balance is called as “family of adjustments” which is needed in order to maintain a posture and to move. This requires a complex interaction of many systems. Sensory and musculoskeletal systems are most important along with movement strategies, postural response latencies, cognitive factors like attention, motivation and intent. Cognitive impairment is a known predictor of falls in older adults. An additional cognitive task increases the demands on postural control and balance in post stroke patients making the patient more susceptible to falls.¹⁻⁵ This may be attributed to untrained cognitive function which has an effect on balance. So, thorough evaluation and assessment of balance with cognitive task is necessary. Modified Clinical Test for Sensory Interaction in Balance (mCTSIB) scale is a sensitive and specific measure of balance.⁶⁻⁷ Hence the purpose of our study was to see the effect to cognitive tasks on balance in chronic stroke patients using mCTSIB scale. The tasks considered were mathematical calculation of subtracting 3 and memorizing a shopping list comprising of 7 items. Both these tasks represent everyday cognitive requirements for a functional individual.

MATERIAL AND METHODS

This was a prospective experimental pre-post design study carried out in Physiotherapy O.P.D. of a tertiary care hospital. Subjects were chronic post stroke patients, above 50 years of age. Sample size was calculated for prevalence of 0.018 and 95% confidence
interval. The sample size is 27 but we decided to include 30 hemiplegic patients in our study so our confidence interval is more than 95%.

**Inclusion criteria:** Subjects were post-stroke since more than 6 months, above 50 years of age and ability to independently stand on their own.

**Exclusion criteria:** Subjects with any cognitive or perceptual problems, aphasia, vestibular disorders, other neurological or neuromuscular disorders and any musculoskeletal injury in lower limbs. Materials used were foam of medium density, i.e. dense enough to avoid bottoming out and a stopwatch.

Study procedure: After the synopsis of the study was approved by the ethics committee, a detailed evaluation of 48 stroke patients was done.

**Table 1. Flow chart – Recruitment of subjects**

<table>
<thead>
<tr>
<th>Excluded (18)</th>
<th>Included =30</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 patients Required support for standing</td>
<td>4 patients had Aphasia</td>
</tr>
<tr>
<td>4 patients had Cognitive problems</td>
<td>5 patients had Cognitive problems</td>
</tr>
<tr>
<td>Fulfilled criteria</td>
<td></td>
</tr>
</tbody>
</table>

The purpose of the study was explained to the subjects and consent was taken from them for their active participation.

Subjects were evaluated using mCTSIB

Starting position of patient was standing with feet together and shoulder width apart and crossed across the chest. The four conditions of the scale were as below:

1) Standing with eyes open on a FIRM surface.
2) Standing with eyes closed on a FIRM surface.
3) Standing with eyes open on a FOAM surface.
4) Standing with eyes closed on a FOAM surface.

Protocol: 30 seconds trial time using stopwatch was recorded.

**TOTAL SCORE: _____/ 120 seconds (30 seconds for each of the four conditions).**

Average time of three trials was recorded as initial mCTSIB score. Subjects were made familiar with the tasks A and B.

**TASK A:** A cognitive task of backward counting by subtracting 3 from 100 under all four conditions of mCTSIB and total score is recorded.

**TASK B:** A cognitive task of memorizing a shopping list of 7 items. Then they were asked to recollect those 7 items under all four conditions of mCTSIB and total score is recorded.

In between the two tasks patients were given the rest pause.

**RESULTS**

The subjects comprised of 22 males and 8 females; Of these 12 were less than 55 years, 11 were between 56 and 60 years, 6 were between 61 and 64 years and only one was above 65 years. 20 subjects were right brain damaged and 10 were left brain damaged. 19 subjects had been diagnosed of stroke 20-49 months earlier.

**Table 2. Comparison in EOFI condition**

<table>
<thead>
<tr>
<th>Mean effect</th>
<th>Initial</th>
<th>Task</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial with Task A Wilcoxon Sign Rank test</td>
<td>2.1 sec</td>
<td>20.4(7.32)</td>
<td>17.5(9.099)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Table 3. Comparison of Inter Quartile ranges in ECFI condition using Wilcoxon sign Rank test**

<table>
<thead>
<tr>
<th>Mean effect</th>
<th>Initial</th>
<th>Task</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial with Task A</td>
<td>2.46 sec</td>
<td>12.7(7.29)</td>
<td>9.25(7.196)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Initial with Task B</td>
<td>3.81 sec</td>
<td>12.7 (7.29)</td>
<td>8.95 (7.101)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The deterioration in balance score was statistically significant after task A & B in EOFI condition.

**Table 4. Comparison of Inter Quartile ranges in EOFO condition using Wilcoxon sign Rank test**

<table>
<thead>
<tr>
<th>Mean effect</th>
<th>Initial</th>
<th>Task</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial with Task A</td>
<td>1.47 sec</td>
<td>11 (7.87)</td>
<td>10 (9.099)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Initial with Task B</td>
<td>2.98 sec</td>
<td>11 (7.87)</td>
<td>8.6 (8.7)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The deterioration in balance score was statistically significant after task A & B in EOFO condition.
DISCUSSION

Results can be explained by conceptual model of systems theory of postural control by (Shumway-Cook). It states that:

Postural control is not regulated by a single system, but emerges from the interaction of many systems. Thus, in a systems approach, postural control results from a complex interaction among many bodily systems that work cooperatively to control both orientation and stability of the body.

Cognition is one of the components affecting balance according to systems approach. Attention is one of the important components contributing to cognition. Attention is defined as the information processing capacity of an individual. An assumption regarding this capacity is that it is limited for any individual and that performing any task requires a portion of this capacity. This suggests that if two tasks are performed together and require more than total processing capacity the performance of either task or both task will deteriorate9-11.

When concurrent cognitive task is performed with postural task these attentional demands are shared between the two tasks. Thus the amount of attention provided for postural control decreases causing further deterioration of postural control in stroke patients in dual tasking. It deteriorates more on foam surfaces as attentional demands are more on foam surface.

According to Kerr et al. who studied attention and postural control using dual task paradigms in which postural task (primary) and secondary task are performed together. Decrease in performance on either task suggests interference between the processes controlling the two tasks and therefore the amount of attentional resources that are shared.

Normal postural control occurs automatically without conscious effort. It’s assumed that few attentional resources are needed when controlling balance. But in conditions of mCTSIB demands required to maintain stable posture are different in different conditions. They depend on the sensory system available for balance along with performing cognitive task9-11.

<table>
<thead>
<tr>
<th>No.</th>
<th>Condition</th>
<th>Sensory system available for balance</th>
<th>Demands placed on balance during task A&amp;B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Eyes open firm surface</td>
<td>Somatosensory, visual, and vestibular</td>
<td>Cognition only</td>
</tr>
<tr>
<td>2.</td>
<td>Eyes closed firm surface</td>
<td>Somatosensory and vestibular</td>
<td>Vision and cognition</td>
</tr>
<tr>
<td>3.</td>
<td>Eyes open foam surface</td>
<td>Vision and vestibular</td>
<td>Somatosensory and cognition</td>
</tr>
<tr>
<td>4.</td>
<td>Eyes closed foam surface</td>
<td>Vestibular</td>
<td>Vision, somatosensory and cognition</td>
</tr>
</tbody>
</table>

In stroke patients these attentional demands are further challenged by underlying sensori-motor impairments.

In EOFI condition:

The balance deteriorated significantly with both the cognitive tasks A and B.

Here, all three sensory systems are available for balance. So, this could be explained by affected motor aspect of postural control of stroke patients in quiet stance increasing demands of attention.

In stroke patients, it has been studied that there is impaired motor strength due to impaired recruitment of motor units secondary to brain damage resulting in inefficient generation of forces by lower limb musculature1,12. Asymmetric body alignment i.e. displaced centre of mass, reduced range of motion due to spasticity and biomechanical constraints and impaired ability to use ankle movement strategy result in impaired balance. Co-ordination, sequencing, timing, and amplitudes of postural muscle activity are impaired in the paretic limb. All of these make the subjects use either hip strategy or stepping strategy which were end points while scoring on mCTSIB.

Thus increased attentional demands are required to maintain postural control.

In dual tasking when these attention demands are shared, it causes deterioration of postural control i.e. early loss of balance in stroke patients with concurrent cognitive task.

In ECFI condition:

The balance decreased significantly with cognitive tasks A and B. Loss of visual input in this condition increases the reliance on somatosensory and vestibular systems in addition to cognitive tasks A &
The sensory aspect of postural control in stroke patients could be explained on basis of, a) loss of sensory redundancy i.e. inability to use impaired somatosensory and vestibular inputs; b) impaired sensory organization i.e. ability to integrate sensory inputs and resolve inter-sensory conflict. Thus a subject may rely heavily on one particular sense for postural control. Stroke subject may also demonstrate problems with sensory selection. They are unable to maintain stability when there is incongruence among senses.

Eyes closed condition removes the visual information available for balance leading to selection of vestibular and somatosensory inputs to maintain balance. Inability to do so by stroke patients causes increased instability and thus increased demands of attention.

In EOFO condition:

There was significant decrease in balance with both cognitive tasks A and B in this condition. The probable explanation to this could be inaccurate somatosensory information received.

Foam surface inaccurately gives information about somatosensory system required for balance. There is increased reliance on vision and vestibular inputs. On foam surface muscle response requirements are greater than on firm surface. This further increases the demand for attention of postural control.

In ECFO condition:

There was significant decrease in balance with both cognitive tasks A and B in this condition. Here, loss of visual and somatosensory inputs increased attention demands on balance. When both visual and somatosensory inputs for postural control are reduced, attentional demands were higher than other previous conditions leading to earlier loss of balance amongst all other conditions with cognitive tasks. Age related changes also contribute to increase in attention demands. As the demand for stability increases, there is a concomitant increase in attentional resources used by the postural control system.

Decreasing sensory information would demand more attention for postural control. When cognitive task is combined, attentional demands are shared and postural control deteriorates. This implies that amount of attention is dependent on the degree of instability inherent in the task13-15.

CONCLUSION

The following conclusion can be drawn from the above study:

1) Balance decreases significantly with cognitive task of calculation under all four conditions of modified clinical test for sensory interaction of balance (mCTSIB) scale.

2) Balance decreases significantly with cognitive task of memorizing under all four conditions of modified clinical test for sensory interaction of balance (mCTSIB) scale.

Application: Balance should be trained considering the cognitive task requirements of individuals with stroke.

ACKNOWLEDGEMENTS

To all the patients who contributed in the study.

Conflict of Interest: - none

REFERENCES


A Cross-Sectional Study on the Significance of Side Step Length for Dynamic Balance Assessment in Ambulatory Stroke Subjects

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ABSTRACT

Objective: To establish the correlation between the Side step length and Berg Balance Scale (BBS) for dynamic balance assessment in ambulatory stroke subjects.

Design: A Cross-sectional study.

Setting: Tertiary care hospital.

Subjects: A total of thirty subjects (mean age: 56 years ±10.66) with supratentorial stroke were recruited for the study by convenient sampling. All the subjects were ambulatory and were able to walk 10 meters unassisted.

Intervention(s): Not applicable.

Main Outcome measure (s): Correlational analysis was done between the BBS and Side step length by using Spearman’s rank correlation coefficient.

Results: Results showed a high linear positive correlation between the Side step length and BBS (p<0.01).

Conclusion: Present study concluded that the Side step length of affected and unaffected side had linear positive correlation with BBS total score. Side step length of both sides was almost equal. Approximate score of BBS may be estimated by the side step length of affected or unaffected side. Side step length can be used as a marker of dynamic balance in ambulatory stroke subjects.

Key words: Stroke, Berg Balance Scale, Balance.

INTRODUCTION

The prevalence of stroke in western countries is 400-800/100,000 whereas in India it ranges from 200-250/100,000.1

Following stroke, subjects lose functions of the motor, sensory and higher cognitive skills to various degrees which diminish their ability to balance effectively and make necessary postural adjustments.2,3 Impaired balance has been implicated in the poor recovery of activities of daily living and is related to incidence of falls between 23% and 50%.4

The major characteristic of impaired balance in hemiparetic subjects is increased postural sway and stance asymmetry which causes a shift in the position of centre of pressure toward the unaffected lower extremity. This leads to pronounced lateral postural instability, so that less weight is taken through the weak leg. They also have smaller excursions when moving their weight around the base of support, especially in the direction of the weaker leg.5,7

The asymmetrical pattern is seen in all aspects of balance—static, dynamic and responses to external perturbations. This asymmetry is also seen in stroke subjects who have high levels of function such as those who are ambulatory in the community.8

Subjects with hemiparesis can shift only approximately 55% of their body weight onto paretic leg.
limb in step stance and 65% of their weight in lateral direction. On the contrary, healthy elderly can voluntarily shift 95% of their body weight onto single limb in both forward and lateral directions.9

The evaluation and treatment of balance disorders is an integral component of a comprehensive stroke rehabilitation program.10 A variety of laboratory and clinical tools are available to measure static and dynamic balance in stroke population.11

Analysis of movements during dynamic weight shifts may provide clinicians an improved understanding of the specific problems that causes instability and falls in subjects with hemiparesis. Such information could also provide valuable directives for selecting the most appropriate therapeutic strategies.12

Berg Balance Scale,13,14 Functional Reach Test15 and Timed Up and Go test16 are some of the commonly used objective clinical tools for evaluating the balance impairment in hemiparetic subjects.

BBS is an objective measure of static and dynamic balance abilities. Based on extensive clinical use and frequency of comparison with other balance measures in both laboratory and research settings, the BBS is accepted as the clinical criterion standard to measure balance.9

Side Step Test developed by Fujisawa and Takeda meets the need for a test of balance disorder in the frontal plane. This test incorporates dynamic weight shifts, which is found to be impaired in hemiparetic subjects.17

Fujisawa and Takeda et al found the correlation between Side Step Test and gait parameters. However the relationship of Side Step Test with any of the standard test of balance was not established. In the present study we aimed to establish the correlation between the Side step length and BBS. The Side step length was measured with inked footprints method.

We hypothesized that the correlation between the Side step length affected and unaffected side with BBS total score would be significant.

MATERIAL AND METHODS
Participants

The 30 subjects (mean age: 56 years±10.66) with supratentorial stroke were selected for the study. Participants’ characteristics are listed in table 1.

Table 1. Characteristics of Subjects (N= 30)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>12</td>
</tr>
<tr>
<td>Type of Lesion</td>
<td>Infarct</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Hemorrhage</td>
<td>07</td>
</tr>
<tr>
<td>Paretic side</td>
<td>Right</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>15</td>
</tr>
<tr>
<td>Duration since stroke (months)</td>
<td>Mean</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>9.94</td>
</tr>
<tr>
<td>Brunnstrom’s recovery stage</td>
<td>Stage V</td>
<td>04</td>
</tr>
<tr>
<td></td>
<td>Stage VI</td>
<td>26</td>
</tr>
</tbody>
</table>

Subjects had to meet the following criteria in order to be eligible to participate: (1) Unilateral Supratentorial stroke subjects referred by the Physician. (2) Brunnstrom’s Stages of lower extremity recovery grade V and VI. (3) A Mini Mental State Examination score e” 24. (4) Able to walk 10 meters without any walking aids.

Subjects with history of any other neurological disorders that would affect balance, diagnosed musculoskeletal disorders or any history of joint replacement in lower limbs which could affect ambulation and visual field defects were excluded.

Procedure

The study was approved by the scientific committee and Institutional Ethics committee. The purpose of the study was explained to the study population and written informed consent was taken. Subjects were selected on the basis of inclusion and exclusion criteria.

BBS and Side step length were used as outcome measures to evaluate the balance of subjects with stroke. In order to minimize the influence of one test over the other, order of the tests was randomized. The subjects were randomized into 2 groups (Group A & Group B) by block randomization method. Group A was evaluated first by the BBS followed by Side step test and group B was evaluated first by the Side step test followed by BBS. Rest period of 15 minutes was given between the two tests to avoid fatigue.

The principle investigator administered the BBS and Side step test and an independent rater measured the Side step length with standardized measuring tape. This rater was blinded to the scoring obtained in BBS.

Berg Balance Scale

Standard procedure for evaluating balance using the BBS was performed and scoring was done.
Side Step Test

Prior to commencing the Side Step Test, visual demonstration of the Side Step Test was done so that subjects could understand the method to perform the same. Long lasting dye was applied over the plantar aspect of subject's feet and subjects were made to stand along the 10 meters walkway with the feet together. This walkway was pasted with 10 meter long white sheet paper to obtain a good imprint of the inked feet of each subject (Fig 1).

There was a highly significant correlation between BBS total score and the ratio of side step length/ leg length of affected (r=0.80) and of unaffected side (r=0.84). (Table 2)

Table 2. Spearman's rank-correlation coefficient and Pearson's correlation coefficient between the ratio of side step length/ leg length of affected and unaffected side with BBS total score

<table>
<thead>
<tr>
<th></th>
<th>Spearman's rank-correlation coefficient (r)</th>
<th>p</th>
<th>r square</th>
<th>Pearson's correlation coefficient (r)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side step length/leg length of affected side</td>
<td>0.804</td>
<td>0.000**</td>
<td>0.64</td>
<td>0.764</td>
<td>0.000**</td>
</tr>
<tr>
<td>Side step length/leg length of unaffected side</td>
<td>0.848</td>
<td>0.000**</td>
<td>0.71</td>
<td>0.776</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

The “r” square for the ratio of side step length/ leg length of affected side was found to be 0.64 and for unaffected side r square was 0.71, which indicates that if the ratio of side step length/ leg length of affected side and of unaffected side contributes 64% and 71% for BBS total score respectively.

As shown in figure 2 there is a linear positive correlation between the ratio of side step length/leg length of affected side as well as of unaffected side with BBS total score. As the ratio of side step length/ leg length of either side increases, the BBS score also increases.

Fig. 2. Scatter plot denoting the relationship between the ratio of Side step length/leg length of affected and unaffected side with BBS total score.
DISCUSSION

One of the major characteristics of subjects with stroke is difficulty in accepting and transferring the weight on the involved lower extremity. Subjects with stroke show postural instability, particularly in the frontal plane. Previous studies concluded that falls occur most commonly during movement related activities in stroke population, as it requires weight bearing and weight shifts in different postures and directions.

A variety of clinical tests have been described for monitoring the changes in balance. BBS is accepted as the gold standard to measure the balance, which consists of various functional tasks of activities of daily living to assess static and dynamic balance in terms of postural maintenance and execution of voluntary if movements.

Strong correlation between the ratio of side step length/ leg length of affected and unaffected side with BBS could be explained since both BBS and Side step test emphasize on weight shifts. We found that subjects with higher side step length had a higher BBS score which may indicate a better functional mobility and stance symmetry.

Our findings showed non-significant correlation with most of the static components of BBS that is unsupported standing, unsupported sitting, standing with feet together and standing with eyes closed. Lack of significant correlation of these components with the side step length of affected and unaffected side may be attributed to the fact that these components do not incorporate weight shifts.

Incidentally two of the static components of the BBS showed significant correlation with the side step length that is tandem standing and standing on one leg. Reduced base of support in tandem standing & standing on one leg increases the demand on the paretic leg to accept almost equal weight as nonparetic leg which could be the reason for significant correlation.

With regard to BBS component ‘standing to sitting’, no significant correlation was seen with the side step length of affected and unaffected side. Change in the muscle work (eccentric control of the hip extensors) in spite of weight shifts seen in this task could be the factor responsible for non-significant correlation.
Limitations of the study

In the present study only the subjects with Brunnstrom's recovery stage V & VI were selected and there is lack of normative data for the side step length measure. There was no control group for comparison.

Future Research

Future studies may also include healthy elderly as control and there is need to establish a normative data for side step length measure.

CONCLUSION

Present study concluded that the Side step length of affected and unaffected side had linear positive correlation with BBS total score and with most of the dynamic components of BBS. Side step length of both sides was almost equal. Side step length can be used as a marker of dynamic balance in ambulatory stroke subjects.

Clinical Implications

Side step length can be used as an easy and quick measure for assessment of lateral balance in stroke patients in routine clinical settings. Clinician may use the Side step length with reasonable confidence as it provides comparable information to the BBS for initial examination purposes.

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REFERENCES


INTRODUCTION

*Hands without sensation are like eyes without vision* - Moberg

The human hand is a delicate and complicated multi system organization that provides sensory information and precise motor execution. A sensate hand can give an instant picture of the overall shape, size, weight and general texture of an object. Without sensation in the hand, there is greater risk of injury to the hand and decreased ability to manipulate small objects. There is also a tendency not to use the hand in functional activities, which adds to the phenomenon of *learned nonuse*, loss of function that results from not using the hand (Carr & Shephard, 1998).

The sensory system is organized into serial chains of neurons that ascend from the hand to the brain. The brain is a complicated neural network, which continuously remodels itself as a result of changes in sensory inputs. Age, occupation, intelligence and callus formation affects the sensitivity of the receptors. The median and ulnar nerves are the most commonly injured peripheral nerves leading to sensory compromise in the hands.

In general, injury to the peripheral nerve is followed by nerve response in the form of nerve degeneration and regeneration. The choice of interventions for sensation is based on the diagnosis, prognosis, and evaluation findings. Bowden in discussing recovery after nerve injuries noted in 1954, that there is an indication that constant usage may lead to greater manual dexterity. Glickman and Mackinnon identified the factors that influence digital sensibility following re-plantation. These factors include age, level and mechanism of injury, digital blood flow, cold intolerance and postoperative sensory reeducation. Therefore, following peripheral nerve repair, functional sensibility of the hand improves overtime, with use, and with training.

Sensory re-education is provided for patients who have some sensation and potential for better sensation or better interpretation of sensory information. Sensory reeducation is the reprogramming of the brain in a re-learning process where items of increasing difficulty are touched and experienced with the eyes open or closed.

Rosen B., Lundborg stated that the recovery of functional sensibility after nerve transection and repair is often disappointing. Sensory reeducation is...
Traditionally not introduced until there is reinnervation in the hand, and such a late onset of training may be one explanatory factor for the poor functional results after nerve repair.

Only few earlier studies have incorporated early intervention (sensory re-education) in peripheral nerve injuries. The sensory re-education programs in earlier studies have included manipulation of objects which stimulate mechanoreceptors and other deep sensory receptors along with the superficial touch receptors. Thus, object identification (naming objects) following training may not be attributed to re-education of touch sensation alone. The current study was done on individuals with median or ulnar nerve injury and repair at the wrist level using a protocol specifically to re-educate touch sensation through early intervention in relatively less duration (number of therapy sessions).

**MATERIAL AND METHODS**

The sample selected for the study consisted of 22 male patients with peripheral nerve injury at wrist level. They were divided equally (n = 11) into experimental (mean age = 26.45 years) and control group (mean age = 32.09 years). Among them, 11 patients had median nerve injury and 11 others had ulnar nerve injury associated with flexor tendon injuries. They underwent repair of the cut tendons by modified Kessler’s technique and suturing of the nerves by microsurgical technique. The duration between the time of injury and repair was maximum 24 hours. The patients were immobilized for 3 weeks and included in the study from 4th week after nerve repair. They were screened to confirm the presence of protective sensation. Those who had associated crush injuries of the distal and middle phalanges of fingers were excluded from the study.

The materials used in the study consisted of the tools including, pencil with eraser end attached, sand papers (5 different textures), wooden blocks (6 different shapes) and 12 different metal objects stuck on wooden board. Various measures of sensation of the hands were done using instruments like Monofilaments, Calibrated aesthesiometer, Object recognition test and Paresthesia level scale.

**Procedure for Data Collection:**

A verbal consent was taken from all the patients included in the study. An initial base line evaluation of Touch-Pressure, Two-Point Discrimination – Static and Dynamic, Level of Paresthesia and the number of objects identified in Object Recognition Test was done in the autonomous zones of the repaired nerves.

Following initial evaluation, therapy in graded steps was started for the experimental group as per the intervention protocol given below. Therapy was given 6 days (1 session/ day) in a week for 3 months and each session lasted for 15 minutes. A detailed home program was also given to the patients. The patient was made to observe the procedure of the treatment step, then to close his eyes and concentrate on what was being felt.

Following it the patient had to explain in words about what he felt. Then the patient was made to observe the stimulus again to confirm the sensory experiences with perception. Assessment was done at the end of each month to check the improvement. The control group was given detailed home program only.

**Intervention Protocol:**

The method of treatment used in the study is a combination of the programs proposed by Wynn Parry and Dellon. The following are the steps used in the reeducation program:

**Step – 1: Reeducation of perception of moving touch and constant touch:**

The eraser end of a pencil was used to stimulate the specific area and a moving touch stimulus was applied either in transverse or longitudinal manner in the autonomous zone of the repaired nerves. A similar procedure was employed for training constant touch using static stimulus.

**Step – 2: Differentiation of roughness of the sand papers:**

In this step, the patient was trained to identify the textures of sand papers that were stuck on a dowel. Both the ends of a selected dowel were lightly moved over a zone of dysfunction while the patient’s eyes were closed. The patient was asked to state whether the two ends are the same or different. If the patient was incorrect, the stimulation was given again with opened eyes. Following this, the stimulation was repeated with closed eyes for further reinforcement. For correct response, appropriate feedback was given. Initially the contrast grade sand papers were selected. As discrimination improved, the grades of sandpaper chosen for practice became more similar.
Step – 3: Identification of shapes of wooden blocks:

In this step, the patient was trained to identify the various shapes of the wooden blocks. Six different shaped wooden blocks were used.

Step – 4: Identification of objects:

In this step, the patient was trained to identify 12 different small metal objects each of which were fixed on wooden plates. Along with the above described sensory reeducation techniques, the patients were taught about the home program activities similar to control group patients.

OBJECT IDENTIFICATION

Home Program:
The control group was given only the following home program:

1. Practicing compensatory techniques for decreased sensation.
2. Identifying different textures by using sand papers (rough and smooth).
3. Identifying objects which are used in day to day life by manipulating it with the fingers.
4. Encouraging the use of the affected hand during the activities thereby providing tactile stimulus.
5. Correlating the details of the stimulus (objects) while manipulating using the fingers with and without vision occluded.

RESULTS AND DISCUSSION

Parametric statistics was used to compare data of the following outcome measures in both the control and experimental groups. The touch pressure, dynamic two-point discrimination and object recognition test were analyzed using paired ‘t’-test. Independent ‘t’-test was used to compare the outcome measure between the control and experimental groups. The significance level of the test was kept at 0.05 level. The statistical analysis was done using SPSS version 15.

Two-Point Discrimination Test:

A) Dynamic test:

The graph 1 shows the result of effectiveness of intervention in both experimental and control groups in Dynamic Two-Point Discrimination test. The analysis of the data showed statistically significant change in the experimental group when compared to the control group following intervention. No statistically significant change was found in the dynamic two-point discrimination test value scored by the control group before and after intervention. Though the home program has enhanced the cortical sensation as seen in the graph 1 (decrease in the height of post therapy bar), the change was not statistically significant. Based on the analyses of the data in experimental and control groups, it is found that Sensory re-education is better than mere home program in improving two-point discrimination in patients with median / ulnar nerve injury at wrist.
B) Static test:

The graph – 2 shows the comparison of Static Two-Point Discrimination test grades between the experimental and control groups before and after intervention. 18% of the experimental group showed change in the test grades of two-point discrimination. Their grades have improved from ‘protective’ level to ‘fair’ level. But the control group showed no change in the level of two-point discrimination grades.

Thus, the experimental group showed statistically significant improvement in both Static and Dynamic Two-Point Discrimination when compared to the control group. It might be due to the sensory re-education they underwent in addition to the home program. The effect of sensory re-education is also supported by Imai et.al. They studied the effect of sensory reeducation in a group of 22 adult patients who had a repair of a clean-cut Median Nerve injury at the wrist. The results demonstrated that sensory reeducation significantly diminished the severity of postoperative paresthesia and gave better improvement in Dynamic Two-Point Discrimination than in Static Two Point Discrimination.
Object Recognition Test:

From the analysis of the data, it was found that there is statistically significant change in both the experimental group and the control group following the intervention. Though both the groups had statistically significant change in the object recognition test, observation of the difference in mean in both the groups (graph – 3), shows that the experimental group has changed more than the control group following their respective interventions.

The significant increase in the number of objects identified in control group might be due to the inclusion of manipulation of day to day objects in the home program. Both the groups were instructed in constant usage of hand and taught the methods how to relearn a new stimulus (object) that is used in daily activities. This might be the reason for improvement in Object Recognition Test in the control group also. The finding is supported by Onne (1962), who observed that the capacity to adapt sensibility deficits in the hand depends on the extent to which the hand was consciously used in daily activities and the motivation of the patient. Moreover, all the patients who participated in this study had a minimum qualification of 8th standard and were involved in some sort of vocation (e.g.: Clerical work, Glass cutter, Librarian etc.) which might demand use of common objects. The experimental group showed more significant change than control group. This might be because of the sensory re-education given along with the home program.

Level of Paresthesia:

Experimental group

Control group

Graph 3. Comparison of Object Recognition Test scores – Experimental VS Control Group.

Graph 4. Comparison of Level of Paresthesia in both the Groups.
The graph – 4 shows the comparison of levels of paresthesia between the experimental and control groups before and after intervention. In the experimental group, it is found that the level of paresthesia has changed from severe to moderate level in 64% of the subjects and from severe to mild level in 36% of the subjects. Therefore all the subjects in the experimental group have undergone change in the paresthesia level. But in the control group, only 27% of the subjects have changed from severe to moderate level of paresthesia. Therefore the change in the level of paresthesia is found to be much better in the experimental group than in the control group. Thus in the experimental group, the paresthesia reduced significantly to a point where they no longer interfere with the Activities of Daily Living (ADL). This might be due to the positive effect of the sensory re-education in addition to the home program. The finding is supported by Imai et al.6 who found in his study that paresthesia was diminished in patients who received sensory reeducation training.

**Touch Pressure Threshold:**

The graph – 5 clearly illustrates the changes in the touch pressure threshold score in both the experimental and control group following intervention. In the experimental group, statistically significant change was found where as in the control group, the mean value of the touch threshold pressure remained the same following the intervention. This means that the home program has not produced any change in the touch pressure threshold of the repaired hands in the control group. The statistically significant change in the experimental group might be due to the graded tactile stimulation which the subjects received as part of the sensory re-education.

From the results obtained, it was found that the experimental group has shown significant change in the five parameters used to measure level of sensation than the control group.

The findings of the study have important implications for occupational therapy practice. It reinforces the need of sensory re-education for patients with peripheral nerve injuries (especially median and ulnar) to reduce their discomfort and to gain better sensibility. To hasten the recovery and achieve independence in ADL, the involved hand need to be incorporated more in the functional use of common objects.

The study also has its own limitations. It was conducted only on male subjects. Hence the results cannot be generalized to the female individuals. There were chances for the home program given being not followed by the subjects as there was no documentation of the home program in terms of regular fill up check list of home program activities done by the patient on any particular day. Only verbal enquiry was done on regular basis.

**CONCLUSION**

The findings from this study suggest that sensory reeducation when added with home program enhances better recovery of sensation. Hence, it can be concluded that sensory reeducation helps in functional recovery of sensibility in men following Median or Ulnar nerve repair. Further study can be done to find out the influence of sex on recovery of sensation following sensory re-education. It is found in the review of literature that the recovery of sensation differs with age. Therefore future research can be done to reveal the effectiveness of sensory reeducation across age.

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A Comparative Study Between High Side Lying and Side Lying Position on Oxygen Saturation in Preterm Infants

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ABSTRACT

Background: Premature birth, commonly used as a synonym for preterm birth, refers to the birth of a baby before its organs mature enough to allow normal postnatal survival and growth and development as a child. Positioning an infant appropriately is one of the easiest ways to provide postural support that has both an immediate and lasting impact on an infant’s motor development. We can prevent complications like respiratory distress syndrome, chronic lung disease, pneumonia by proper positioning of child. No relationship between these two positions with oxygen saturation is yet proved in preterm infants.

Methods: This was a comparative study between high side lying and side lying position that were randomly assigned to 40 preterm infants i.e. those who were born in less than 37 weeks gestation age and were haemodynamically stable. They were made to lie in each position in neonatal nursery under constant supervision for 3 regular hours in same day. Saturation of peripheral oxygen in infant was recorded by pulse oximeter every 15 minutes during these 3 hours and monitoring was continued till it reached the baseline again. The infant was assigned in the next position once oxygen saturation reached the baseline again. Random order of positioning was used.

Results: The influence of both positions on the saturation of peripheral oxygen (SPO2) in preterm infants was then evaluated and results formulated using paired t-test for evaluation of data. The data was collected with positioning using Pulse Oximeter as an outcome measure.

Conclusion: This highlighted that high side lying is better than side lying in improving saturation of peripheral oxygen in preterm infants.

Key words: Saturation of peripheral oxygen (SPO2); Pulse oximeter; Respiratory distress syndrome; Preterm infants; Neonatal nursery

INTRODUCTION

Prematurity as defined by the World Health Organization (WHO) is a baby born before 37 weeks of gestation counting from the first day of the last menstrual period. “Premature” infant is one that has not yet reached the level of fetal development that generally allows life outside the womb2. In the normal human fetus, several organ systems mature between 34 and 37 weeks. The lungs are one of the last organs to develop in the womb, because of this; premature babies typically spend the first days/weeks of their life on a ventilator2. Worldwide prematurity accounts for 10% of neonatal mortality or around 500,000 deaths per year5. Premature birth and complications cause about 25% of neonatal deaths. About 16000 babies develop respiratory problem each year. Very preterm infants are physiologically ill-prepared for extra-uterine life4. Positioning of preterm infants is a basic neonatal nursing care. It includes supine, prone, side-lying and head up tilted position. A variety of outcomes can be demonstrated that are affected by different body positioning of preterm infants11. Positioning describes use of body position as a specific treatment technique. Positioning for Intensive care unit patients can be used with physiological aims of improving oxygen transport through its effects of improving ventilation/perfusion (V/Q) matching,
increase lung volume, reducing work of heart and enhancing mucociliary clearance. High side lying position in adults refers to the use of five or six pillows to raise the patient’s shoulders while lying on his side. It is more comfortable if the knees are bent and the top leg placed in front of the one beneath. The patient who is exhausted and is using the accessory muscles of respiration can be helped by careful positioning, using the support of pillows, in high side lying or in upright position, so that it is more possible to gain relaxation of the upper chest and shoulder girdle muscles. In practice, it is imperative to ensure that when the patient is in the supine or lateral position that a head up tilt to a maximum of 30° is obtained. This improves venous drainage with minimal effect on arterial pressure. In addition the higher the head, the greater is the effect of gravity on the flow of venous blood. However, as the head is raised, the gravitational effect on the arterial pressure at the brain is also increased. The best compromise is the position described above of 30 degrees head raise. When patients with severe head injuries are nursed or transported it must be with a 30° head up tilt and the blood pressure maintained.

Side-lying Position in the preterm infants is weight bearing on one side of body, hips and knees flexed to approximately 110 degrees, head slightly flexed forward, upper extremities protruded with hands in the midline. The side-lying position eliminates gravity, encourages relaxation, visual awareness and midline orientation of the upper extremities. A pulse oximeter typically has a pair of small light-emitting diodes (LEDs) facing a photodiode through a translucent part of the patient’s body, usually a fingertip, toe or an earlobe. Because of their simplicity and speed, pulse oximeters are of critical importance in emergency medicine and are also very useful for patients with respiratory or cardiac problems. Positioning an infant appropriately is one of the easiest ways to provide postural support that has both an immediate and lasting impact on an infant’s motor development. Positioning itself is a unobstrusive intervention strategy that can be used to promote infant neurobehavioral and neuromotor stability. Therefore the way the preterm infants are placed in the initial days, weeks and months after birth, as well as how long that position is maintained, can affect the infant’s future safety, posture, movement and overall development.

**METHODOLOGY**

Haemodynamically stable preterm babies i.e. those who were born in less than 37 weeks of gestation age with no post, peri and antenatal trauma were included in this study. Those infants were excluded from this study that was post term or full term i.e. babies born after 37 weeks gestational age. During course of our study when any infant became haemodynamically unstable, he/she was excluded from our study. If child showed signs of distress when placed in assigned position and could not tolerate it, he/she was to be excluded from the study. Infants with any chest deformity or diaphragm paralysis were also excluded.

Random sampling method was done among preterm babies who were admitted in Neonatal nursery of Gian Sagar Medical College and Hospital, Ram Nagar, Rajpura during the period of this study. Independent variables were high side lying and side lying position whereas dependent variable was Saturation of peripheral oxygen (SPO2).

**Sample size**: Total 42 preterm infants participated in the pre-assessment session to confirm the inclusion criteria. 2 preterm infants were excluded from the study. The two had to be excluded due to their nursing care protocol involving feeding every hourly. Due to this no position could be maintained for regular three hours in these infants.

**Positioning procedure**: 40 Preterm infants were included in the study based on inclusion/exclusion criteria after signing the informed consent form. A comparative study was done in which random sampling technique was used. 40 subjects (22 male preterm infants and 18 female preterm infants) were taken. Treatment was divided into two groups. Parents of all preterm babies who were included in study signed a parental consent form. Normal nursing care was continued along with positioning in both the groups. The order of these 2 positions was randomly assigned to all preterm infants.

**Group 1- High Side Lying positioning (figure 1.1)**

1st group- This group included total 40 subjects. They were made to lie in high side lying position in Neonatal nursery for 3 regular hours in one day. Saturation of peripheral oxygen (SPO2) in infant was recorded by pulse oximeter every 15 minutes during these 3 hours after which infant was made to lie supine and monitoring was continued till SPO2 reached the baseline again.

**Group 2- Side Lying positioning (figure 1.2)**

2nd group- This group had same 40 subjects. When the oxygen saturation reached the baseline in supine position, they were made to lie in side lying position (with 30 degrees head raise) for next 3 hours. Saturation of peripheral oxygen (SPO2) in infant was recorded by
pulse oximeter every 15 minutes during these 3 hours after which infant was made to lie supine till SPO$_2$ reached the base line again.

The thickness of the cotton padding used to raise the head of the infant to approximately 30 degrees was 4 inches. It was prepared regularly with the help of the nursing staff on duty. No proper instrument was used to raise head to 30 degrees because of practical difficulties. The order of these 2 positions was randomly assigned to infants. It was a single blinded study because the staff on duty taking the readings was unaware of our research and its possible effects on oxygen saturation in preterm infants. Any change in SPO$_2$ with both positions was evaluated.

**RESULTS**

The mean of gestation age of 40 preterm infants taken in this study was calculated as 33 weeks 4 days and the mean birth weight was 1 kg 727 gms. The values of SPO$_2$ of 40 preterm infants taken after every 15 minutes in 3 hour period was tabulated and statistically analyzed. All data was expressed as mean $\pm$ standard deviation. Parametric statistical tests were used to determine the statistical difference among parameters. The post and pre-intervention readings of both high side lying and side lying were compared using paired t-test. Also comparison between effect on SPO$_2$ with high side lying and side lying was compared using unpaired t-test. One way ANOVA was applied to both these values to justify the final results.

The comparison between post and pre-intervention readings (graph 1.1) revealed that mean of post-intervention readings was more than pre-intervention readings in both the positions. On comparison using paired t-test, the results in two groups showed significant difference ($p<0.05$). Using ANOVA, t-calculated (17.48) was compared with t-tabulated (3.072) at 5% level of significance at degrees of freedom 2 and 117. On comparison the results showed significant difference in both groups ($p<0.05$).

The comparison between the high side lying and side lying was done after comparing mean and standard deviation in these two positions. The mean of high side lying was more than side lying whereas standard deviation of high side lying was less than side lying. The t-calculated value at 5% level of significance in right tail test at $n1+n2-2$ degree of freedom was found to be 1.645 whereas t-calculated value was calculated as 2.13. The t-calculated was found to be more than t-tabulated as in graph 1.2. Thus,
null hypothesis was rejected. It revealed that high side lying position shows significant difference in saturation of peripheral oxygen (SPO₂) as compared to side lying. One-way ANOVA was done to prove which position is better than the other two positions. The f-calculated (25.73) was compared with f-tabulated (3.072) at 5% level of significance at degrees of freedom 2 and 117. The f-calculated was found to be more than f-tabulated. So this justifies the result that high side lying has better results than side lying position.

**DISCUSSION**

The post-intervention and pre-intervention readings in 40 preterm infants were compared for saturation of peripheral oxygen (SPO₂) in both the positions. The difference between the two readings was found to be clinically significant in both positions. The t-calculated for high side lying and side lying was found to be more than t-tabulated in both the positions. Therefore, it proves there is increase in the value of saturation of peripheral oxygen (SPO₂) when compared with the pre-intervention readings with positioning. There always is an increase in values (in %) of saturation of peripheral oxygen (SPO₂) when the preterm infant is placed in any of the two positions. Thus, this study justifies the importance of positioning in preterm infants.

Also, in comparison between two positions using unpaired t-test, t-calculated (2.13) was found to be more than t-tabulated (1.645). This revealed that high side lying is better than side lying in improving SPO₂.

Both statistically and clinically, it was found that the maximum significant improvement was there in high side lying position as compared to in side lying position.

**Limitations:** Small sample size among the preterm infants admitted in Gian Sagar Medical College and Hospital, Ram Nagar, Rajpura was taken. Due to the limited resources, more sophisticated tools like bed with provision for fixed head raise could not be used. Also, subjects taken in this study had different gestation ages. In the inclusion criteria, same baseline SPO₂ and ranges of all other vitals like heart rate, respiratory rate and birth weight were not considered.

**Future studies:** There is great scope of future studies through this present study. Other physiotherapy interventions can be added or compared along with positioning for evaluating effect on SPO₂ on a large sample using more sophisticated tools for measurement. Equal number of male and female can be compared for SPO₂ in the different positions. Also, same order of positioning can be taken rather than random order. Same gestation age and baseline SPO₂ can be taken in inclusion criteria.

**CONCLUSION**

This highlights that both high side lying and side lying produced significant increase in SPO₂ when post and pre-intervention readings were compared among 40 preterm infants. However, high side lying was found to be better than side lying in improving SPO₂ in preterm infants. Thus, we should prefer placing the preterm infants in neonatal nursery in high side lying position.

**REFERENCES**

Efficacy of Knee Osteo-arthritis Outcome Score (KOOS) in Measuring Functional Status of Knee Osteo-arthritis Patients in the Indian Population

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ABSTRACT

Knee osteoarthritis is the most common disease encountered in the Physical Therapy Clinic. The main outcomes of Physiotherapy treatment is based on symptomatic pain relief along with prevention of deterioration of the functional capacity and improvement in ADL. But measurement tools usually measure these aspects as separate identities. KOOS as a tool, measures all these aspects in a comprehensive manner. This study compares KOOS and WOMAC, and establishes the reliability of the best scale.

Objectives: To find out the efficacy of KOOS over WOMAC in assessing the functional status of the knee OA patients in the Indian population.

Methods: 30 subjects included in the study based on inclusion and exclusion criteria. Both groups were made to fill two questionnaires, WOMAC and KOOS.

Results: Data analysis, it was found that KOOS and WOMAC were positively correlating.

Conclusion: It was concluded that KOOS can also be used in the clinical as well as functional assessment of Knee OA in the Indian Population.

Key words: KOOS, WOMAC, Knee Osteoarthritis, Functional Status.

INTRODUCTION

Osteoarthritis, also called as Degenerative Joint Disease (DJD), Osteoarthrosis, Hypertrophic arthritis, Post-traumatic arthritis, is the most common of all joint diseases to affect mankind. It is considered almost an inescapable consequence of aging if accompanied by risk factors like obesity, heavy physical activity or inactivity. Although joint inflammation is implied by the suffix “itis” in osteoarthritis, inflammation is typically found only after there has been substantial articular degeneration. According to epidemiological studies, OA of the knee is the leading cause of chronic disability in the US. Knee OA, a problem that is much more prevalent in India than in the west, accounts for at least as much disability as any other chronic conditions including congestive heart failure, Diabetes, Heart diseases, Chronic obstructive pulmonary diseases or Depression. Despite ethnic and cultural diversities in the Asian scenario, there is a common thread that binds millions of its inhabitants in near similar lifestyles, ranging from squatting and kneeling to sitting cross-legged on the ground for prayers. Hence, predisposition to knee OA increases in the Asian, especially Indians. Primary OA of knee is almost a disease of elderly population.

Knee OA is associated with considerable disability; and functional limitation is an inevitable consequence. However, knee OA does not affect all types of functional activities equally. Activities like walking, squatting and stair climbing are the ones affected to the most. The need for a standardized assessment tool hence becomes important. Various assessment batteries are available; Arthritis Impact Measurement Scale (AIMS), Lequesne Index of Severity for OA of the knee, Lysholm knee scoring scale, WOMAC and KOOS, to name a few. Traditionally, process measures...
like radiographs, laxity and other clinical findings have been used to evaluate knee OA. Clinical trials have used these measures as their primary dependent variables. Seldom have patient’s preferences for outcomes (i.e. functional improvement) been used to evaluate treatment; they have often been perceived as important but subjective and unreliable. These concerns have stimulated researchers in clinical and rehabilitative sciences to expand the methods and metrics used to evaluate the effects of health services. It is well recognized that weak correlations and frequent discordance is found when comparing process measures like radiographic findings and laxity to patient relevant outcome measures such as pain, function and activity level. Therefore, the use of patient relevant outcome measures should be promoted and should be considered the primary outcome measure in clinical trials.

**Need For The Study:**

There are several knee specific instruments but only 3 are knee OA specific, namely, WOMAC (1980), Lequesne index of severity (1989), and KOOS (1995). The WOMAC OA Index is the first patient-administered outcome measure developed for OA. The questionnaire is validated for use in knee and hip OA and is frequently used around the world. The Lequesne index of severity of OA of the knee assesses Pain or discomfort (5 questions), walking (2 questions) and ADL (4 questions).

KOOS is basically a derivative of WOMAC whereby the KOOS has 2 more domains, namely, Sports and Recreation and Quality of Life. WOMAC is considered to be a gold standard for assessment of OA patients. The intended purpose of this study is to check the efficacy of KOOS in comparison to WOMAC in measuring severity of symptoms and functional status of knee OA patients in the Indian population.

**Aims And Objectives:**

To find out the efficacy of KOOS over WOMAC in assessing the functional status of the knee OA patients in the Indian population.

**Methodology:**

Materials used: KOOS, WOMAC.

The population of the study is defined as having medial compartment knee OA and a sample 30 females were taken.

**Inclusion Criteria:**

- Female patients having medial compartment osteoarthritis with grade 3 of Kellgren and Lawrence grading system for osteoarthritis, 1957.
- Patients having primary medial compartment osteoarthritis with at least 3 of the clinical symptoms according to Criteria for classification of idiopathic Osteoarthritis of the knee, 1986 (American college of Rheumatology)

**Exclusion Criteria:**

- Males
- Osteoarthritis secondary to any trauma like ligament injury, fractures etc.
- Osteoarthritis of any other compartment of the Knee.

**Study Design:**

Cross-Sectional survey

**METHODS**

The study includes 30 females selected based on the inclusion and exclusion criteria. The patients have to undergo radiographic examination of the knee in AP view standing on one leg.

The stage of osteoarthritis is determined according to the Kellgren and Lawrence grading system for osteoarthritis, 1957.

According to this grading system:

Grade 3 — moderate osteophytes and joint space narrowing, some sclerosis and possible deformity.

Patients are then assessed for the clinical symptoms according to Criteria for classification of idiopathic Osteoarthritis of the knee, American college of Rheumatology, 1986. The patient should have knee pain and at least 3 positive symptoms out of the 6 to fulfill these criteria.

To measure the functional status of the patients, they are made to fill both questionnaires i.e. KOOS and WOMAC.

**RESULTS**

Data analysis is done using Karl-Pearson Correlation Coefficient. The r value was 0.92 which is considered to be high positive correlation.

**Table 1. Showing the Correlation Coefficient r=0.92 showing highly positive correlation**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>KOOS</td>
<td>99.83</td>
<td>10.56</td>
<td>r=0.92</td>
</tr>
<tr>
<td>WOMAC</td>
<td>49.83</td>
<td>8.19</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

Data analysis for comparison of KOOS and WOMAC is done using non-parametric statistics as the data obtained from both the questionnaires are ordinal. WOMAC is a valid, reliable and responsive measure of outcome, and has been used in diverse clinical and interventional environments. The WOMAC OA Index, developed for elderly with more advanced OA, fulfilled the metric requirements. The instrument is linguistically validated and is widely used in the evaluation of knee OA. Numerous validation studies have addressed specific clinimetric issues regarding reliability, validity and responsiveness. Results were found to be satisfactory. The reliability of KOOS is also established. To ensure content validity for the older population with OA, the questions from WOMAC were included in their full and original form in the KOOS questionnaire. In an article by Ewa M. Roos and Stefan Lohmander (2003), the authors write that KOOS was developed as an extension of the WOMAC OA index with the purpose of evaluating short- and long-term symptoms and function in young and physically active subjects with knee injury and OA. KOOS has 2 more domains, namely, Sports and Recreation and Quality of Life, otherwise WOMAC as an instrument is sufficient for older population with severe OA and still remains to be an instrument of choice to detect severity of OA symptom in geriatric population. Addition of the 2 subscales makes KOOS more comprehensive and covers the total picture of the condition of the patient. The items under these dimensions concentrate on the questions relating to recreational activities which can be linked to the activities commonly seen in Indian population e.g. kneeling can be related to prayer pattern or squatting could be related to gardening.

CONCLUSION

The clinicians in the field of Orthopaedics, Physiotherapy and Occupational therapy are using several assessment batteries to evaluate the pain, stiffness and other features of OA. WOMAC and KOOS were used among various populations with knee OA and proved that they are efficient in assessing and quantifying the clinical presentations by different authors at different time periods. Among these two instruments, comparatively KOOS is having more number of items under the domains of sports and recreational activities and quality of life. Assessment tools hold a significant place in the field of Physical Therapy. As this profession is based on Rehabilitation i.e. bringing the individual back to his optimal functional capacity, emphasis is on Function. Knee OA, a debilitating condition, is the frequent presentation in a Physiotherapy clinic. Patient’s complaints range from pain to inability to carry out ADL. Numerous scales measure these aspects, but only a few deals with it in a comprehensive manner. WOMAC is considered to be the gold standard in assessing knee OA patients. In this study, it was our intention to establish KOOS, which is a scale that deals with Pain, symptoms and Function, sports and recreation and Quality of life, for use in the Indian population.

It has been concluded that KOOS and WOMAC are positively correlating indicating that KOOS can also be used for the assessment of functional status of OA patients in Indian population.

REFERENCES

1. Garratt AM, Brealey S, Gillespie WJ. Patient-assessed health instruments for the knee; a structured review. 2004
Reliability and Concurrent Validity of Dynamic Rotator Stability Test — A Cross Sectional Study

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1Clinical Instructor cum Lecturer, College of Physiotherapy, Medical Trust Institute of Medical Sciences, Kochi, Kerala, 2,3Associate Professor, Kasturba Medical College Hospital, Mangalore, Karnataka

ABSTRACT

Purpose of the Study: To find intra-rater and inter-rater reliability of Dynamic Rotator Stability Test (DRST) and to find concurrent validity of Dynamic Rotator Stability Test (DRST) with University of Pennsylvania Shoulder Score (PENN) Scale

Material and Method: 40 subjects of either gender between the age group of 18-70 with painful shoulder conditions of musculoskeletal origin was selected through convenient sampling. Tester 1 and tester 2 administered DRST and PENN scale randomly. In a subgroup of 20 subjects DRST was administered by both the testers to find the inter rater reliability. 180° Standard Universal Goniometer was used to take measurements.

Results: For intra-rater reliability, all the test variables were showing highly significant correlation (p=.94-1). For inter-rater, with tester 2, test variables like position, ROM, force, direction of abnormal translation, pain during the test, compensatory movement during test were found to be significant (p=.71-1). Only some variables of DRST showed significant correlation with PENN scale (P=.320-.450).

Conclusion: Dynamic Rotator Stability Test has good intra rater and moderate inter rater reliability. Concurrent validity of Dynamic Rotator Stability Test was found to be poor when compared to PENN Shoulder Score.

Key words: Dynamic Rotator Stability Test, Shoulder, Instability, Rotator Cuff.

INTRODUCTION

Shoulder pain is estimated to be the third most common cause of musculoskeletal consultation in primary care.1 The incidence of shoulder pain is quite high.2

Shoulder pain often impairs the ability to sleep, and restricted and/or painful range of motion of the shoulder influences performance of activities of daily living. 3

Four basic mechanical abnormalities causing pain at the shoulder are stiffness, instability, weakness, and roughness. Instability is a functional complaint. Asymmetry, reproduction of symptoms, and apprehension are possible signs of instability.4

The shoulder joint instability occurs due to an imbalance in the interaction of both static and dynamic-stabilizing structures. Static stabilizers include the bony anatomy, negative intra-articular pressure, the glenoid labrum, and the Gleno-humeral ligaments along with the joint capsule provide mainly end range stability.5

The dynamic stabilizing structures include the rotator cuff muscles and other shoulder muscles. Mid-range stability is provided by rotator cuff muscles by "concavity compression".6

Failure of function of rotator cuff muscles in their stabilizing role leads to creation of an abnormal axis of rotation and abnormal translation of the head of humerus.7 Excessive translation of the humeral head along the glenoid results in pain and functional impairment.8

Commonly used tests for shoulder joint stability were mostly done at end range or mid range which were passive and assess only integrity of the capsular and ligamentous structures.9

Recent research findings have shown the need to consider dynamic joint stability and the local muscle system in the treatment of segmental spinal pain.10
Strong evidence is available that pain alters the timing of contraction in stabilizing muscles — transversus abdominis and multifidus in relation to the lumbar spine, vastus medialis obliquus in relation to the knee. Tests to detect lumbar and cervical dynamic stability are routinely used in clinical practice.

Such tests developed to assess and treat dynamic stability of the shoulder is Dynamic Rotator Stability Test and Dynamic Relocation Test developed by Mary Magarey and Mark Jones. DRST is more important for assessment of humeral head translation due to abnormal rotator cuff activity and the test involves multiple positions which might mimic function.

In order for any type of measurement tool to be used with confidence when making decisions regarding patient care, the psychometric or measurement properties of reliability, validity, and responsiveness must be established. To date, research on reliability and validity and on establishing normative values for DRST is incomplete. But no study has been published which confirms reliability and concurrent validity of Dynamic Rotator Stability Test in subjects with painful shoulder.

**METHODOLOGY**

**Source of data**

Department of physiotherapy KMC Hospitals, Mangalore.

**Study design**

Cross sectional design for which ethical clearance granted by the institutional ethical committee

**Subjects**

40 subjects of either gender between the age group of 18-70 with painful shoulder conditions of musculoskeletal origin referred to KMC Hospitals, Attavar and Ambedkar Circle were recruited for the study.

**Inclusion criteria**

1. Subjects with painful shoulder of musculoskeletal origin
2. Availability of active shoulder ROM up to 120°
3. Subjects with pain, apprehension or click with active shoulder movement.
4. Willingness to participate in the study
5. Capable of understanding instructions given by the tester.

**Exclusion criteria**

1. History of recent fracture of the shoulder complex
2. History of recurrent shoulder dislocation
3. Subjects with diagnosed neurological problems pertaining to trunk and upper extremity
4. Worsening of symptoms or high irritability with movement of shoulder complex.

![Diagram of Dynamic Rotator Stability Test](image)
PROCEDURE

Dynamic Rotator Stability Test (DRST)

The subject seated on a stool. The therapist holds around the head of the humerus as shown in the figure.

The test is done as described by Mary Magarey and Mark Jones. The movement is done first in Scaption between 0-120 degrees. (Fig. 1) All the movements are started in internal rotation direction(Figure 3); later movement to external rotation is done. The force initially used is isometric (30% of max.voluntary contraction force). As progression free active (Fig. 4), resisted concentric and eccentric force is used. If no abnormal humeral head translation is detected in Scaption, the test progress to flexion (sagittal) and abduction (coronal) plane. The test stops at the position where abnormal translation is detected and measurement is taken using Goniometer. (Figure 5)

Fig. 2. Hand positioning of therapist for Humeral Head Palpation during DRST.

Fig. 3. Therapist hand placement- manual resistance with subject’s arm in Scaption for Isometric internal rotation.

Fig. 4. Free active internal rotation

Fig. 5. Goniometric measurement of the arm position in DRST positive position

University Of Pennsylvania Shoulder Score (Penn) Scale. 

Penn Scale,100-point self-report scale consisting of 3 sections: pain, satisfaction, and function. There are 3 questions regarding pain (30 points), 1 regarding satisfaction of shoulder function (10 points), and 20 regarding function (60 points). Measurement properties have been established for the Penn scale in patients with various shoulder pathologies.

Prior to starting of study, testers underwent a habituation programme to habituate with the test variables or parameters of assessment in dynamic rotator stability test. Dynamic Rotator Stability Test was done in shoulders of 4 asymptomatic subjects of age between 20-25 years.

Penn shoulder score was also administered in a sample population of 40 asymptomatic subjects of either gender between the ages of 20-30 for cross cultural validation.
Subjects were selected through convenient sampling. Written informed consent was obtained after explaining them about the objectives and methodology of the study. Subjects were then screened using screening check-list for inclusion and exclusion criteria.

**Part-I Reliability of DRST:**

Order of the tester for the performance of DRST was randomized and the testers were blinded to each other’s findings.

**Part-II Validity-Concurrent Validity**

One tester evaluated the patient by administering score. Other tester did Dynamic Rotator Stability Test. Randomization of the tester was done for selected test for each subject. Each tester was blinded to other tester’s finding. Only one trial of assessment was done.

**Statistical analysis**

All statistical testing was carried out using Statistical Package for Social Science version 13.0 software. Differences were considered statistically significant at p<0.05.

For reliability, Spearman’s correlation coefficient was used for pair wise comparison regarding agreement with the test variables between testers.

For validity, Spearman’s correlation coefficient was used for pair wise comparison of test variables of DRST and test variables of Penn Shoulder Score.

**RESULTS**

40 subjects between the ages of 18 to 70 was included in the study. 22 subjects were males and 18 were females. All the subjects were right hand dominant. In the subgroup of 20 for finding inter rater reliability 11 were males and 9 were females.

The subjects’ demographic characteristics were as shown

<table>
<thead>
<tr>
<th></th>
<th>Intra Rater Reliability-DRST(Tester 1)</th>
<th>Inter- Rater Reliability-DRST (Tester 1&amp;2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Age Mean SD</td>
<td>47.35±14.94</td>
<td>47.38±14.94</td>
</tr>
<tr>
<td>Gender- Total (M/F)</td>
<td>22/18</td>
<td>11/9</td>
</tr>
<tr>
<td>Hand Dominance(R/L)</td>
<td>40/0</td>
<td>20/0</td>
</tr>
<tr>
<td>Side of Shoulder Pain(R/L)</td>
<td>23/17</td>
<td>14/6</td>
</tr>
<tr>
<td>Duration of pain- Median (Range)</td>
<td>71.50(2-3650)</td>
<td>87.00(2-3640)</td>
</tr>
</tbody>
</table>

(M=male, F=female, R=right, L=left)

**Reliability- Results for DRST (Spearman’s Correlation Co-efficient Rho):**

<table>
<thead>
<tr>
<th></th>
<th>Intra Rater (Trial 1 &amp; 2)</th>
<th>Inter Rater (1&amp;2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position (S/F/Ab)</td>
<td>1.00*</td>
<td>1.00*</td>
</tr>
<tr>
<td>ROM</td>
<td>.94*</td>
<td>.70*</td>
</tr>
<tr>
<td>Force</td>
<td>1.00*</td>
<td>.72*</td>
</tr>
<tr>
<td>Rotation</td>
<td>1.00*</td>
<td>.12</td>
</tr>
<tr>
<td>Direction of Abnormal Translation</td>
<td>1.00*</td>
<td>.71*</td>
</tr>
<tr>
<td>Pain during DRST</td>
<td>1.00*</td>
<td>.79*</td>
</tr>
<tr>
<td>Click during DRST</td>
<td>.95*</td>
<td>.546</td>
</tr>
<tr>
<td>Compensatory movements during DRST</td>
<td>1.00*</td>
<td>.76*</td>
</tr>
</tbody>
</table>

(*-denotes significant findings)  (S=Scaption, F=flexion, Ab=abduction)

For intra-rater reliability, all the test variables were showing highly significant correlation. For inter-rater, with tester 2, test variables like position, ROM, force, direction of abnormal translation, pain during test, compensatory movement during test were found to be significant.

**Concurrent Validity- Results (Spearman’s Correlation Co-efficient Rho):**

<table>
<thead>
<tr>
<th></th>
<th>Pain at rest</th>
<th>Pain with normal</th>
<th>Pain with Strenuous</th>
<th>Pain Subscale</th>
<th>Satisfaction Subscale</th>
<th>Functional Subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>1.07</td>
<td>.065</td>
<td>-.094</td>
<td>-.018</td>
<td>-.145</td>
<td>-.138</td>
</tr>
<tr>
<td>ROM</td>
<td>.062</td>
<td>-.060</td>
<td>-.01</td>
<td>-.045</td>
<td>.318*</td>
<td>-.100</td>
</tr>
<tr>
<td>Force</td>
<td>-.228</td>
<td>.010</td>
<td>.129</td>
<td>.000</td>
<td>.329*</td>
<td>-.196</td>
</tr>
<tr>
<td>Rotation</td>
<td>.041</td>
<td>-.121</td>
<td>.327*</td>
<td>-.207</td>
<td>-.284</td>
<td>.088</td>
</tr>
<tr>
<td>Direction of Abnormal Translation</td>
<td>.074</td>
<td>.210</td>
<td>.048</td>
<td>.109</td>
<td>.201</td>
<td>.358*</td>
</tr>
<tr>
<td>Pain during DRST</td>
<td>.143</td>
<td>.129</td>
<td>.077</td>
<td>-.011</td>
<td>.237</td>
<td>-.091</td>
</tr>
<tr>
<td>Click during DRST</td>
<td>1.37</td>
<td>.320*</td>
<td>.170</td>
<td>.280</td>
<td>.061</td>
<td>.450*</td>
</tr>
<tr>
<td>Compensatory movements during DRST</td>
<td>.137</td>
<td>.320*</td>
<td>.170</td>
<td>.280</td>
<td>.061</td>
<td>.450*</td>
</tr>
</tbody>
</table>

For concurrent validity of Dynamic Rotator Stability Test with Penn Shoulder Score, variables which showed significance are Force and satisfaction subscale, Direction of rotation and satisfaction subscale, Direction of abnormal translation and pain with strenuous activities, Pain during DRST and functional subscale, Compensatory movements during DRST and pain with normal activities, Compensatory movements during DRST and functional subscale

**DISCUSSION**

The result of intra-rater reliability shows highly significant correlation among all test variables. This can be attributed to the habituation undergone by tester 1. To avoid recall bias DRST was administered randomly on either shoulder of the subjects.
Preliminary screening was only done prior to the administration of the test. Clinical implication of the intra-rater results shows that DRST is a useful test for detecting dynamic instability in clinical practice, especially when the tester uses the test on a one to one basis.

In inter-rater reliability, apart from clicks and rotation during DRST, all other variables showed significant agreement between the testers.

There was mutual agreement between the testers regarding the position where DRST were positive. For all the subjects the abnormal translation of humeral head occurred in scaption. Scaption is defined as 30 degree anterior to the coronal plane.7 In the scaption plane, the capsular fibers of the glenohumeral joint are relaxed.16 Hence the joint relies more on rotator cuff muscles for stability. So any alteration in rotator cuff muscle activation results in instability.

Range of motion showed moderate correlation between the testers. Minor variations in the position of arm, force applied by the subjects and placement of Goniometer while taking reading might have caused this variation.

Force used during testing and direction of abnormal translation in DRST showed correlation. In an unstable shoulder, or one in which dynamic control is lacking, humeral head translate when the rotator cuff is loaded, usually anteriorly during resisted lateral rotation and posteriorly with resisted medial rotation. Studies had shown consistent activation of rotator cuff prior to more superficial delto-pectoral muscles in normal subjects.6 Strong evidence is available that pain alters timing of contraction in stabilizing muscles.11

Pain during DRST showed good agreement between testers. The result can be attributed to the habituation programme and efficiency of examiners in collecting subjective feed back during test.

Compensatory movements showed good correlation. It is demonstrated that increase of upper trapezius activity occur during external rotation in shoulder pain patient group and decreased activity in the middle trapezius.8

Inter rater reliability of DRST was moderate in our study. This is in agreement with Inter-rater reliability of physical tests for shoulder in other studies showing moderate reliability.17-20 Differences in clinical experience between testers would still have caused this effect. A great variability in reliability exists even in other physical tests of shoulder girdle.20

For concurrent validity, some variables of DRST showed significant correlation with Penn Shoulder Score.

Force and satisfaction correlation can be attributed to the fact that satisfaction is purely subjective. The patient’s satisfaction with the ability to use the shoulder is an important construct to measure for both the patient and clinician.12 Rotation and satisfaction showed significant correlation. It may be due to the fact that subjects with more external rotation range may be more satisfied. Maximum elevation on all planes of shoulder required external rotation of humerus. Loss of external rotation results in significant functional disability.16

Pain with DRST and function showed significance. Greater functional loss may be associated with pain with DRST. Functional disability due to pain in the shoulder at rest or during movement or functional disability due to restricted range of motion is frequently observed in painful shoulder subjects.21

Overall all of our subjects had a better Penn Shoulder Score, near normal. DRST can be positive even in the absence of any symptoms. Studies in low back pain subjects showed motor control deficits persisting even after the reduction of symptoms.22

We do not have as on data, an established gold standard measure for dynamic stability of the shoulder. So we chose Penn Shoulder as a first line attempt. Condition-specific questionnaires of the shoulder have demonstrated greater responsiveness than generic measures in patients with shoulder disorders.12 Although DRST seems to have face validity, concurrent validity could not be found.

The study however is the first of its kind on DRST, after the initial description given by the developers which opens a new era of research and future studies.

One of the limitations of the study was small sample size which had reduced the statistical power. The important observations of the study are that DRST was well tolerated, had produced no adverse effects and no latent symptoms occurred. So the test is very safe to use in clinical practice though it depends solely on the thorough patient understanding. This could be solved by testing and explaining on the unaffected side first.
REFERENCES


13. Mark. A Jones. Personal communication through e mail, Mark.Jones@unisa.edu.au to tester


A Randomised Controlled Trial of Stimulation of Triceps as an Adjunct to Motor Training of Paretic Arm in Stroke Patients

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ABSTRACT

Background: 30-60% of patients with stroke have no arm function. Spasticity causes hyperactivity in those muscles that can lead to decreased activity of their antagonists. Thus biceps spasticity can cause reduced control of triceps amounting to reduced reach function which is usually an important therapeutic goal.

Some studies have evaluated efficacy of electrical stimulation (ES) on spasticity.

Aims: Purpose of the trial was to assess effect of stimulation of triceps on forward reach distance in stroke patients.

Settings and Design: Prospective, analytical, experimental, randomized and open trial done in Physiotherapy OPD of a tertiary care hospital.

Methods and Material: 50 post stroke patients, in the age group of 30 to 60 years with spasticity of shoulder, elbow, wrist and hand muscles of affected extremity up to grade 2 on Ashworth Scale and Brunnstrom sequential recovery stage 3 or 4; were assessed for modified Tardieu Scale (MTS), active elbow extension range at elbow (AROM) and forward reach distance (FRD). They were randomly assigned to either of the Conventional Group (CG) or Experimental Group (EG). CG received motor training only whereas the EG received motor training and ES to triceps on affected upper extremity. After 3 weeks they were evaluated again for the above outcomes.

Statistical tests were non-parametric tests as the data obtained was not normally distributed, as analyzed using Shapiro-Wilk test for normality. Wilcoxon Rank sum test for comparing medians in all 3 outcome measures. Mann Whitney test was also used to compare percent mean differences in both groups for all 3 outcome measures.

Results: FRD, AROM and MTS improved after 3 weeks in CG with significance of p-value of 0.0122 each and in experimental group with significance of p-value of 0.0121 each. FRD showed insignificant change between groups with p-value of 0.207. The mean percent difference in MTS, AROM and FRD was 0.007, 0.007 and 0.977 respectively.

Conclusions: Electrical Stimulation when given to the triceps muscle as an adjunct to the motor training has shown additional improvement in reducing the biceps spasticity, improving AROM but not significantly improving the FRD.

Key words: Stroke, Motor Training, Electrical Stimulation.

INTRODUCTION

Stroke is the leading cause of neurological disability in adults. Out of the total stroke survivors, 85% of patients have an initial arm sensorimotor dysfunction with impairments persisting in 55 to 75% of cases for more than 3 months and 30-60% of patients have no arm function. Many Clinicians view spasticity to be the most significant impairment constraining function in the patients with stroke. It causes decreased activity of their antagonists through reciprocal inhibition. This leads to shortening and alteration of the length–tension relationship of antagonist muscle. In a study by Cheng-Chi Tsao it was shown that the maximum voluntary contraction of elbow extensors was
significantly lower in spastic than healthy arms and inversely correlated with reflex stiffness gain of elbow flexors. We also have varied views on management of spasticity and its effect on function. One such treatment method is the ES. It involves the contraction of innervated yet paretic muscles by electrical stimulation of corresponding intact peripheral nerve. A Cochrane Database systemic review revealed insufficient robust data to inform use of ES for neuromuscular re-training. Synder-Macleretal have described 3 approaches of application, a) stimulation of antagonist to the spastic muscle, b)stimulation of spastic muscle itself and c) alternate stimulation of agonist and antagonist. Taylor et al in 2002 had shown that by stimulating the spastic muscle itself, the spasticity may be stronger when it returns and hence this method is not preferred. Whereas, Santos et al 2006 has proved that electrical stimulation of antagonist muscle can reduce spasticity immediately following treatment. Hence we chose to stimulate the antagonist muscle i.e. triceps to reduce spasticity in biceps. As therapist our goal for patients is always function related. We agree with all the studies on electrical stimulation, regarding it as an adjunct to conventional treatment for motor training. Thus motor training comprised of myofascial release, weight bearing through upper extremity (WU) and task specific training which included repetition of trunk restraint reach training (TRRT). FRD was considered as primary, whereas MTS and AROM were considered as secondary outcomes measures respectively. Hence our aim was to evaluate effect of stimulation of triceps on biceps spasticity as an adjunct to motor training of paretic arm in post stroke patients.

MATERIAL AND METHODS

This is a prospective analytical experimental study with simple randomized sampling done on 50 post stroke patients, both males and females in the age group of 30 to 60 years at Physiotherapy OPD of a tertiary care hospital from period June 2008- June 2010.

Inclusion criteria-a) Medically stable patients post stroke, after 6 months of diagnosis, b) complete passive range of motion at elbow of the affected extremity; c) spasticity of affected extremity up to grade 2 on Ashworth Scale and d) Brunnstrom sequential recovery stage 3 or 4.

Exclusion criteria for trail were previous neurological or any other sensory and sensori-motor impairments of affected upper extremity, epilepsy, dementia, cerebellar affection or any perceptual problems, any cognitive or behavioral abnormalities and skin allergies.

Materials used: Electrical stimulator (Electro Medica)with 2 plate electrodes, lint pads, Velcro straps, belt for trunk stabilization, a universal goniometer, measuring tape and plastic blackboard duster.

Study intervention: Synopsis of the study was approved by the ethics committee at institution. Sample size of 25 in each group was calculated considering prevalence of stroke subjects with desired inclusion criterions as 0.015, α error probability 0.05 and power of test (1-β) 95%. After evaluation the subjects included in the study were explained the purpose and written consent was taken from them for their active participation. MTS, AROM and FRD were measured by UP.

For forward reach distance, subject was seated with trunk supported and secured to the back rest of the chair with a belt for minimizing compensatory trunk movements. Upper extremity length was measured from the acromion process till the tip of middle finger as per the anthropometric techniques by H.V. Vallois. Patient’s affected upper extremity was placed in the initial position of slight abduction and flexion of shoulder and elbow flexed to 90 degrees with forearm supported on the table. The hand was placed in the plane of the shoulder and the point at ulnar styloid was marked as initial position. A target was placed at 100% of arm’s length in the forward plane of the affected shoulder. Patient was then instructed to pick up the object (a plastic blackboard duster) kept at the initial starting position of the hand and reach as far as possible towards the target. The point at the ulnar styloid at the final position of the hand was marked again and the distance between the two markings (initial starting point and the final point) was noted as the forward reach distance.

After pre assessment, they were then randomly assigned using a computer generated list for randomization to either of the CG or EG by UP. Both groups were given conventional treatment of motor training and total time of treatment for every subject was 45 minutes for 5 days per week and this for 3 weeks.

Myofascial release over biceps muscle was given with hold of 90-120 seconds, till soft tissue release was felt. WU was given in position of slight shoulder abduction and external rotation, elbow extension, and wrist extension. They were then asked to move the trunk well over the supporting arm, transferring most
of the weight onto the affected hip and hand for 30 seconds and such 7-8 repetitions.

Trunk restraint reaching training was done with the subject in seated position with forearm on chair. A straight line was drawn along the forward plane of shoulder from the initial starting point. Two other lines were made at 45 degrees on the ipsilateral and contralateral side of the initial straight line from the initial starting point. Targets were placed at 100% of arm’s length along all three lines. Patient was instructed to pick up object (a plastic blackboard duster) from the initial starting position and reach as far as possible along the drawn paths towards the target at a self-paced speed.

10 repetitions were given for each of the 3 directions with a 30 sec pause after each 10 repetitions.8

In experimental Group 25 subjects were treated first with electrical stimulations for 15 minutes and then treated with conventional training. For stimulations, participants were seated on a chair and forearm rested on an arm rest. 2 plate electrodes were strapped at either end of triceps muscle belly and electrical stimulation was given using the following set of parameters:

- **Frequency:** 50 Hz, **Duration:** 0.3ms, **On:** time 2sec, **Off:** time 2sec, **Time:** 15 minutes
- **Amplitude:** adjusted for every subject to intensity such that minimal muscle contraction was present.9

A home programme was given to all the participants in both the groups. This comprised of auto assisted shoulder, elbow and wrist flexion-extension: weight bearing on affected upper extremity and stretching the trunk.

After three weeks, assessments of all the participants were done for the 3 outcome measures. The pre and post intervention measurements were compared and statistical analysis was done. The study was performed from June 2008 to June 2010.

**RESULTS**

The data obtained was not normally distributed as found by Shapiro-Wilk test for normality.

Both the groups were comparable at the commencement of the study for the factors such as age – mean 51 years and 50 years in CG and EG respectively by Mann-Whitney test, gender- 5 females; 20 males and 4 females; 21 males in CG and EG respectively using Chi-Square test, dominance- left sided 12% and 16%; right sided 88% and 84% in CG and EG respectively using Chi-Square test and the time period between stroke onset and commencing the study –mean 19.68 and 19.72 months in CG and EG respectively using Mann-Whitney test; as there was no statistical significance.

The results showed improvement in the scores of the intervention groups. A comparison of pre and post intervention measurements for trunk restraint reaching training was done using Wilcoxon signed rank test.

**Table 1. Comparison between medians of outcome measures in Conventional group and Experimental group before and after intervention. (Wilcoxon Sign Rank test)**

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Conventional</th>
<th>Experimental</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTS</td>
<td>101</td>
<td>97</td>
</tr>
<tr>
<td>AROM</td>
<td>45</td>
<td>51</td>
</tr>
<tr>
<td>FRD</td>
<td>8.1</td>
<td>9.1</td>
</tr>
</tbody>
</table>

MTS-modified Tardieu scale; AROM active range of motion for extension; FRD-forward reach distance

All the 3 outcome measures have significantly improved post intervention in conventional therapy group and experimental group as shown in Table 1.

**Table 2. Forward Reach Distance medians between Conventional and Experimental groups**

<table>
<thead>
<tr>
<th>Pre intervention</th>
<th>Post intervention</th>
<th>Diff</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>Experimental</td>
<td>20</td>
<td>0.207 i.e. NS</td>
</tr>
<tr>
<td>8.1</td>
<td>9.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical analysis of pre to post intervention in the measurements of Forward reach distance between groups showed no statistically significant difference as seen in Table 2.
DISCUSSION

Optimal functional recovery is the ultimate aim of neuro-rehabilitation after acute brain lesion. In response to intervention, functional or adaptive recovery takes place. In our study, both the conventional and the experimental groups were given treatment interventions. We will discuss the study under 3 domains; effects of conventional therapy, effects of electrical stimulation and forward reach distance as an outcome measure.

In CG and EG, all 3 outcome measures MTS, AROM and FRD have improved. Our subjects had complete passive range at elbow. So, myofascial release could have helped in altering structural alignment within the muscle and to some extent, reducing spasticity. WB helps in normalizing tone. This is because of activation of elbow joint receptors causing inhibition of biceps spasticity; and slow stretching of biceps thereby causing relaxation and decreased spasticity as suggested by Brenda Brower et al. The cutaneous and proprioceptive inputs can markedly increase magnitude of cortically evoked responses and reduction in homonymous group 2 inhibition associated with maintained stretch of spastic flexors.

In ES group, ES along with conventional training caused improvement in MTS, AROM and FRD. When a muscle contracts, activity in the muscle spindles is relayed via inhibitory interneurons to the alpha motor neurons of the antagonist muscle reducing its activity. The essence of Sherrington’s principle of reciprocal innervation is that, during contraction of agonist muscles, the antagonists do not behave passively, but are actively inhibited by central nervous mechanisms. When the agonist muscle is activated, its spindle 1a afferent discharge, through action of the gamma loop may increase and feedback is send to the spinal cord to inhibit antagonist muscles, peripherally via the 1a inhibitory interneuron. 1a afferents and inhibitory neurons are of larger diameter, they require only low level of stimulation to excite them, so will always be excited even if stimulation produces only a small contraction. Thus, electrical stimulation of triceps reduces biceps spasticity, also seen by improvement in MTS. And this in turn decreased the inhibitory effects on the triceps leading to increased recruitment of motor units. It also served to reset the balance between flexor and extensor tone thus allowing active contraction of the agonist with less effort than previously required in the presence of increased spasticity. Both of these led to improvement in the AROM (of extension).

FRD as an outcome measure has improved in both groups by 58.5% and 59.5% respectively. One important distinction characterizing the movement in stroke subjects is the non-typical use of trunk for reaching a target placed well within the range of arm’s reach. Use of trunk restraint as a treatment paradigm aimed at decreasing compensatory strategies and along with the goal directed movements it improved the inter-joint coordination. It also led to forced use of the affected extremity for accomplishing the reaching task. The underlying normal patterns of movement coordination were thus uncovered to maximize function. Also repetitive training would have caused increased recruitment of the triceps muscle and reaching movements using increased angular ranges obtained by this method are made in a more coordinated way.

As a study question, we analyzed the effectiveness of electrical stimulations, by comparing both groups using Mann-Whitney test for their mean differences. Here MTS and AROM have significantly improved, both with p-value of 0.007.

But for FRD p-value is 0.977 which is not significant. Levin et.al defined articular ranges in which hemiparetic patients could make isolated elbow flexion and extension movements by using a reciprocal muscle activation pattern which mainly took place in the midrange. Movement beyond this range required more effort and is accompanied by a pattern of excessive agonist/antagonist co-activation. FRD assessment in
our subjects required this mid-range to outer range movement. ES could not, in addition to motor training improve the FRD.

CONCLUSION

Electrical Stimulation when given to the triceps muscle as an adjunct to the motor training has shown additional improvement in reducing the biceps spasticity, improving elbow active extension range but not significantly effective in improving the forward reach distance.

ACKNOWLEDGEMENTS

To all the patients who contributed in the study.

Conflict of Interest: none

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The Effect of Task Oriented Training on Hand Functions in Stroke Patients- A Randomized Control Trial

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ABSTRACT

Purpose: The goal of this study is to find out the effect of task oriented training on hand functions in stroke patients.

Methodology: This was an experimental study of 30 stroke patients with unilateral involvement, with paresis of hand. All the subjects were enrolled in identical subgroup and divided into two equal groups (15 patient in each group) one control group (A) and another experimental group(B). Experimental group receive task oriented training and control group receive conventional physiotherapy training.

We assessed the hand functions (Gross and Fine manual dexterity) by Box and Block test and Nine hole peg test respectively and tried to find out the additional effect of task oriented training on hand functions.

Results: Result shows that, both the group improved significantly but task oriented training group improved much better than conventional training group.

Conclusions: This study suggests that task oriented is more effective as compare to the conventional training for the hand functions in stroke patients.

Key words: Task Oriented Training, Gross Manual Dexterity, Fine manual Dexterity.

INTRODUCTION

Stroke affects 15 million people in the world each year and approximately one-third will live with the sequel of this disease¹. After coronary heart disease (CHD) and cancer of all types, stroke is the third commonest cause of death worldwide. However unlike the Caucasians, Asians have a lower rate of CHD and a higher prevalence of stroke² Stroke is one of the 10 highest contributors of Medicare costs and among elderly, stroke and transient ischemic attacks are leading causes of hospitalization³.

The definition of stroke originates with the World Health Organization (WHO) and dates back to 1980 (1): which states that “Rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin”⁴.

THE COMMON NEUROLOGICAL IMPAIRMENTS DUE TO STROKE ARE

Motor impairments are most prevalent of all deficits seen after stroke, usually with involvement of the face, arm and leg (hemiparesis) alone or in various combinations, which include involvement of cranial nerves, muscle power and tone, reflexes, balance, gait, co ordination and apraxia. Motor skills are also affected. Most common sensory losses include astereognosis, agraphia, barognosis, kinesthesia, tactile extinction and two point discrimination⁶.

The stroke causes the inability to understand and express emotions. Common speech disorder that are seen include aphasia, dysphasia. Dysphasia may be exhibited by disturbances in comprehension, naming, repetition, fluency, reading or writing⁷.

Hemiparesis represent the dominant functionally limiting symptoms in 80% of patients with acute stroke.
within 2-5 months after stroke; patients recover a variable degree of function, depending on the magnitude of the initial deficit. Arm recovery after stroke is typically poor; with 20% to 80% of patients showing incomplete recovery depends on the initial impairment.

Upper limb dysfunction in stroke is characterized by paresis, loss of manual dexterity, and movement abnormalities that may impact considerably on the performance of ADLs.8

Grasping, holding, and manipulation objects are daily functions that remain deficient in 55% to 75% of patient 3 to 6 months poststroke.8

After rehabilitation 9% of patients with severe UE weakness at onset may gain good recovery of hand function. As many as 70% of patients showing some motor recovery in the hand by 4 weeks make a full or good recovery.9

Grasping, holding, and manipulation objects are daily functions that remain deficient in 55% to 75% of patient 3 to 6 months poststroke.9

VARIOUS TREATMENT APPROACHES FOR HEMIPARESIS

In physiotherapy a variety of movement therapy approaches are available for retraining motor skill in adult patients with hemiparesis. Certain approaches like proprioceptive neuromuscular facilitation, Rood, Brunnstrom, and Bobath relay on reflex and hierarchical theories of motor control and motor learning as well as the principles of neural plasticity.11

TASK ORIENTED TRAINING

Task oriented training is newer approach. Task oriented training involves practicing real-life tasks, with the intention of acquiring or reacquiring a skill (defined by consistency, flexibility and efficiency).12 The tasks should be challenging and progressively adapted and should involve active participation (Wolf & Weinstein, 2009). Previous studies done on task oriented training has advocated the different effects of it in stroke patients.13 But currently available data do not definitively answer all the questions. Therefore, to obtain a clear characterization of effectiveness of task oriented training a research study was required.

CONVENTIONAL PHYSIOTHERAPY TRAINING

These exercises prevent complications of immobilization and improve ADL skill at the earliest. This helps in preventing contractures and development of abnormal postures.14 The purpose of this study is to find out that how much task oriented training is effective as compared to the conventional training in functional recovery of hand in stroke rehabilitation.

METHODOLOGY

Total 30 patients of stroke were selected from M.M hospital Mullana and nearby areas. For patient selection purposive sampling was done. The total 30 patient were divided into two equal groups (15 patients in each group), one experimental and another control group. Experimental group received task oriented training and control group received conventional physiotherapy training.

INCLUSION CRITERIA

1. Age group=40-70 years.
2. Both males and females included.
3. Duration of stroke within 30 – 150 days (1-5 months), prior to start of study.
4. Paresis in upper extremity and Hand
5. First time stroke survivors.
6. Able and willing to participate in the study of 6 weeks and to sign consent form.

EXCLUSION CRITERIA

1. Any associated medical and high risk cardiovascular diseases.
2. Any musculoskeletal impairment of upper extremity.
3. Any neurological pain or disorder limiting the movement.
4. MMSE less than 23.
5. Still enrolled in any form of physiotherapy treatment.

PROCEDURE

Thirty patients of stroke who fulfill the inclusion criteria were included in this study. Total numbers of patients were divided into two equal groups, one experimental group and another control group. Each group contained 15 patients. The task oriented training for upper extremities had given to the experimental group and conventional training for upper extremity had given to the control group. All participants were evaluated by Box and Block test and Nine Hole Peg test for gross and fine manual dexterity respectively.
Box and Block test (BBT)

This instrument is designed to measure the gross manual dexterity of hand in stroke patients. It consists of a wooden/cardboard box having two compartments and some small wooden blocks in it. The number of blocks displaced from one compartment to another in one minute is recorded as reading/score/value.

Nine Hole peg test (9HPT)

This instrument is designed to measure the fine manual dexterity of hand in stroke patients. It consists of a wooden base having nine holes in it and nine dowels/pegs are provided separately with it. Time to place nine dowels in holes and then removing them is noted in seconds and is recorded as reading/score/value.

Mini mental status scale is a reliable and valid scale to assess the mental status of subjects used in this study.

At the first, the patients were informed about the purpose, procedure, possible discomforts, risks and benefits of the study prior to obtaining an informed written consent from the patient.

All patients were first assessed by Mini-Metal status scale to know the mental status.

After that all patients were assessed by Box and block test and Nine hole peg test. The subjects were asked not to participate in any other study or physiotherapy treatment for hand functions from for the duration of the study and to follow the designated protocol.

Treatment protocol

Experimental Group

All subjects in this group performed task oriented exercises which contain both simple and complex task programs with attending therapist. The task oriented training protocol was inspired by Gad Alon et al. was a standardized protocol. Components of task oriented protocol included were – range of motion exercises, weight bearing and supporting reactions, reaching holding and releasing activities and activities of daily living involving use of hand.

Control Group

All subjects in this group performed exercises based on conventional physiotherapy. Patients of the conventional PT training group were made to start of exercise from passive/ active movements of all the joints of upper extremities including shoulder joint, elbow joint, wrist joint, metacarpophalangeal joints and interphalangeal joints with the use of upper extremities.

After active movements patients were made to start weight bearing, strength training reaching activities with the use of upper extremity and at last patients was performed ADL activities (e.g. dressing and self feeding activities).

These exercises start with simple movements and subsequently complex movements and actions are tried.

All the exercises were performed in 90 minutes. There was no subdivision of time for each activity. Patients were performed exercises on the bases of their motor control for 90 minutes in a day and 3 days in a week for 6 weeks.

Data and Statistical Analyses

Comparison was performed between both the groups first at baseline level. Then again, comparisons were done at discharge level as well as from baseline to discharge level and results were noted. Paired T test was used for analyzed the pre to post changes within the groups. Unpaired T test was used to analyze the changes between the two groups. Data was analyzed using SPSS 17.

RESULTS

We successfully matched 30 patients of both control and experimental group for hand functions. First we compared demographic and functional data of the age matched subgroup. Analysis comparison was done between both the groups first at base line and then at the end of intervention.

Baselines characteristics of both the group are shown in table1.chacteristic of both the groups were same at the base line level prior to intervention.

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mean ± S.D</td>
<td>55.93 ± 9.08</td>
</tr>
<tr>
<td>Values</td>
<td></td>
<td>t=0.22</td>
</tr>
<tr>
<td>Gender</td>
<td>M</td>
<td>9(60%)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>6(40%)</td>
</tr>
<tr>
<td>Side Affected</td>
<td>L</td>
<td>8(53.3%)</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>7(46.6%)</td>
</tr>
<tr>
<td>Type of Stroke</td>
<td>I</td>
<td>5(33.3%)</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>10(66.6%)</td>
</tr>
</tbody>
</table>

M-Male, F-Female, L-Left, R-Right, I-Ischemic, H-Hemorrhagic
This table shows that before intervention there was no significant difference of Box and block test score \((p=0.59)\) and nine hole peg test score \((p=0.87)\) between the groups.

**Table 2. Box and block test Scores of both the group before and after intervention**

<table>
<thead>
<tr>
<th>Group</th>
<th>Before treatment</th>
<th>After treatment</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6.00</td>
<td>8.00</td>
<td>0.0001</td>
</tr>
<tr>
<td>B</td>
<td>5.67</td>
<td>10.33</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Above table shows that after intervention there was significant difference in both the groups.

**TABLE 3. Nine hole peg test score of both the group before and after intervention**

<table>
<thead>
<tr>
<th>Group</th>
<th>before Intervention</th>
<th>after Intervention</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>73.40</td>
<td>72.87</td>
<td>0.00610</td>
</tr>
<tr>
<td>B</td>
<td>74.47</td>
<td>71.93</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Above table shows that after the intervention there was significant difference between the groups \((p value < .001)\).

**TABLE 4. BBT and 9HPT scores of both the group before and after intervention**

<table>
<thead>
<tr>
<th>Group</th>
<th>BBT score after intervention</th>
<th>P value</th>
<th>9HPT after intervention</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8.00</td>
<td>0.0007</td>
<td>72.87</td>
<td>0.89</td>
</tr>
<tr>
<td>B</td>
<td>10.33</td>
<td>0.0001</td>
<td>71.93</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Above table is showing the BBT and 9HPT scores after treatment in both the groups. Independent t test was to analyses data in between the groups and dependent t test was used to analyze the data within the groups.

The evaluated data suggest that the gross manual dexterity has been more improved in task oriented group \((p=0.0007)\), whereas fine manual dexterity has been improved clinically but not statistically in between group comparison \((p=0.89)\) but within group results are statistically significant.

**DISCUSSION**

In this experimental design study, result shows the effects of task oriented training as compare to the conventional training on hand functions in stroke patients. The results support the hypothesis that task oriented training is more effective for hand functions in stroke patients as compare to the conventional training. Although both the groups task oriented training and conventional training improved significantly post intervention, but task oriented training group improved much better than task oriented training. The overall evaluation of data suggests that the gross manual dexterity has been improved more in task oriented training group (experimental group), whereas fine manual dexterity has been improved clinically but not statistically in between group comparison post intervention, but within group results are statistically significant.

The results of the study are consistent with the previous studies done on task oriented training.  

The task oriented training is based on the motor programming theory of motor control and system theory. The former theory puts an emphasis on the special neural circuits known as central pattern generators (CPG). The practice play important role in strong engrs formation in the brain. The task oriented training focuses on the intention of acquiring or reacquiring a skill \(\text{(defined by consistency, flexibility and efficiency)}\) important to a functional task rather than educating the specific muscles in isolation hence it is a functional approach. In this approach, movement is organized around a behavioral goal; thus multiple systems are organized according to the inherent requirements of the task being performed. In this approach, the patient is working on functional tasks rather than on movement patterns for movement alone as compared to conventional physiotherapy.

The significant results in task oriented training group also may be due to more motor unit recruitment being activated as the patient is practicing the same functional task again and again. Task oriented approach leads to acquisition of new skills as patient gets feedback simultaneously which leads to better learning of activities of daily living. The results for fine manual dexterity are clinically significant at post intervention level but are not statistically significant. 

The gain in changes was small and also may be due to the fact that nine whole peg test is not a very sensitive measure to analyze such small changes of fine manual dexterity in hemiparetic patients. Moreover the test used the time values that too in seconds which is further a very specific count.

**CLINICAL IMPLICATION**

This treatment will help the patients to enhance the functional recovery of hand in stroke patients and increased functional recovery will provide the improvement in quality of life. So, task oriented approach can be used clinically as it will be much easier to perform, safer and convenient for patients.
Limitations of a Study

The sample size used in this study was small so that result is not generalized. There is no follow up period after 6 weeks, so it may be another limitation of the study. The measure of fine manual dexterity was not appropriate.

Future Scope of Study

Follow-ups can be done to see the long term effects of training. The initial degree of level of deficit can be taken. More sensitive measure can be used to determine fine manual dexterity. Study can be replicated by molding the treatment protocol and large sample size can be taken.

CONCLUSION

This study suggests that task oriented training is more effective as compare to the conventional training for the functional recovery of hand in stroke patients.

REFERENCES

1. World Health Organization. The WHO stroke surveillance... 2004. World
Effects of Three Weeks Plyometrics on Sprint Velocity

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ABSTRACT
In Plyometrics the muscles store energy during the landing (stretching phase) which is released in the immediate rebound. The stretching during the lowering stimulates the nervous tissue within the muscles. This result in a greater number of muscle fibers called into action and stimulates closely the situations like sprinting. The study analyzed the effect of plyometrics on sprint velocity in male sprinters of 20-25 years with minimum of one year athletic background. Out of 30 male subjects aged between 20-25 years, 15 were selected conveniently for experimental group (GROUP B) and 15 randomly for control group (GROUP A). For both the groups 3 week research was done. The training session was held once a week. On each training day both the control group and experimental group started their warm up exercises for 40 minutes. After the warm up the experimental group were subjected to Plyometrics. The assessment of running time through 60 meter was assessed after every week. On comparing the both groups it was found that both groups show statistically insignificant improvement after week 1 but experimental group show statistically significant improvement after week 2 and week 3 as compared to control group

Key words: Plyometrics, Sprint, Sprinters, Sprint velocity

INTRODUCTION
Plyometrics are training techniques used by athletes in all types of sports to increase strength and explosiveness. Plyometrics consists of a rapid stretch shortening cycle. It involves eccentric loading immediately followed by a concentric contraction. Plyometrics is a method of developing explosive power by shortening the amortization phase. That’s why it is an important component of most athletic performances. It is a combination of exercises incorporating skipping, hopping, jumping and throwing exercises etc. Plyometrics training is commonly adapted in sprint running and many other sports to develop leg extensor strength and power. These exercises have been credited with inducing neuromuscular adaptations to the stretch reflex, elasticity of muscle, and Golgi tendon organs. The stretching of the muscle prior to subsequent contraction enhances utilization of muscle properties and has positive effect in the velocity at a certain concentric level. Researchers have shown that Plyometric training can improve the strength and explosiveness of performance in as little as 6 weeks.

The sprints cover the following track events: 100 meters, 200 meters, 400 meters, 4 x 100 meter relay and the 4 x 400 meter relay. Although the sprints are events in themselves, the ability to sprint is an important weapon in an athlete’s any sports. Sprint training or speed training is the ability to perform at high frequency. Maximum Plyometric program efficiency and injury prevention depends on the logical progression of exercise intensity.

Methodology
The research design is experimental.

The data was collected from the athletic population from lovely college of physical education. In the present study Random sampling through chit system was used.

Inclusion criteria: No previous Plyometrics training.
Males aged 20-30 years with professional background in sprint run.
Being involved in athletics for minimum of 3 years
Exclusion criteria: Athletic background of less than three years
Subjects with any systemic disease like visceral pathology.
Subjects with traumatic injury of bones, muscles, ligaments, tendons

Subjects with any kind of muscular, bony, visceral pain

Subjects involved in any other specific and major conditioning or training program like circuit training program, weight lifting program, endurance development program, progressive resisted exercise training.

Demographic profile and detailed medical history was taken through individual interview and past medical history. After one week of conditioning session, all subjects underwent pre training sprint velocity assessment through 60 meter distance at their maximum speeds. The time taken by each subject to cover 60 meter track was recorded with the help of electronic stop watch. Out of 30 male subjects aged between 20-25 years, 15 were selected conveniently for experimental group and 15 randomly for control group. The following plyometrics regimen was implemented and the assessment of running time through 60 m was assessed after every week.

**Easy**

Hop on both feet over a line for 30 sec followed by rest for 3 min and repeat again.

Hop on one foot over a line for 30 sec followed by rest for 3 min and repeat again with other leg.

Hop for distance and height with legs, 10 repetitions, and rest for one minute.

Hop for distance and height on right leg, 10 repetitions, and rest for one minute.

Hop for distance and height on left leg, 10 repetitions, and rest for 60 sec

**Moderate**

Two sets of 10 depth jumps of (30-80cm height) with rest of 2 minutes between the sets.

Three sets of tuck jumps for 30 sec with 3 minutes rest between the sets

Three sets of double leg hurdle hopping (6 hurdles) of height (12-36 inches) with 90sec rest between the sets

**Difficult**

Two sets of single leg bounds on each leg on and off (30-80 cm height) box with 3 minutes rest between the sets.

Two sets of double leg bound on and off 6 to 8 (30-80cm height) box with 3 min rest between the sets.

**Findings**

Statistics were performed by using SPSS 11. Results were calculated at 0.05 level of significance.

Table 1. Mean and standard deviation for the variable at different sessions (0, 1, 2 and 3 weeks) for Group A

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 week</td>
<td>9.15</td>
<td>1.24</td>
</tr>
<tr>
<td>1 week</td>
<td>9.44</td>
<td>1.12</td>
</tr>
<tr>
<td>2 week</td>
<td>9.18</td>
<td>0.93</td>
</tr>
<tr>
<td>3 week</td>
<td>9.20</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Table 2. Mean and standard deviation for the variable at different sessions (0, 1, 2 and 3 weeks) for Group B

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 week</td>
<td>8.82</td>
<td>0.69</td>
</tr>
<tr>
<td>1 week</td>
<td>8.60</td>
<td>0.56</td>
</tr>
<tr>
<td>2 week</td>
<td>8.33</td>
<td>0.87</td>
</tr>
<tr>
<td>3 week</td>
<td>8.27</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Table 3. Comparison of mean values at different session for the variable within Group A

<table>
<thead>
<tr>
<th>Variable</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 week Vs 1 week</td>
<td>-1.382</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>0 week Vs 2 week</td>
<td>-0.146</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>0 week Vs 3 week</td>
<td>-0.207</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>1 week Vs 2 week</td>
<td>1.669</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>1 week Vs 3 week</td>
<td>1.250</td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td>2 week Vs 3 week</td>
<td>-0.110</td>
<td>p&gt;0.05</td>
</tr>
</tbody>
</table>

It can be seen in table 3 that in group A(control group)shows insignificant results therefore showing no improvement whereas in table 4 group B(experimental group)shows significant results at week 2 and week 3 as compared to 0 week.

Table 4. Comparison of mean values at different session for the variable within Group B

<table>
<thead>
<tr>
<th>Variable</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 week Vs 1 week</td>
<td>1.906</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>0 week Vs 2 week</td>
<td>2.433</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>0 week Vs 3 week</td>
<td>2.814</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>1 week Vs 2 week</td>
<td>1.329</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>1 week Vs 3 week</td>
<td>1.632</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>2 week Vs 3 week</td>
<td>0.953</td>
<td>p&lt;0.05</td>
</tr>
</tbody>
</table>

P < 0.05 → Significant
P > 0.05 → Not Significant

Table 5. Mean diff. (3 week - 0 week) and SD for the variables of Group A and Group B

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean diff</td>
<td>SD</td>
</tr>
<tr>
<td>3 week - 0 week</td>
<td>0.04</td>
<td>0.92</td>
</tr>
</tbody>
</table>
Table 6. Comparison of mean values at different sessions for the variable between Group A and Group B

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 week</td>
<td>0.893</td>
<td></td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>1 week</td>
<td>2.602</td>
<td></td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>2 week</td>
<td>2.578</td>
<td></td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>3 week</td>
<td>3.118</td>
<td></td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Mean diff. (3-0) weeks</td>
<td>1.927</td>
<td></td>
<td>&gt; 0.05</td>
</tr>
</tbody>
</table>

P < 0.05 → Significant
P > 0.05 → Not Significant

In the present study the effect of plyometrics training on sprinters was studied by measuring the sprint time as pre test (0 week) and post test (1,2,3 week). The two groups were taken as group A(control group) and group B(experimental). The result shows that there was statistically significant improvement in sprint velocity in sprinters of experimental Group and statistically insignificant results in sprinters of control group. On the very 1st week (0 week-week 1) of treatment there was statistically insignificant improvement of sprint velocity in experimental group, but the results show statistically significant improvement of sprint velocity after the treatment of 2 weeks (0 week - 2 week) and 3 weeks (0 week-3 week) from the initial readings of 0 week. On comparing the both groups it was found that both groups show statistically insignificant improvement after week 1 but experimental group show statistically significant improvement after week 2 and week 3 as compared to control group.

CONCLUSION

From the present study it is concluded that Plyometrics has statistically significant effect in increasing the sprint velocity in sprinters. In addition, the results support that there was statistically significant improvement in sprint velocity in as little as 3 weeks of plyometrics training. The effect of plyometrics is only significant after 2nd and 3rd week and not in 1st week. It is also seen that sprint performance did not improved with easy level of plyometrics but with progression to moderate, difficult level the performance was improved. This study implementing one Plyometric session in 1 week of Plyometric training improves running economy of regular but not highly trained distance runners. After searching the literature, it is believe that this is the first study to demonstrate that a regimen of Plyometric training of moderate and difficult intensity specifically improves running economy. So it can be interpreted that moderate and difficult level of plyometrics training helps to improve the sprint velocity in sprinters receiving plyometrics instead of sprinters not subjected to plyometrics. Hence plyometrics decreases the time taken to cover the distance of 60meters and the performance is not noticeable immediately but it improves with time. Thus plyometrics should be included as an important part of training in athletes.

ACKNOWLEDGEMENTS

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Conflict of Interest: - Nil

REFERENCES

Perception about Stroke amongst Rural Population in Maharashtra

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ABSTRACT

Background: Prevalence of stroke in India varies in different regions of country and ranges from 40 to 270 per 1,00,000 population. Only one study in India evaluated the perception of warning signs of stroke and its risk factors. Amount of evidence available with this respect is very low and there is a need for extensive research.

Method: In this prospective study 600 subjects from Loni, Maharashtra were handed over a multiple choice questionnaire in the local language that addressed questions regarding warning signs and risk factors of stroke and sources of information regarding stroke.

Results: Awareness for stroke was considerably low with only 51% subjects being able to recognize brain as the organ responsible for stroke. Knowledge of risk factors was moderate with 66% participants being able to establish at least 1 risk factor. Weakness of one side of the body was the most established warning sign, other warning signs were however less known. Awareness of warning signs was in direct proportion with educational qualification.

Conclusion: The study revealed that the knowledge regarding the organ involved, warning signs and some risk factors is lacking in the population. It is important to bring about awareness amongst the population so as to minimize the long term debilities associated with stroke. Different means of mass communication should be effectively used in this regard to reach out to the rural Indian population.

Key words: Stroke, Risk Factors, Warning signs, Awareness
METHOD

The study participants were randomly approached individuals which included shopkeepers, farmers and housewives. They were approached door to door and requested to fill up the questionnaire. The inclusion criteria were personal willingness to participate, Oral consent was obtained. Exclusion criteria was inability to read as the questionnaire had to be completed by the participant himself. The survey questionnaire was adapted from previous studies (1) with modifications by the authors to suit the sociocultural practices. The questionnaire was translated in the local language (Marathi) for easy understanding of the subjects. The questionnaire comprised of two sections. The first section asked about personal information including name, age, sex and education. The second section was about stroke awareness. The subjects were asked to identify the warning signs of stroke and rate the risk factors. Lastly they were asked about the media through which they got information about stroke.

Respondents’ knowledge of important warning signs of stroke was assessed with signs established by American Stroke Association, which list the following as important warning signs of stroke in their educational materials:

(1) sudden numbness or weakness of the face, arm, or leg, especially on one side of the body; (2) sudden confusion or trouble speaking or understanding speech; (3) sudden trouble seeing in one or both eyes; (4) sudden trouble walking, dizziness, or loss of balance or coordination; and (5) sudden severe headache with no known cause.

Knowledge of risk factors was assessed using the following established risk factors: hypertension, history of heart disease, previous stroke, excessive alcohol consumption, smoking, psychological stress, lack of exercise, old age, high blood cholesterol levels, diabetes, and excessive caffeine intake.

STATISTICAL ANALYSIS

A summary variable ‘Stroke awareness’ was derived by calculating the percentage of correct answers to the presented risk factors, Stroke warning signs and source of information about stroke, for each participant.

RESULTS

Of the total 600 individuals contacted 376 completed the questionnaire yielding to a response rate of 62.6%. 76.4 % males 23.6 % females. 30% were educated up to 12th standard.

Table 1. shows knowledge about the organ involved. 52% identified brain as the organ responsible for stroke, followed by heart (19%). 2%, 2% and 1% opined lungs, kidney and stomach respectively while 24% did not know about the organ involved. In a multivariate analysis the knowledge of organ involvement was highest among those educated up to primary level (72%) and graduates (73%), while the values were low amongst 12std standard (41%) and secondary (43%) groups. Heart (38%) was a typical incorrect answer given by the 12th std group.

Table 1. Knowledge of organ involved.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain</td>
<td>51%</td>
</tr>
<tr>
<td>Heart</td>
<td>19%</td>
</tr>
<tr>
<td>Kidney</td>
<td>2%</td>
</tr>
<tr>
<td>Lungs</td>
<td>2%</td>
</tr>
<tr>
<td>Stomach</td>
<td>1%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>24%</td>
</tr>
</tbody>
</table>

66% of the participants could identify at least 1 risk factor. The best known risk factors were High blood pressure(48%), Cigarette smoking(38%), History of heart disease(31%) and High blood cholesterol (30%) and the less known were Diabetes(23%) and Previous history of stroke(13%). 51% population rated Mental stress as an important risk factor while Lack of exercise(47%), Excessive alcohol consumption(42%), Old age(40%), Excess caffeine consumption(27%) were the other perceived important risk factors. When asked to identify at least one risk factor, the awareness was found highest amongst Graduates (86.9%) followed by 12std group 86%, secondary(64.7%), Primary(63.6%) and informally educated(40%).

With respect to the warning signs listed, 81% of the population could identify at least 1 warning sign. The most commonly recognized sign was ‘sudden numbness or weakness of hand, leg face or half of the body’(82%), followed by ‘sudden difficulty to speak’(57%), ‘sudden trouble walking, dizziness or loss of balance’(52%). Table 2 gives a bivariate analysis between educational qualification and ability to recognize at least one warning sign.

Table 2. Bivariate analysis between educational qualification and ability to recognize at least one warning sign

<table>
<thead>
<tr>
<th>Education</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal</td>
<td>90%</td>
</tr>
<tr>
<td>Primary school</td>
<td>72.7%</td>
</tr>
<tr>
<td>Secondary school</td>
<td>76.4%</td>
</tr>
<tr>
<td>12th standard</td>
<td>76.6%</td>
</tr>
<tr>
<td>Graduate</td>
<td>86.9%</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>88.8%</td>
</tr>
</tbody>
</table>
DISCUSSION

Majority of the population correctly identified brain as the organ causing stroke, as opposed to a previous study\(^1\) which reported lack of awareness about the same.

In an observational analysis a considerable misconception was found between a ‘heart attack’ and ‘stroke’. The term ‘stroke’ was found to be commonly used for emergency conditions related to cardiac involvement. On the other hand ‘Paralysis’ was the term commonly used with relation to stroke.

Psychological stress was reported as a highest known risk factor for stroke. This has previously been reported by only one study till now\(^5\). Several studies\(^1-4\) stated hypertension as an important risk factor for Stroke. Similar results were found in our study.

Lack of exercise was reported amongst the most important risk factors in our study. Previous studies\(^6-9\) have shown an inverse relation between exercise and risk of stroke. Heart Disease and Stroke Statistics 2011 Update: A Report from the American Heart Association\(^24\) demonstrated a consistent relationship between higher levels of physical activity associated with lower stroke risk.

In our study excess alcohol consumption was also reported as an important risk factor. In previous studies\(^10-13\) light and moderate alcohol consumption was associated with a reduced relative risk of ischemic stroke whereas heavy alcohol consumption was associated with increased relative risk of hemorrhagic stroke. A meta-regression analysis revealed a significant nonlinear relationship between alcohol consumption and total and ischemic stroke and a linear relationship between alcohol consumption and hemorrhagic stroke.

A previous study\(^14\) demonstrated that dementia in old age may be an early manifestation of cerebrovascular disease (CVD), that eventually becomes clinically evident as an acute cerebrovascular accident, another term for stroke. On The Short Portable Mental Status Questionnaire (SPMSQ)\(^15\) stroke incidence was lowest in those with normal SPMSQ score, intermediate in those with moderate impairment, and highest in those with severe impairment. Our study demonstrated a considerable awareness regarding the relationship between old age and stroke.

Confirmatory data were presented in the Tromso Study\(^16\), a cross-sectional study among middle-aged persons, in which low levels of HDL cholesterol were associated with echolucent carotid artery plaques, a major risk factor for stroke. A study demonstrated that low HDL cholesterol level was associated with a 2.0-fold higher risk of fatal cardiovascular disease (95% confidence interval [CI], 1.2-3.2). Another study observed inverse relationship between HDL cholesterol levels and ischemic stroke in middle-aged Israeli men\(^17\). In our study\(^18\) the participants’ knowledge demonstrated a direct relation between stroke and cholesterol levels, which is coherent with the findings for HDL cholesterol levels as above. This in turn estimates the knowledge of inverse relation between LDL cholesterol level and stroke seems to be lacking. However the knowledge about levels of the two types of lipoproteins was not assessed separately in our study, owing to the limitations of the language.

The presence of signs or symptoms of coexistent cardiovascular disease have been shown to increase stroke risk in many studies\(^19, 22, 21, 22-23\). Similar results were found in our study. Atrial fibrillation (AF) is a powerful risk factor for stroke, independently increasing risk 5-fold throughout all ages.

The risk of ischemic stroke associated with cigarette smoking has been shown to be approximately double that of nonsmokers after adjustment for other risk factors (FHS, CHS, Honolulu Heart Program [HHP]\(^24\)). A good awareness with this respect was found in our study. The result could be attributed to the mandatory warning signs on cigarette packets. Smokers living in countries with government mandated warnings reported greater health knowledge. Smokers who noticed the warnings were significantly more likely to endorse health risks, including lung cancer and heart disease\(^25\).

In our study excess coffee consumption was perceived to be a risk factor for stroke, a possible reason being increase in systolic blood pressure with increased coffee consumption, as reported by a previous study\(^26\). However another study suggested that habitual coffee consumption of >3 cups/day was not associated with an increased risk of hypertension compared with <1 cup/day\(^27\). Another study suggested that decaffeinated coffee consumption may modestly reduce risk of stroke\(^28\).

However the knowledge for two major risk factors for stroke, Diabetes and History of previous stroke (listed by American Heart Association) was lacking, the finding being consistent with two other studies\(^2, 29\). This emphasizes the need to generate
specific awareness regarding these two risk factors.

The awareness of warning signs was directly proportional to the educational qualification. (Those with Informal education were an exception to this pattern with 90% being able to identify at least 1 warning sign.) Knowledge about ‘sudden numbness or weakness of hand, leg, face or half of the body’ as warning signs as given by the American Heart Association was good, however that about ‘sudden difficulty to speak’, ‘sudden trouble walking, dizziness or loss of balance’ was comparatively low. A limitation of this study was that ‘deviation of mouth to one side’ was not taken into. The authors considered it under weakness of one side of face as mentioned above. The terms were adopted from the warning signs of stroke listed by American Heart Association.

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2. Pancioli AM, Broderick J, Kothari R, Brott J, listed by American Heart Association. terms were adopted from the warning signs of stroke
3. Weakness of one side of face as mentioned above. The awareness of warning signs was directly proportional to the educational qualification. (Those with Informal education were an exception to this pattern with 90% being able to identify at least 1 warning sign.) Knowledge about ‘sudden numbness or weakness of hand, leg, face or half of the body’ as warning signs as given by the American Heart Association was good, however that about ‘sudden difficulty to speak’, ‘sudden trouble walking, dizziness or loss of balance’ was comparatively low. A limitation of this study was that ‘deviation of mouth to one side’ was not taken into. The authors considered it under weakness of one side of face as mentioned above. The terms were adopted from the warning signs of stroke listed by American Heart Association.

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To Study and Compare the Effect of Laptop Computers with Desktop Computers on Working Posture and Self-Reported Musculoskeletal Symptoms

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¹²Incharge, Physiotherapy IAHSET, Government Medical College, Haldwani

ABSTRACT

Purpose: Comparing the effect of the laptops with desktops on the working posture and self reported musculoskeletal system.

Objective: To determine the extent to which health problems associated with laptops, and the risk factors involved. How do these risk factors compare with those using full sized desktop.

Methodology: The study was done on randomly selected sample from different age group of people. Sample size was 135 respondents from 3 different places (Haldwani, Pantnagar and Delhi). Data was analyzed by descriptive statistics.

Results: It has been observed that Length of working hours have strong association with suffering (.729). It has also been observed that age of the computer users is having a considerable effect on the upper back pain (.381). Out of 47 laptop users 37 have reported that they are suffering with some pain, fatigue or numbness. i.e. 78 per cent of laptop users are suffering from some kind of pain in comparison to 28 per cent of desktop users.

Conclusion: The study showed the ill effect of laptop on posture is more when compared with desktop. The musculoskeletal problems are more reported by the laptop users as compared to desktop users. The future

Key words: Cumulative Trauma Disorders, Work-Related Musculoskeletal Disorders, Computer Vision Syndrome, Desktop, Personal Computers, Repetitive Stress Injury, Musculoskeletal Problems.

INTRODUCTION

Since computer were introduced in the 1980s, personals computers have become powerful and extremely versatile tools that have revolutionized how people work, learn, communicate and find environment.¹ Laptop computers have become widely used in many workplaces and schools and are currently the largest growth area within the PC market.² There was a sell of 2.5 million laptops in India that is a growth of 63% over previous year.³

In laptop the issues of comfort, adjustability and ergonomics are important to prevent foreseeable ergonomic and occupational health problems. Laptops are designed with the screen attached to the keyboard, resulting in constrained body postures and movements.

Given this ergonomic disadvantage of the conventional laptop several studies have shown an increase in neck flexion, torque and physical discomfort.⁴ In a study by Saito et al (1997) the neck muscle load (EMG value) was significantly greater using the laptop PC than with the desktop PC. Furthermore, there was greater forward head inclination, less head movement and shorter viewing distance increasing the visual and musculoskeletal workload at the laptop PC as compared to the desktop PC.⁵

In a recent follow up study on newly hired employees with computer use for more than 15 hours a week and follow up period of 3 years, incident neck-shoulder and hand-arm symptoms were frequent.⁶,⁷,⁸,⁹

Villanueva net al 1996 found that screen height strongly influenced neck flexion, with lower screens resulting in greater neck flexion.¹⁰ Prior research has suggested that increased neck and shoulder flexion increases the biomechanical load an surrounding structures, leading to discomfort and possibly the development of musculoskeletal disorders.
PURPOSE AND OBJECTIVES OF THE STUDY

The purpose of this study was to evaluate and to compare the effect of laptops with desktops on the working posture and the risk associated with the long term use of laptops and desktops on the musculoskeletal system. Specifically the objective of the study is to determine the extent to which health problems associated with laptops, and the risk factors involved. How do these risk factors compare with those using full sized desktop.

METHODOLOGY

To fulfill the objective of the study, it was decided that data from randomly selected 135 individual from GB Pant University, Pant Nagar and Amrapali Institute of Applied Sciences, Haldwani and respondent, who are working in some BPOs will be collected. The mean age of the subjects will be taken as 34 years (range 20-45), whose work/studies involve minimum 3 hours of regular PC use. The subject had 3 years of mean PC experience (range 1-4 years) and 2 years of laptop PC work experiences (range 2-4).

Inclusive Criteria

1. The subject should be minimum 2 years of laptop and 3 years of desktop work experiences
2. Work should involve minimum 3 hours of regular PC use.
3. Subject aged between 20-45 years.

Exclusive Criteria

The volunteer were excluded if they had previously diagnosed torticollis, forward head, rounded shoulders, excessive thoracic kyphosis and lumbar lordosis and asymmetrical shoulder height or if they had a medical history of idiopathic scoliosis or recent back or neck injuries or had experienced symptoms of musculoskeletal injuries or discomfort in previous to the use of laptops with or without attached keyboards which resulted in medical treatment or time off work.

DATA ANALYSIS

SPSS 10.1 was used to calculate counts and frequency tables on various variables.

Cross tabulation between User type verses different variables was calculated to know the behaviour of particular variable in comparison to Laptop or desktop users. Simple correlation coefficient was also calculated from the collected data to know the association between different variables.

RESULTS

Observations on the following variables was collected.

Name, Occupation, Age, Left / right handed, User type (Laptop / Desktop), Length of use, Work related suffering (Neck problem, Right shoulder, Left shoulder, Right arm, Left arm, Right forearm, Left forearm, Right palm, Left palm, Upper back, Lower back).

Table 1: Correlation Coefficients

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>User Type</th>
<th>Length (in years)</th>
<th>Rt.arm pain</th>
<th>Rt. Forearm pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Type</td>
<td>0.152</td>
<td>1.000</td>
<td>-0.010</td>
<td>-0.045</td>
<td>-0.035</td>
</tr>
<tr>
<td>Length (in years)</td>
<td>0.440**</td>
<td>-0.010</td>
<td>1.000</td>
<td>0.132</td>
<td>0.023</td>
</tr>
<tr>
<td>suffering (overall)</td>
<td>0.128</td>
<td>-0.066</td>
<td>0.729**</td>
<td>0.082</td>
<td>0.119</td>
</tr>
<tr>
<td>Neck pain</td>
<td>0.038</td>
<td>-0.081</td>
<td>0.311</td>
<td>0.029</td>
<td>-0.089</td>
</tr>
<tr>
<td>Rt. Shoulder pain</td>
<td>0.057</td>
<td>-0.173</td>
<td>0.111</td>
<td>0.263**</td>
<td>0.118</td>
</tr>
<tr>
<td>Rt. arm pain</td>
<td>0.127</td>
<td>-0.045</td>
<td>0.132</td>
<td>1.000</td>
<td>0.392</td>
</tr>
<tr>
<td>Rt. Forearm</td>
<td>-0.036</td>
<td>-0.035</td>
<td>-0.023</td>
<td>0.391**</td>
<td>1.000</td>
</tr>
<tr>
<td>Rt. Palm</td>
<td>0.262**</td>
<td>0.074</td>
<td>0.259**</td>
<td>0.293**</td>
<td>0.122</td>
</tr>
<tr>
<td>Lt. shoulder</td>
<td>-0.069</td>
<td>-0.151</td>
<td>0.088</td>
<td>0.101</td>
<td>0.047</td>
</tr>
<tr>
<td>Lt. arm pain</td>
<td>-0.079</td>
<td>-0.104</td>
<td>0.041</td>
<td>0.348**</td>
<td>0.115</td>
</tr>
<tr>
<td>Lt. Forearm pain</td>
<td>-0.100</td>
<td>-0.096</td>
<td>-0.068</td>
<td>0.111</td>
<td>0.884**</td>
</tr>
<tr>
<td>Lt. Palm pain</td>
<td>0.019</td>
<td>-0.010</td>
<td>0.159</td>
<td>-0.021</td>
<td>0.047</td>
</tr>
<tr>
<td>Upper back pain</td>
<td>0.381**</td>
<td>0.076</td>
<td>0.114</td>
<td>-0.056</td>
<td>-0.081</td>
</tr>
<tr>
<td>Lower back pain</td>
<td>0.105</td>
<td>0.096</td>
<td>0.400**</td>
<td>-0.089</td>
<td>-0.067</td>
</tr>
</tbody>
</table>

Table value of r at 120 d.f. at 5% level 0.195 and at 1% level 0.254 *significant at 5% level, ** significant at 1% level

Tabular analysis and Graphic representation:

The calculated results were placed in the following tables and graphs. The results are based on counting and calculation of frequencies and percentage of effected persons in comparison to total users.

Fig. 1. It can be seen in the picture, how two type of computer users, (1) Laptop and (2) Desktop, are suffering from various type of body pains. As many as 75 % people are suffering due to working with computer for a prolonged period.
Fig. 2. Shows complaints of neck problem between two type of users of computer. It can be observed that out of 37 laptop users 19 have reported having problem at their neck, whereas out of 88 desktop users 28 have reported problem in neck.

Fig. 3. Shows how people are suffering with shoulder pain in both side due to use of computers. It is observed that laptop users are suffering more that desktop users.

Fig. 4. Shows how use of computers are affecting the users on their arm. It seems arm areas of the users are not that affected due to use of computer, as only 4 percent of laptop users and 6 percent of the desktop users have reported for problem. However, it can be said that laptops are more harmful than desktops.

Fig. 5. Also shows affect of computer use on forearm. It can be seen from the observation that both forearm area of the users are not very affected due to use of computer as only smaller percentage of users are affected. Here also it can be observed that laptops are more harmful.

Fig. 6. Shows the affect of laptop and desktop use on palm. It has been observed that around 20 percent laptop users are suffering from palm pain, whereas 10-12 percent desktop users have reported for the same.

Fig. 7. Shows how people are suffering with back pain working with computers.
DISCUSSION

The result of the present study showed a significant difference between working at a laptop and the desktop. The use of laptop produced more musculoskeletal problems when compared with desktop. The result of the study confirms a strong correlation between the length of computer use and suffering (.729). It has also been seen that age of computer users is having a considerable effect on the upper back pain (.381). It can also be seen that length of working hours is having a positive effect on lower back pain (.399). The correlation studies have also shown that if a person is having pain in one of his shoulder, it may affect his other side also (cor is .664). The same has been observed in case of forearm pain.

Study by Kilbom and Persson (1987) found that those who worked at a VDT with increased forward flexion of the neck ran a higher risk of musculoskeletal disorders.11 the results of a study by Bauer and Wittig (1998) showed “that preference is to be given to a screen position in which the vision axis is horizontal or inclined slightly downward” when using a desktop PC.11

Fig. 1 shows the level of suffering between two type of users of computers. Out of 47 laptop users 37 have reported that they are suffering with some pain, fatigue or numbness. i.e. 78 per cent of laptop users are suffering from some kind of pain in comparison to 72 per cent of desktop users.

Fig. 2. Shows complaint of neck problem between two type of users of computer. It can be seen that out of 37 laptop users 19 have reported having problem at their neck, whereas out of 88 desktop users 28 have reported problem in neck. The picture depicts that 40 percent laptop users are having problem in neck in comparison to 31 percent of desktop users. 21.28 percent respondent, who are using laptop, have reported that they are having shoulder pain in both side. Whereas 10.23 per cent desktop users have reported that they are having shoulder pain in right side and 13.64 per cent users have reported that they feel pain in left shoulder. (Fig. 3)

Present study found that during continuous laptop use there is increased back pain, as about 42 percent of laptop users have reported that they are having back pain and 22 percent of the desktop users have reported the same. (Fig. 7)

Lower back is more prone to suffering due to use of computer. It may be due to bad posture or continuous sitting at a particular position. Concentration, bad posture, continuous sitting etc may effect badly on lower back. Fig. 8 revils that 53 per cent of laptop users are suffering with lower back pain, whereas 31 percent of the desk top users are suffering with it. Thus it can be said that continuous use of laptop effects more on lower back than use of desktop. At the end the study concluded that about 78% of laptop users are suffering from musculoskeletal problems as compared to desktop (Fig.1)

CONCLUSION

This study has highlighted some of the concern associated with laptop and desktop use, particularly in term of postural discomfort and MP. It has been seen that there is a poorer posture and greater discomfort associated with laptop then desktop users. Concerning the study done about 78% of laptop users are suffering from neck pain and back ache whereas 28% of desktop users have complained any suffering. Study also showed a high correlation between the working hours and suffering (.729). it should be noted that, where a laptop must be used for a shorter period with proper rest period and correct ergonomics then desktop to minimise the suffering. As this is the first preliminary study, it will not be proper to generalized the observation. So it is recommended that further detail studies can be done on the problem to confirm the result.

As the computer technology has revolutionised and will continue to revolutionise work practices and the trend toward miniaturisation of equipment should not be at the expense of the people who use it.

LIMITATION OF THE STUDY

1. The ability to observe actual PC usage and the ergonomic issues that arise in a workplace will be difficult. Home access may not be granted by any of the participants in the study.
2. Data will be collected by use of a survey, which will be constructed by the researcher. Survey data collection will only be as reliable as those who participate in the survey.

REFERENCES

An Analysis of Memory Retrieval and Performance of Physiotherapy Exercises in Younger and Older Patients

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ABSTRACT

Introduction: Physiotherapists routinely prescribe exercises in the O.P.D. and advice the patient to follow the same at the home. The clinical goals set by the therapist depend on the success of the exercises programme and protocols, which the patient has to follow regularly. These studies aimed to have a "know - how" of how far the patient remembers the sequence of exercises that are prescribed.

Design: 90 patients were selected; patients were of common problems like Postural Neck Pain, Postural Low Back Pain, Knee Pain. Patients were further divided into 30 each and three groups were made, each group contains 10 of each condition and 5 younger & 5 older patients. Groups were Group I - Verbal Instructions and Self Performance, Group II - Pictorial Diagram / Written Material and Self Performance, Group III - Demonstration by Model and Self Performance. Exercises were told to patients and were told to recall them on 2nd day & 5th day for short and long term memory.

Methods: Study included Younger adults aged between 20 to 40 & older adults aged between 60 to 80. Patients were prescribed exercises and asked to recall on 2nd & 5th day for short and long term memory respectively. The outcome was measured by using "Rastall’s Exercise Scoring Table". Points allotted were 02, 03, 03, 02 respectively total 10 points - minimum scoring was 08 points. Data Analysis was done using unpaired” test.

Results: This study proves that “demonstration by model and self performance” has better memory retrieval of short term and long term memory in both younger and older adult patients compare to other two groups i.e. “Verbal Instructions and Self Performance & Pictorial Diagram / Written Material and Self Performance”.

Key words: Retrieval, Short Term Memory, Long Term Memory, Exercises
demonstration, there will be a modeling of an action either by videotape or by the teacher performing the action, it will help the learner to develop and helps to understand the conceptual representation of the action. By observation the learner can know the amplitude of movement, appreciate the timing and fluency of the action and relationship between the body parts. Demonstration will provide a visual impression on the minds of the people and is more effective than printed one. Lastly, Verbal instructions are most commonly used for conveying information or prescribing the exercises. Verbal instructions mainly focus on kinematics description for example angular displacement, oaths of the body parts, which require an understanding by the therapist of linked segment dynamics and biomechanical necessities of the action to be learned. Instructions are given in such a way as to present a clear goal and to reduce uncertainty. In addition to make the goal to be pursued with enthusiasm verbal instructions needs to be meaningful to the individual so assist the patient in self-management and enable them to manage various aspects of own care.

AIMS

To assess the retrieval capability of prescribed exercise in younger and older population group following verbal instructions, Pictorial diagrams written material, and demonstration by subject, methods and to compare efficiency of the three sets of prescribed exercises programme and suitability for age groups.

METHODOLOGY

Patient Selection

Inclusion Criteria
1. Younger adults of age group from 20 to 40.
2. Older adults without disabilities and impairments of age group between 60 to 80 years.
3. Subjects with postural neck pain, low back pain, knee pain.

Exclusion Criteria
1. Neurological deficits.
2. Visual impairments.
3. Hearing impairments.

Material Used
1. Model – To demonstrate the exercises. The model was initially trained to perform the given set of exercises for each of the three conditions. When he was well versed with all the exercises, he was asked to demonstrate same for the subjects.
2. Fully equipped exercise therapy room.

Sample Selection

Stratified random sampling was used in this study. Sample consists of 90 subjects in the age group ranging between 20 to 80 years. The subjects included for the study were those who were referred to Physiotherapy OPD. These subjects were informed about the study, which was being undertaken. The subjects were than suitably selected based primarily on their consent to participate in the study and on follow regular Physiotherapy for duration of one week. Subjects included in the study were assessed by using general assessment form; the subjects were assessed for any impairment and/or disabilities as per inclusion/exclusion criteria. The total number of subjects in study design was 90. For the purpose of conducting the trials these 90 subjects were divided into 3 groups. Each group comprised of 30 subjects. These 30 subjects in each group were further divided into 15/15 younger and older population respectively. The study design for each group(30) was now constructed as follows:-

Three postures related stress syndromes were designated for each group. This was implemented by providing one stress syndrome for 10 subjects. Care was taken that the 10 subjects had equal distribution of younger and older age groups of 5 each. Permission for the study was taken from concerned authorities. The purpose of the study was explained to all subjects. A written and informed consent form was taken from the subjects.

Both the older and younger age group subjects were divided into 3 groups each (i.e. the tabulated column of groups and its demographic data are explained in table below) based on first come bases.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Younger adults</th>
<th>Older adults</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I. Verbal instruction group.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postural neck pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Postural low back pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Knee pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Group II. Pictorial diagrams written material group.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postural neck pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Postural low back pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Knee pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Group III. Demonstration group.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postural neck pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Postural low back pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Knee pain</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>
Samples –

The samples were drawn from the following setting –

Physiotherapy Out Patient Department, Pravara Medical Trust’s, Pravara Rural Hospital, Loni.

Tools for exercises performance measurement –

Exercise performance scoring table. The exercise performance scoring table was developed by Maggie Rastall et al 2000. This scale measures primarily the four components of an exercise.

They are -

1) Correct standing position of the exercise.
2) Exercise body components moving in correct plan.
3) No compensation or cheat movements.
4) Movements performed within correct range.

Every exercise performance had a maximum scoring of 10 points. The possible 10 points were appended in table below -

Table 2. Contains of Maggie Rastall exercise scoring table with points allotted.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correct standing position of the exercise</td>
<td>2</td>
</tr>
<tr>
<td>2. Exercise body components moving in correct plan</td>
<td>3</td>
</tr>
<tr>
<td>3. No compensation or cheat movements.</td>
<td>3</td>
</tr>
<tr>
<td>4. Movements performed within correct range.</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
</tr>
</tbody>
</table>

On exercise performance a score of 8 points or more, was deemed to be correctly done they were considered as number of exercises correctly performed by the subject.

Procedure

The subjects of three different conditions i.e. Postural Neck Pain, Postural Low Back, and Knee Pain were selected. The set of seven exercises were given for each condition.

Postural Low Pain – 1st set – 7 exercises.
Knee Pain – 1 set – 7 exercises.

Same set of exercises were explained to patients, in all three medium of instructions. The exercises were performed in three different ways, they are -

- Verbal Instructions and Self Performance.
- Pictorial Diagram Written Material and Self Performance.
- Demonstration by Model and Self Performance.

Method for Verbal Instructions and Self Performance

In this group exercises were told to the patients by therapist verbally and asked to remember and do it.

Patients was asked whether he or she understood it properly or not and than he or she was told to recall exercises on subsequent follow up i.e. on 2nd day for short term memory and 5th day for long term memory when asked by therapist.

Method for Pictorial Diagram Written Material and Self Performance

In this group exercises were told to the patient by therapist in form of Pictorial Diagram / Written Material and told to read it, remember it and do it.
Patient was asked whether he or she understood it properly or not and than he or she was told to recall exercises on subsequent follow up i.e. on 2nd day for short term memory and 5th day for long term memory when asked by therapist.

Method for Demonstration by Model and Self Performance.

In this group exercises were demonstrated to the patient by the help of model who demonstrated the exercises to the patient, as told by the therapist. Patient was told to remember and do it. Patient was asked whether he or she understood it properly or not and than he or she was told to recall exercises on subsequent follow up i.e. on 2nd day for short term memory and 5th day for long term memory when asked by therapist.

**DATA ANALYSIS**

To apply the appropriate test of significance the data collected was analysed at 2nd sitting (Short Term Memory) and 5th sitting (Long Term Memory) for all three methods. For analysis of effectiveness of verbal instruction’s, pictorial diagram & written material, demonstration by model in younger and older individuals at both short term and long term memory, student unrelated “t” test was performed. To know whether these result’s been significant, highly significant and not significant the final readings were compared with ‘P’ value. (‘t’>2.58- Highly Significant) (P<0.05).

**DISCUSSION**

This study proves that demonstration by model and self performance has better memory retrieval of exercises performance, in comparison to verbal instruction and self performance & pictorial diagram, written material and self performance methods in younger and older adults. Hence this study recommends the usage of demonstration by model and self performance method.

**CONCLUSION**

The analysis of the data has led to following inferences:

1) In the younger adults, demonstration by model and self performance, verbal instruction and self performance methods showed a higher amount of memory retrieval of exercises compared to pictorial diagram / written material and self performance in short term memory but all the three interventions are equally effective in long term memory.
2) In older individuals demonstration by model and self performance has given a better memory retrieval of exercises where as verbal instruction and self performance has given least in both long term and short term memory.

3) When both younger and older adult’s performances are compared, demonstration by model and self performance showed a better retrieval of exercises in long term and short term memory.

4) When both younger and older adults performances are compared, by pictorial diagram / written material and self performance younger adults showed a better performance than older adults at both short term and long term memory.

RESULT

In younger adults exercise prescription can be done by any of the three intervention i.e. Verbal instructions and self performance, pictorial diagram / written material and self performance, demonstration by model and self performance. All three interventions are effective.

But for the older adult’s demonstration by model and self performance is found to be most effective. Therefore one can conclude that it is better to prescribe exercise using demonstration by model and self performance in older adults for the easy recollection of prescribed exercises.

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8. Engel kemp, 2000, Item and Older information in Subject Performed Tasks and Experimented Performed Tasks.


Effectiveness of Physiotherapy for the Handwriting Problem of School Going Children

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ABSTRACT

Purpose: The purpose of the study is to see the effectiveness of a 12 week physiotherapeutic intervention to improve the handwriting quality of school going children.

Methodology: This study is a randomized clinical trial of 60 school going children who have handwriting problem as diagnosed with Handwriting Proficiency Screening Questionnaire (HPSQ). The 60 subjects are than randomly divided into 2 groups, Group A (Intervention Group) which consists of a set of Physiotherapeutic Exercises and Group B (Ergonomic Advice). The Handwriting quality was evaluated using Minnesota Handwriting Assessment (MHA).

Results: The results of the present study showed that both the groups showed significant improvement but the group receiving 12 week physiotherapeutic intervention showed more significant improvement.

Conclusion: Finally it can be concluded that a well planned physiotherapeutic program can help to improve the handwriting quality of school going children over a short period of time and thus help the child to improve his self-confidence and his academic results.

Key words: Handwriting Skills, Physiotherapy Intervention, Assessment Scales.

INTRODUCTION

Skilled handwriting is an essential activity for school aged children that allows them to write within a reasonable time and to create a readable product through which thoughts and ideas can be communicated.¹ Handwriting is often judged and seen as reflection of an individual’s intelligence and capabilities as illustrated by several studies in which lower marks are consistently assigned to children with poor handwriting and higher marks are given to those with legible handwriting despite similar content.¹²

The effect of sex is also an important consideration in handwriting development.¹ Girl’s handwriting is more legible than boy’s handwriting and also the girls write faster. Right hander’s are also faster than the left hander’s.⁵

Factors that affect the handwriting performance can be intrinsic i.e because of lack of fine motor control, improper visual-motor integration or may be extrinsic like sitting position, chair-desk height, blackboard position, environmental lighting etc.⁶

Writing difficulties have been documented in children with and without disabilities. Legible handwriting constitutes to be an important skill for children to develop in elementary school and difficulty with this area can affect any child’s proficiency at work. Proficiency is the quality of having great facility and competence at school work.⁷ Those children who do not succeed in developing proficient handwriting are defined by some authors as “poor hand writers” and by the others as dysgraphic.⁸

In addition to legibility and timing deficits, observations by clinicians have revealed that children with dysgraphia erase more, complain more about fatigue and hand pain, and are unwilling to write and do their homework.¹ All of these signs may be considered to represent a category of physical and emotional well-being.⁹

The teacher is an important source of information about a child’s handwriting.¹ The perceptions of regular education teachers on problems with handwriting can provide valuable information to practitioners when providing consultation and direct services related to
Besides this various handwriting assessment tools are available. Judith E. Riesman developed the Minnesota Handwriting Test (MHT) which has been used in the present study. This tool is norm referenced and measures changes in handwriting performance of first and second graders. The interrater reliability of the Minnesota Handwriting Test has a strong range of 0.87-0.98.11

When consulted, physicians most often choose physiotherapy as the preferred method to help. The physiotherapeutic interventions help to improve the intrinsic factors related to handwriting skills. But, little is known about the effectiveness of physiotherapy in treating children with such disorder.

Methodology: A total of 200 Handwriting Proficiency Screening Questionnaires (HPSQ) were distributed in 3 schools. The questionnaires were filled by the teachers of teaching grade 1 and 2. A total of 60 children were selected to participate in this study with the aid of the standardized and validated HPSQ. These 60 children were then randomly assigned to 2 groups. Simple random sampling was used to randomly allocate the children into 2 groups.

INCLUSION CRITERIA
1) The child is a non-proficient writer as assessed by the HPSQ.
2) The child attends a regular elementary school.
3) The child is in grade 1 and 2.
4) Age b/w 5-7 years.
5) Both boys and girls were included in the study.
6) Has no neurological problem.
7) Has no orthopedic problem.
8) Has no developmental delay.
9) Has no physical impairment of the upper limb.
10) Should not have received any physiotherapeutic treatment before.

Exclusion Criteria:
1) Developmental delay.
2) Physical impairment of upper extremity
3) Hearing deficit.
4) Has good handwriting.
5) Gross motor impairments.
6) Any recent trauma to upper limb.
7) Has poor intelligence.
8) Neurological deficit.
9) Visual problem.

PROCEDURE

The students selected by the teacher on the basis of the HPSQ who fulfilled the inclusion criteria were randomly assigned to 2 groups. Simple random sampling was used to randomly allocate 30 students in group A and 30 students in group B.

Group A (Intervention group): n=30
Group B (Ergonomic advice): n=30

Pre-Intervention measurement was taken for both the groups using the MHA. The students were asked to copy a sample from near point. The student sat on the desk opposite to the blackboard. The words utilized were a derivative of the sentence, “The quick brown fox jumped over the lazy dogs.”. The quality of the sample was determined by assessing legibility, form, spacing, alignment, and size.

Following this students in Group A (Intervention Group) were given a set of physiotherapeutic exercises. The student’s received 4 sessions of physiotherapy per week, for 1 hour on alternate days for 3 months. The students in the Group B (Ergonomic Advice) received ergonomic advice on handwriting and were taught appropriate writing posture by their parents and teachers. After a period of 3 months, again the Handwriting Proficiency Screening Questionnaire (HPSQ) were filled by the school teachers and the post intervention measurements were taken for both the groups using MHA.

Group A (Intervention Group) n=30
1) Exercises to improve proximal stability of the upper limb (5 repetitions each).
2) Fine motor exercises for handwriting (5 repetitions each)
3) Exercises to improve visual-motor development (5 repetitions each)
   i) Exercises to improve Ocular motor control:
   ii) Exercises to improve eye-hand coordination:
Group B (Ergonomic Advice): n=30

Students in the Group B were taught appropriate writing posture and were given ergonomic advice only.

Data Analysis: The data was tested parametrically. To determine the possible differences within and between the groups on the pre-test and post-test measures paired “t” test and “z” test were used respectively. p value was set at <0.05 level of significance and SPSS software was used for analysis.

Results: In the present study 200 HPSQ were distributed to the school teachers of teaching grade 1 and 2. On the basis of this subjective assessment 90 students were diagnosed by the teachers as non-proficient hand writers and were included in the study. Next MHA was filled by the students and 40 students having a score of ≤30 on MHA were excluded from the study.

Table 5.1. Demographic data for the 2 groups.

<table>
<thead>
<tr>
<th></th>
<th>Group A intervention Group</th>
<th>Group B Ergonomic Advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>n = 09</td>
<td>n = 10</td>
</tr>
<tr>
<td>Males</td>
<td>n = 21</td>
<td>n = 20</td>
</tr>
<tr>
<td>Age = 6 years</td>
<td>n = 05</td>
<td>n = 00</td>
</tr>
<tr>
<td>Age = 6+ years</td>
<td>n = 12</td>
<td>n = 14</td>
</tr>
<tr>
<td>Age = 7 years</td>
<td>n = 13</td>
<td>n = 16</td>
</tr>
<tr>
<td>Handedness</td>
<td>n = 30</td>
<td>n = 30</td>
</tr>
<tr>
<td>Class I</td>
<td>n = 17</td>
<td>n = 20</td>
</tr>
<tr>
<td>Class II</td>
<td>n = 13</td>
<td>n = 10</td>
</tr>
</tbody>
</table>

The baseline data shows that the 2 gps did not differ regarding Gender, Age, Handedness, Class.

Table (5.2). Mean and S.D for HPSQ, Total MHA, and MHA Subscale for Group A

<table>
<thead>
<tr>
<th></th>
<th>Pre – Test</th>
<th>Post – Test</th>
<th>t value</th>
<th>p valued*.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPSQ</td>
<td>56.50 ± 7.28</td>
<td>42.33 ± 7.65</td>
<td>8.413</td>
<td></td>
</tr>
<tr>
<td>MHA Total</td>
<td>135.33 ± 5.51</td>
<td>155.60 ± 4.56</td>
<td>42.17</td>
<td></td>
</tr>
<tr>
<td>MHA Subscale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legibility</td>
<td>29.03 ± 0.96</td>
<td>32.63 ± 0.96</td>
<td>18.42</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Form</td>
<td>26.77 ± 1.85</td>
<td>30.47 ± 1.22</td>
<td>15.09</td>
<td></td>
</tr>
<tr>
<td>Alignment</td>
<td>26.73 ± 2.21</td>
<td>31.53 ± 1.77</td>
<td>18.78</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>25.33 ± 2.10</td>
<td>30.27 ± 2.11</td>
<td>13.63</td>
<td></td>
</tr>
<tr>
<td>Spacing</td>
<td>27.47 ± 1.99</td>
<td>30.70 ± 1.46</td>
<td>9.47</td>
<td></td>
</tr>
</tbody>
</table>

Above table is showing the scores of the HPSQ, Total MHA and MHA Subscale. It was interpreted that there is a statistically significant improvement in the scores at the 0.05 level of significance.

Table (5.3). Mean and S.D for HPSQ, Total MHA, and MHA Subscale for Group B.

<table>
<thead>
<tr>
<th></th>
<th>Pre – Test</th>
<th>Post – Test</th>
<th>t value</th>
<th>p valued*.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPSQ</td>
<td>48.33 ± 7.65</td>
<td>44.67 ± 7.10</td>
<td>6.71</td>
<td></td>
</tr>
<tr>
<td>MHA Total</td>
<td>136.73 ± 6.97</td>
<td>144.13 ± 6.88</td>
<td>34.00</td>
<td></td>
</tr>
<tr>
<td>MHA Subscale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legibility</td>
<td>29.23 ± 1.13</td>
<td>30.83 ± 0.98</td>
<td>12.99</td>
<td></td>
</tr>
<tr>
<td>Form</td>
<td>27.47 ± 1.57</td>
<td>28.80 ± 1.66</td>
<td>15.23</td>
<td></td>
</tr>
<tr>
<td>Alignment</td>
<td>27.30 ± 1.89</td>
<td>28.67 ± 1.82</td>
<td>11.19</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>24.63 ± 2.22</td>
<td>25.97 ± 2.20</td>
<td>13.35</td>
<td></td>
</tr>
<tr>
<td>Spacing</td>
<td>28.00 ± 2.01</td>
<td>29.77 ± 2.04</td>
<td>15.45</td>
<td></td>
</tr>
</tbody>
</table>

Above table is showing the scores of the HPSQ, Total MHA and MHA Subscale.

It was interpreted that there is a significant improvement in the scores at 0.05 level of significance.

Table (5.4): Comparison of the Mean and S.D for the HPSQ, Total MHA Score between Group A (Intervention Group) and Group B (Ergonomic Advice).

<table>
<thead>
<tr>
<th></th>
<th>Group A Mean ± S.D</th>
<th>Group B Mean ± S.D</th>
<th>Mean diff. b/w group</th>
<th>Zvalue</th>
<th>p valued*.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPSQ</td>
<td>14.17 ± 0.06</td>
<td>3.67 ± 0.06</td>
<td>10.50 ± 0.43</td>
<td>5.92</td>
<td>significant</td>
</tr>
<tr>
<td>MHA Total</td>
<td>20.27 ± 2.59</td>
<td>7.40 ± 1.19</td>
<td>12.86 ± 1.40</td>
<td>34.64</td>
<td></td>
</tr>
</tbody>
</table>

Above table is showing the scores of the HPSQ, Total MHA Score. It was interpreted that there is a statistically significant improvement in the scores at 0.05 level of significance.

Table (5.5) : Comparison of the mean change in the MHA Subscale Scores between Group A (Intervention Group) and Group B (Ergonomic Advice).

<table>
<thead>
<tr>
<th></th>
<th>Group A Mean ± S.D</th>
<th>Group B Mean ± S.D</th>
<th>Mean diff. b/w group</th>
<th>Zvalue</th>
<th>p valued*.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legibility</td>
<td>3.60 ± 1.07</td>
<td>1.60 ± 0.87</td>
<td>2.00 ± 0.39</td>
<td>8.66</td>
<td></td>
</tr>
<tr>
<td>Form</td>
<td>3.70 ± 1.34</td>
<td>1.33 ± 0.47</td>
<td>2.36 ± 0.97</td>
<td>9.09</td>
<td></td>
</tr>
<tr>
<td>Alignment</td>
<td>4.80 ± 1.40</td>
<td>1.37 ± 0.66</td>
<td>3.43 ± 0.73</td>
<td>12.12</td>
<td>significant</td>
</tr>
<tr>
<td>Size</td>
<td>4.93 ± 1.98</td>
<td>1.33 ± 0.54</td>
<td>3.60 ± 1.44</td>
<td>9.59</td>
<td></td>
</tr>
<tr>
<td>Spacing</td>
<td>5.32 ± 1.87</td>
<td>1.77 ± 0.62</td>
<td>3.56 ± 1.25</td>
<td>4.07</td>
<td></td>
</tr>
</tbody>
</table>

Above table is showing the scores of the MHA Subscale. It was interpreted that there is a statistically significant improvement in the scores between the 2 groups at 0.05 level of significance.

DISCUSSION

In this study it was observed that a 12 week physiotherapeutic intervention had a significant effect on improving the handwriting quality and the earlier
studies also show the same result. The positive results found in this study can be supported by the sufficient evidence in the literature that intervention to improve handwriting would result in greater gains than no intervention at all.

The intervention was so structured that it directly targeted the intrinsic components which are required for good handwriting. The intervention consisted of exercises to improve proximal stability of upper limb, fine motor exercises for handwriting, and exercises to improve the visual-motor control. The intervention targeted primarily at improving the proximal muscle stabilization of the upper extremity. This is supported by the “proximal-distal” muscle principle which states that the proximal muscle stability is a prerequisite for manipulative hand use.

Next the in-hand manipulation skills which included activities like rolling the balls of clay between the tips of the thumb, middle and index finger; pinching and sealing a zip-lock; twisting open a small tube of toothpaste with thumb, index and middle fingers while holding the tube with the ulnar digits; and ball squeezing exercises. All these exercises make use of the muscles of the thenar-eminence which is considered as the “skilled triad” of the hand. So, the in-hand manipulation skills helped to improve the fine motor skills.

Another important factor was the intensity and duration of the intervention used for this study. The intervention lasted for a period of 12 weeks and was administered 4 times a week for 1 hour. This duration of intervention for improving the handwriting quality has been supported by various studies in which similar duration of intervention resulted in improving the handwriting. Lastly all the activities which were included were of playful nature which the children might have enjoyed and thus led to their maximum participation and thus resulted in significant improvement in the group which received intervention.

The children in Group B were taught appropriate writing posture and were given ergonomic advice provided by the physiotherapist to their parent’s and teacher’s. The ergonomics and the writing posture are the extrinsic factors related to handwriting. Ergonomics play an important role. Body posture is generally considered to have an important influence on the efficiency of writing process and product. So, students in group B also showed improvement in their handwriting quality.

After a period of 3 months both the groups showed an improvement in their handwriting quality but in comparison the students in group A (Intervention Group) showed more significant improvement as compared to the students in group B (Ergonomic Advice). Finally it can be concluded that a well planned physiotherapeutic program can help to improve the handwriting quality of the children and help improve their academic results and confidence.

Clinical Implication

The findings of the present study can be used in the schools by the teachers to improve the handwriting quality of the students who have poor handwriting.

Limitations of the study:

1. The inclusion criteria is subjective based on HPSQ.
2. Purposive Sampling was used leading to decreased generalizability.
3. No individual attention was given.

Future Research:

1. To see the effectiveness of the intervention in children with cerebral palsy, hyperactivity disorder, developmental co-ordination disorder.
2. Comparing the effectiveness with the other available handwriting programs: “Handwriting without Tears”; “Log Handwriting Program” etc.
3. Effectiveness of the intervention in improving the speed of writing.

REFERENCES

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Effect of Kinesio Tape in the Treatment of Antenatal Carpal Tunnel Syndrome

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ABSTRACT

This study was conducted to detect the efficacy of Kinesio tape on the treatment of carpal tunnel syndrome in antenatal period. 15-primipared females at 3rd trimester of pregnancy with positive electro diagnostic findings (MMDL >4.2 ms) participated in this study, their ages ranged between 20-35 years (27.53±4.47). They were received kinesio tape technique on the affected wrist for 3 days, then day off and then another 3 days of kinesio tape / week for 4 weeks. Median motor distal latency (MMDL) was performed before and after the treatment program for all patients. The obtained results showed statistically highly significant (P< 0.0001) improvement in median motor distal latency at the end of the treatment program. Accordingly, it could be concluded that the use of the kinesio tape was found to be effective in the treatment of carpal tunnel syndrome during pregnancy.

Key words: Kinesio Tape, Antenatal, Carpal Tunnel Syndrome, Electro Diagnostic Finding.

INTRODUCTION

Carpal tunnel syndrome (CTS) is one of the most common upper limb compression neuropathies, it accounted for approximately 90% of all entrapment neuropathies. It occurred due to an entrapment of the median nerve in the carpal tunnel at the wrist. The pregnant women are more prone to develop carpal tunnel syndrome because they retain more fluid during the later stages of their pregnancies. The more fluid retains, the more swelling occurs, squeezing the nerves that run through the hands and fingers, also most women who experience pain, numbness, and tingling in the hands for the first time due to pregnancy have no idea that they have carpal tunnel syndrome.

There are several treatment options for CTS, and they can be broadly categorized into surgical and nonsurgical. Non-surgical methods are effective in patients with mild to moderate CTS. They are indicated in patients with no muscle weakness, atrophy, or denervation and with only a mild abnormality on nerve conduction studies.

Conservative treatment of about six weeks to twelve weeks can be considered in patients with mild disease. Lifestyle modifications, including decreasing repetitive activity and using ergonomic devices, have been traditionally advocated, but have inconsistent evidence to support their effectiveness. Oral corticosteroids are considered first-line therapies, with local corticosteroid injections used for refractory symptoms. Non steroidal anti-inflammatory drugs, diuretics, and pyridoxine (vitamin B6) have been shown to be no more effective than placebo. Most conservative treatments provide short-term symptom relief, with little evidence supporting long-term benefits. Patients with moderate to severe disease should be considered for surgical evaluation. Open and endoscopic surgical approaches have similar five-year outcomes.

In physiotherapy there are several ways to treat and control carpal tunnel syndrome, this procedure should be directed specifically towards the pattern of pain, symptoms and dysfunction assessed by the therapist. As such, it may include soft tissue massage,
conservative stretches, exercises, techniques to directly
mobilize the nerve tissue and therapeutic ultrasonic15,16.

The purpose of this study was to investigate the
effect of kinesio tape on the treatment of carpal tunnel
syndrome during pregnancy.

SUBJECTS, MATERIAL AND METHODS

Subjects

The study was conducted on 15 primipara patients
selected randomly from the gynecology and obstetrics
department of El khazendara general hospital, Shobra,
Egypt. With mild to moderate CTS, their ages ranged
from 20-35 years, they received a program of kinesio
tape application on the affected wrist in form of fascia
technique application for 3 days and then one day off
and then another 3 days of application each week for
4 weeks.

Inclusive Criteria

Selections of the patients were according to the
following criteria:
1. All patients would not take any analgesics by any
route during the period of study.
2. They were in the 3rd trimester of pregnancy.
3. All patients had positive electro diagnostic findings.

Exclusive criteria:

Subjects were excluded for any of the following
criteria:
1. Patients with history of wrist or median nerve
injury from trauma (e.g. contusion, fractures) or had
previous surgery on wrist.
2. Subjects who had carpal tunnel syndrome before
pregnancy.
4. Skin over sensitivity to the tape in some patients.

Instrumentations:

A. Instrumentations used for evaluation:

1. Computerized electromyography:

Schwarzar, topas 2 channel version with EMG/
NCV/EP system. It consisted of topas base unit, topas
preamplifier with cable, PC, electrical stimulator and
foot switch, this instrument made in Germany
(Baermann strasse 38 Munich, D-81245). It was used
to measure (MMDL) before treatment and after 4
weeks of treatment for all patients.

B. Instrumentations used for treatment:

1. Kinesio tape:

A roll of water resistant original K T with 2 inch
widths was used.

2. Cotton and alcohol:

To clean the skin of the patient’s affected arm before
kinesio tape application and also before electro
diagnostic assessment to reduce the skin-electrode
interface impedance.

3. Scissor:

Used to cut a kinesio I strip as a Y shape.

Evaluation procedures:

A- Initial evaluation:

The initial evaluation was carried out before
starting the program of treatment in form of:

1- Patient’s sheet.

2- Electro diagnostic evaluation.

B- Final evaluation:

It was in the form of electro diagnostic evaluation
after 4 weeks from starting of the treatment program.

PROCEDURE

Before electro diagnostic assessment, the patients
were prepared as follow:

1. The room temperature was adjusted to be 22°C and
the patient body temperature was 37°C during
assessment.
2. The patients were informed about the aim of the
tests.
3. Using alcohol to clean the skin of the patient’s
affected arm to reduce the skin-electrode interface
impedance. Also the therapists were abrasive the
skin firmly with abrasives paper to eliminate the
dead epidermis layer.
4. The patients were allowed to rest in room for about
15 minutes before the assessment to allow them to
relax and accommodated to the room temperature.
5. The patients were relaxed in supine position with
affected arm rested comfortably and exposed16.

- Measuring the median motor distal latency
(MMDL):

The active recording electrode was placed on the
motor point of abductor pollicis brevis (APB). The
reference electrode was placed on the tip of thumb. The bipolar stimulating electrodes was placed between the tendons of palmaris longus and flexor carpi radialis muscles on the course of median nerve with the positive electrode towards distal, and then make point by skin marker on the area in which the stimulating electrode applied. The ground electrode was placed mid way between the stimulating and recording electrodes. After giving stimulus at wrist, MMDL can be measured by recording the amount of time it takes for the charge to travel from the stimulus electrode to recording electrode (latency) [9,17].

Treatment procedures:

(1) Verbal explanations about the importance of this research and about the treatment program were explained to the patients.

(2) All patients were instructed not to take any analgesics by any route during the study.

(3) All subjects were treated by Kinesio tape in form of fascia technique application for three days then day off and then another three days of application each week for four weeks during the 3rd trimester of pregnancy, each time before applying kinesio tape the area should be cleaned using cotton and alcohol. An I kinesio strip was measured from the proximal palmar crease to the epicondyles of the humerus then a Y cut on the kinesio strip was made, the patient’s elbow should be extended with wrist extended and fully stretched by patient’s another hand, the base of Y cut is attached to proximal palmar crease, and the medial proximal tail in the direction of medial epicondyle of the humerus with light to moderate tension (25-50%) of available tension with no tension for the last 1-2 inches, and lateral proximal tail of the Y cut in the direction of medial epicondyle of the humerus with light to moderate tension (25-50%) of available tension with no tension for the last 1-2 inches then another kinesio I strip was applied to the dorsum of the wrist with tension directly over the distal 2 inches of the ulna and the radius on the dorsum of the hand18.

All patients continued to perform the study for 4 weeks then the final evaluation was performed at the end of the study.

Statistical Analysis

Statistical package for social science (SPSS) was used for data management and analysis quantitative data were expressed as mean ± SD. Independent sample T test was used for normally distributed quantitative variables. Validity of the used tests was done by calculating their sensitivity, specificity and predictive values. P value less than or equal to 0.05 was considered significant and less than 0.01 was considered highly significant19.

RESULTS

All data had been collected and statistically analyzed and presented under the following headings;

- Physical characteristics of the patients.

- Median motor distal latency (MMDL).

Physical characteristics of the patients:

The mean values of patients’ age, weight, height and BMI were 27.53±4.47 years, 84.6±9.38 kg, 160.86±4.67 cm and 31.73±3.55 Kg/m² respectively.

The differences concerning the physical characteristics (age, weight, height and BMI) between subjects were compared together and there were statistically non significant differences (P >0.05).

Median nerve motor distal latency:

There was statistically highly significant difference (P<0.0001) between before and after the treatment programme, the mean value of pre treatment was (4.65±0.27) and post treatment was (3.54±0.36) with percentage of improvement of 23.87 % (Table1).

Table 1. Mean values of the patients, Median nerve motor distal latency before & after treatment.

<table>
<thead>
<tr>
<th>Median nerve motor distal latency</th>
<th>Pre treatment</th>
<th>Post treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.65±0.27</td>
<td>3.54±0.36</td>
</tr>
<tr>
<td>Percentage of improvement</td>
<td>23.87 %</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>16.66</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.0001</td>
<td></td>
</tr>
</tbody>
</table>

*SD: standard deviation, P: probability, HS: Highly significant.

DISCUSSION

Carpal tunnel syndrome is a medical condition in which the median nerve is compressed at the wrist leading to parenthesis, numbness and muscles weakness in the hand16,20.

Most pregnant women who experience pain, numbness, and tingling in the hands for the first time due to pregnancy had no idea that they had carpal tunnel syndrome. Carpal tunnel symptoms during pregnancy tend to increase in the second and third trimester due to fluid retention7,21.
Carpal tunnel syndrome (CTS) is a frequent complication of pregnancy, with a prevalence reported as high as 62%. The most typical symptoms were numbness and tingling in the thumb, index finger, middle finger, and radial half of the ring finger. Other common manifestations included burning dysesthetic wrist pain, as well as the loss of grip strength and dexterity. Proximal radiation along the volar forearm, medial arm, and shoulder, while not as common but is not unusual. Symptoms were often worse at night and could be exacerbated by forceful activity and extreme wrist positions. It could be diagnosed to a high degree of specificity via history and physical examination. Median nerve function is impaired in virtually all pregnant women during the third trimester, even in the absence of symptoms\textsuperscript{21,22}.

The aim of this study was to investigate the effect of kinesio tape in the treatment of carpal tunnel syndrome during pregnancy. The study was conducted to 15 pregnant patients suffering from carpal tunnel syndrome; they received a program of Kinesio tape. Electro diagnostic assessment using median nerve motor distal latency was performed before and after 4 weeks from the beginning of the study for each patient.

In the present study there was statistically highly significant improvement of electro diagnostic assessment median nerve motor distal latency in response to the Kinesio tape program (P<0.0001) with percentage of improvement of 23.87%.

This comes in support with Mindy and Pou,\textsuperscript{23} who performed a study to investigate the effect of kinesio tape treatment to release the median nerve, increase the wrist joint’s range of motion and pinch force of the fingertips also they investigated the effect of fatigue on CTS patient’s treatment before and after application of kinesio tape on right hand (CTS) and left hand (normal). Four CTS housewives with symptoms of Pain, numbness and tingling on the right hand for more than two years served as participants for this study and were tested for pinch force in wrist flexion, wrist flexion with radial deviation and wrist flexion with ulnar deviation for one minute with no treatment and then after kinesio taping. At the end of the study the main results for the condition of fatigue showed that the mean force of pinch in wrist flexion, mean power frequency of action for flexor carpi ulnaris in wrist flexion, mean power frequency of action for flexor carpi ulnaris in ulnar deviation and mean power frequency of action for flexor carpi ulnaris in radial deviation were significantly different (P < 0.02), the treatment of kinesio tape on hand with CTS could be consistent with the performance of pinch by reduction of the rate of muscular recruitment\textsuperscript{24}.

Another study was performed by Hyland et al.,\textsuperscript{24} to investigate the effect of kinesio tape on pain. forty one patients with plantar heel pain were randomly assigned into 4 groups: (1) stretching of the plantar fascia, (2) calcaneal taping, (3) control (no treatment), and (4) sham taping. A visual analog scale for pain and a patient-specific functional scale for functional activities were measured pretreatment and after 1 week of treatment. At the end a significant difference was found post treatment among the groups for the visual analogue scale (P < 0.001). Specifically, significant differences were found between stretching and calcaneal taping (mean + SD, 4.6±0.7 versus 2.7±1.8; P<0.006), stretching and control (mean±SD, 4.6±0.7 versus 6.2±1.0; P<0.026), calcaneal taping and control (mean±SD, 2.7±1.8 versus 6.2±1.0; P<.001), and calcaneal taping and sham taping (mean±SD, 2.7±1.8 versus 6.0±0.9; P<0.001). No significant difference among groups was found for post treatment patient-specific functional scale (P<0.078).

The lymphatic drainage system contains both superficial and deep lymphatic vessels which can become filled in response to localized inflammation. Kinesio taping takes advantages of the mechanical connection of the anchoring filaments to the endothelial cells, by way of connection to the dermal layer the lymphatic channels can be opened up by the elastic qualities of the tape creating the characteristic convolutions on the tape this allows for the lymph obilatory load to fill the lymphatic capillaries toward areas of decrease pressure under the tape which allows fluid to move more freely. The elastic property of kinesio tape also creates a gentle massage with movement, this pressure changes and movement of the skin open and close the initial lymphatic vessels and kinesio taping on the superficial lymphatic encourages edema movement, the edema reduction removes heat and chemical substance in tissue, improving circulation and reducing trigger points. Decreasing pressure and chemical receptors reduce pain and improve the return of normal sensation\textsuperscript{25,26}.

CONCLUSION

From the statistical point of view, it could be concluded that kinesio tape was found to be effective in the treatment of CTS, providing a simple, non invasive, cheap, light, safe to be used during pregnancy and has no harmful effects on the mothers and their fetus.

REFERENCES

Effect of Antenatal Exercises on Umbilical Blood Flow and Neonate Wellbeing in Diabetic Pregnant Women

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ABSTRACT
This study was conducted to determine the effects of moderate aerobic antenatal exercise on the umbilical blood flow and neonate wellbeing in Type II diabetic pregnant women. Forty multiparous pregnant women with Type II diabetes at 24 weeks’ gestation were participated in this study. Their age ranged from 25-32 years old, their body mass index >30Kg/m² and all of them were under insulin therapy. They were classified into 2 equal groups (A&B). Each patient in the study group (A) underwent moderate intensity aerobic exercise training (60% of maximum heart rate) 30 minutes, 3 times /week for 10 weeks (30 sessions) in addition to their medical treatment and advices to continue normal daily activities, while patients of the control group (B) were only follow their medical treatment and advices to continue normal daily activities. Fasting blood glucose level and umbilical artery blood flow for each patient in both groups (A&B) were evaluated before starting and after the end of the study duration (10 weeks). Also, APGAR score at 1st and 5th minutes after delivery were assessed for all neonatal infants. Results of this study revealed that moderate intensity aerobic exercise training caused statistically highly significant (P<0.001) improve in the placental blood flow through decreasing umbilical artery pulsatility index (PI), resistance index (RI), systolic/diastolic (S/D) ratio and maximum systolic velocity as well as increasing its end diastolic velocity. Also, results revealed a statistically highly significant (P<0.001) decrease in blood glucose level for the exercised ladies and a statistically significant (P<0.05) increase in 1st minute Apgar scores in neonatal infants of the exercising mothers. Thus it could be concluded that aerobic exercises are effective in improving placental blood flow offering more nutrients to the fetus in Type II diabetic pregnant women.

Key words: Type II Diabetes, Antenatal Exercises, Blood Glucose Level, Umbilical Artery Blood Flow- Apgar Score.

INTRODUCTION
Diabetes is one of the most common chronic diseases encountered in the health care setting. It places a substantial burden on the individual, society and the economy¹. It has been known that diabetes antedating pregnancy can have severe adverse effects²³ and may result in un-favorable maternal and neonatal outcomes.²³

Pregnancy is a diabetogenic condition characterized by insulin resistance with a compensatory increase in ß-cell response. The placental secretion of hormones (progesterone, cortisol and placental lactogen,) is a major contributor to the insulin resistance, which likely plays a role in ensuring that the fetus has an adequate supply of glucose.²⁶

Pregnancy in patients with diabetes is associated with an increased incidence of congenital anomalies for the fetus and spontaneous abortions in women with poor glycemic control.²⁰

Several researches have indicated that type II diabetes is becoming an increasingly prevalent disorder in young people all over the world²⁶. It may range from predominant insulin resistance to predominant secretory defect.²⁵

It is a general clinical observation that the number of pregnant women with pre-gestational type II diabetes has become more frequent in the recent years; however, little knowledge exists concerning the prevalence and outcome of these pregnancies⁴.

Women with type II diabetes are of greater risk of prenatal mortality, congenital malformation, preterm delivery, and fetal loss before 24 weeks’ gestation¹¹. Also, women who have diabetes before pregnancy
have birth defect four times greater than women who got diabetes during pregnancy4.

There are at least two pathological defects in diabetic pregnant women, one is a decreased ability of insulin to act on peripheral tissue to stimulate glucose metabolism i.e. insulin resistance. The other is inability of pancreas to fully compensate this insulin resistance21.

Many clinical complications of type II diabetes may be ascribed to attention in vascular structure and functions27. Maternal diabetes also produces alterations in red blood cells, oxygen release and reduced placental as well as uterine blood flow which contribute to the increased incidence of intrauterine growth retardation13.

Umbilical artery (UA) Doppler blood flow velocity waveforms can be used to identify fetuses that might benefit from increased surveillance or planned delivery. Owing to difficulties encountered with volumetric blood flow assessment in small, pulsatile, convoluted UA, qualitative analysis of blood flow velocity waveforms, or semi-quantitative indexes, such as pulsatility index (PI), resistance index (RI), and the systolic-to-diastolic ratio (S/D) are often used14.

Studies concerning the effect of exercise on diabetes are available but the effect of exercise on maternal blood glucose level during pregnancy still not documented11. Also, exercise have proved by many authors to improve uterine blood flow17 as well as placental blood flow16 in normal pregnant and pre-eclamptic women. Whereas, none of the previous studies showed the exact role of exercise on blood flow in diabetic pregnant women7,8.

As the data available seems incomplete for physicians and physical therapists to prescribe safe and effective antenatal exercise for diabetic pregnant women. So, this study is an attempt to provide such information by examining the effects of moderate aerobic exercise on the maternal blood glucose level as well as umbilical blood flow and neonate wellbeing in Type II diabetic pregnant women.

SUBJECTS, MATERIALS AND METHODS

Subjects

Forty multiparous pregnant women with type II diabetes at 24 weeks’ gestation were participated in this study. Their age ranged from 25-32 years old, their body mass index > 30Kg/m² and all of them were under insulin therapy.

They were classified into 2 equal groups (A&B). Each patient in group (A) underwent moderate intensity aerobic exercise training (60% of maximum heart rate) 30 minutes, 3 times /week for 10 weeks (30 sessions) in addition to their medical, while patients of the control group (B) were only follow their medical treatment. Fasting blood glucose level as well as umbilical artery blood flow for each patient in both groups (A&B) were evaluated before starting and after the end of the study duration (10 weeks). Also, APGAR score at 1st and 5th minutes following delivery were assessed for all neonatal infants.

Instruments

1. Electronic bicycle ergometer (ECD ergometer E405) was used for performing exercise training program.
2. Doppler ultrasound machine (SONY Au530 ESAOTE EIOMCIA) with a linear 5MHz probe was used for measuring the umbilical artery blood flow.
3. Apger score was used for quick and summarize assessment of the neonate at the 1st and 5th minutes following delivery.

Procedures

I. Evaluative procedures

a. Umbilical artery Doppler measurement: The waveforms were only accepted when a clear continuous signals corresponding to the umbilical vein were visible in the reverse channel. The maximum systolic and end diastolic velocities of the umbilical artery were recorded, after that S/D ratio, RI and PI were calculated.

b. Blood samples were drawn to measure her fasting blood glucose level

c. After delivery, APGAR score was used for assessment of the neonate wellbeing at the 1st and 5th minutes following delivery.

II. Aerobic exercise training program (for participants of group A):

Every session of the exercise training program (30 minutes) were consisted of three stages: First stage (warming up), consisted of 5 minutes warming up in the form of pedaling at a speed of 60 revolutions per minutes without load. Second stag (Active stage), consisted of 20 minutes pedaling at the same speed of the first stage with adjusted load to achieve 60% of her maximal heart rate (maximal heart rate= 220-age of the woman)14. Third stage (Cooling down), which is the same as first stage. Aerobic exercise training was performed 3 sessions per week for 10 weeks.

III. Statistical analysis

The data was collected and fed into computer for analysis. Paired & unpaired t-test was carried to compare between both groups before and after the end of the study program (10 weeks), at a level of significance P < 0.05.
RESULTS

Before the study, blood glucose level and umbilical artery maximum systolic velocity, end diastolic velocity, systolic / diastolic ratio, resistance index as well as pulsatility index were representing no statistical difference (P> 0.05) as shown in Table 1.

Table 1. The mean values of blood glucose level and umbilical artery blood flow for both groups (A&B) before starting the study.

<table>
<thead>
<tr>
<th>Variable*</th>
<th>Group</th>
<th>Mean ± S.D</th>
<th>Mean Difference</th>
<th>t. value</th>
<th>P. value</th>
<th>Significance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGL</td>
<td>A</td>
<td>146.450±13.985</td>
<td>4.700</td>
<td>0.767</td>
<td>0.452</td>
<td>N.S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>141.750±14.348</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery MSV</td>
<td>A</td>
<td>0.423±0.016</td>
<td>-0.003</td>
<td>-0.655</td>
<td>0.520</td>
<td>N.S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.426±0.018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery EDV</td>
<td>A</td>
<td>0.119±0.005</td>
<td>0.001</td>
<td>1.453</td>
<td>0.163</td>
<td>N.S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.118±0.005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery S/D</td>
<td>A</td>
<td>3.211±0.029</td>
<td>-0.014</td>
<td>-0.412</td>
<td>0.685</td>
<td>N.S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>3.225±0.022</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery RI</td>
<td>A</td>
<td>0.689±0.003</td>
<td>0.001</td>
<td>1.129</td>
<td>0.899</td>
<td>N.S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.688±0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery PI</td>
<td>A</td>
<td>1.086±0.039</td>
<td>-0.062</td>
<td>-1.030</td>
<td>0.316</td>
<td>N.S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>1.147±0.034</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. The mean values of blood glucose level, umbilical artery blood flow and Apgar score for both groups (A&B) following the study.

<table>
<thead>
<tr>
<th>Variable*</th>
<th>Group</th>
<th>Mean ± S.D</th>
<th>Mean Difference</th>
<th>t. value</th>
<th>P. value</th>
<th>Significance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGL</td>
<td>A</td>
<td>94.550±13.372</td>
<td>-45.700</td>
<td>-4.179</td>
<td>0.001</td>
<td>HS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>140.250±12.192</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery MSV</td>
<td>A</td>
<td>0.397±0.016</td>
<td>-0.026</td>
<td>-3.287</td>
<td>0.004</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.427±0.018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery EDV</td>
<td>A</td>
<td>0.149±0.004</td>
<td>0.020</td>
<td>4.225</td>
<td>0.001</td>
<td>HS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.129±0.005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical artery S/D</td>
<td>A</td>
<td>2.535±0.066</td>
<td>-0.517</td>
<td>-5.877</td>
<td>0.001</td>
<td>HS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>3.052±0.057</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Umbilical artery RI</td>
<td>A</td>
<td>0.608±0.009</td>
<td>-0.066</td>
<td>-5.772</td>
<td>0.001</td>
<td>HS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.674±0.007</td>
<td></td>
<td></td>
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<tr>
<td>Umbilical artery PI</td>
<td>A</td>
<td>1.085±0.039</td>
<td>-0.062</td>
<td>-4.701</td>
<td>0.001</td>
<td>HS</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>1.147±0.034</td>
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</tr>
<tr>
<td>Apgar score At 1st min.</td>
<td>A</td>
<td>9.250±0.142</td>
<td>0.850</td>
<td>2.482</td>
<td>0.023</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>8.400±0.311</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apgar score At 5th min.</td>
<td>A</td>
<td>9.600±0.168</td>
<td>0.200</td>
<td>1.073</td>
<td>0.297</td>
<td>N.S</td>
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<tr>
<td></td>
<td>B</td>
<td>9.400±0.133</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After the study, as shown in (Table 2), the blood glucose level of the group (A) was 94.550±13.372, while it was 140.250±12.192 in group (B). This difference equaled about 32% representing a highly significant decrease (P<0.001).

MSV was 0.423±0.018 m/h in the control group compared to 0.397±0.016 m/h in the study group after training which revealed a statistically significant (P<0.01) decrease. Also S/D ratio was decreased from 3.052±0.057 in the control group to 2.535±0.066 in the study group with a percentage decrease equal about 17%. The mean value of the umbilical artery RI was 0.674±0.007 in the control group and 0.608±0.009 in the study group. The mean reduction represented 10% in group A.

EDV was 0.129±0.005 m/h in group B and increased by about 13% to reach 0.149±0.004 m/h in group A which revealed a statistically highly significant (P<0.001) increase.

After birth, it was found that there was a statistically significant (P<0.05) increase in the Apgar score of the neonates in group A at the 1st minute following delivery while there was no statistically significant difference (P>0.05) at the 5th minute following delivery.
DISCUSSION

Many of clinical complications of diabetes may be ascribed to attention in vascular structure and function. Compared to non diabetic subjects, diabetic individuals are at increased risk for coronary artery diseases, increased proliferation and migration of vascular smooth muscle cells which contribute importantly to the formation of both atherosclerosis and restenotic lesion causing decrease in microvascular and macrovascular blood flow.

Diabetic pregnant women with vascular complication may develop fetal growth retardation and intrauterine demise as early as the second trimester however, stillbirth have been observed most often after 36th weeks of pregnancy.

This study was conducted to determine the effects of moderate aerobic exercise on reducing maternal blood glucose level as well as improving umbilical blood flow in type II diabetic pregnant women.

The results of this study revealed a significant (P<0.001) reduction in blood glucose level after the exercise training program, these results come in agreement with Ross et al.,22 who had established that both acute and chronic exercise is associated with improvements in glucose tolerance in individuals with type II diabetes.

These results are also in agreement with Giacca et al.,15 who conducted a study on obese subjects with type II diabetes, and reported that plasma glucose levels decreased after engagement in moderate aerobic exercise program.

The improvement in umbilical artery blood flow obtained in the current study could be explained by the results obtained by Rafia and Beazely9, who related the decrease in the umbilical artery S/D ratio following exercise at the 2nd trimester of pregnancy to the decrease in umbilical blood flow resistance and the increase in placental circulation. This also supported by Salvesen et al.,24 who concluded that high umbilical artery pulsatility index (PI) occurred only when the woman exercised more than 90% of maximal HR because the mean uterine artery volume blood flow may drop to less than 50% of the initial value.

These could be also explained by the results of Eriksson et al.,12 who reported that in diabetic individuals, exercise may cause a decrease of triglycerides and low density level cholesterol, as well as increase of high density level cholesterol thus, decreasing the incidence of atherosclerosis or vasoconstriction which cause deficiency of placental blood flow.

These results are supported by James17 who concluded that, when moderate exercises continued during mid pregnancy, the placenta grow faster and had 15% more vessels and surface area at term. Thus, reducing the risk of intrauterine growth retardation and intrauterine fetal death.

The results are also in agreement with Clapp and his colleagues8, who studied the effect of exercise on normal pregnant women and found that moderate exercises lead to faster placental growth as well as increased morphometric indices of placental function leading to decrease the risk of fetal anomalies.

Thus it could be concluded that aerobic exercises seem to be effective in reducing blood glucose level and improving umbilical blood flow offering more nutrients to the fetus and increasing the wellbeing of the neonates in diabetic pregnant women.

REFERENCES


Efficacy of Active Release Technique in Tennis Elbow – A Randomized Control Trial

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¹Postgraduate student, ²Professor & Principal College of Physiotherapy, Pravara Institute of Medical Sciences, Loni- 413 736, Maharashtra state

ABSTRACT

Purpose: To evaluate the efficacy of Active Release Technique on functional performance by Patient Rated Tennis Elbow Evaluation (PRTEE) and Pain Free Grip Strength (PFGS) in patients with Tennis Elbow.

Methodology: A total of 30 patients having symptomatic chronic tennis elbow were taken and randomly assigned to one of the two groups. Group A received Active Release Technique (ART) and conventional treatment, whereas Group B acted as a control group and received conventional treatment of pulsed ultrasonic therapy at 20% duty cycle, frequency 3MHz and an intensity of 2 W/cm² for 7 ½ min, progressive resisted exercises and stretching. Fourteen treatment sessions are given. Baseline measurement of PRTEE score and Pain Free Grip Strength was taken on Day 1 and then subsequently on day 14.

Results: The data was analyzed using the software Instat. Differences were found for 2 outcome measures: success rate at 3 weeks. Findings indicated ART was more effective than the other protocol. After 3 weeks of intervention, improvement in Functional performance as measured on PRTEE was more (SD=8.87) in group 1, as compared with (SD=7.41) in group 2. Improvement in grip strength as measured by PFGS was more (SD=1.52) in group 1, as compared with (SD=1.05) in group 2.

Conclusion: The study concludes that both the Active Release Technique is effective in reducing pain, improving strength and functional performance.

Key words: Active Release Technique, Lateral Epicondylalgia, Soft tissue Technique.

INTRODUCTION

Tennis elbow is like a snail, slowly progressing and leaving behind a trail of mess. Most often associated with overuse or a repetitive stress, as opposed to an acute inflammatory reaction. It is a common pathology of both athletes and non-athletes, affecting 1 to 3 % of the population at large. This condition is characterized as pain on the lateral side of the elbow that is aggravated with movements of the wrist, by palpation of the lateral side of the elbow, or by contraction of the extensor muscles of the wrist. It is a self-limiting complaint; without intervention, the symptoms will usually resolve within 8 to 12 months. The peak prevalence of is in the fourth decade of life when it is four times more common than any other decade. It is found that there is no difference in incidence between men and women or association between the lateral epicondylalgia and the dominant arm.

Several interventions for the management of tennis elbow have been described, including corticosteroid injections, use of orthotic devices, surgery, and use of thermal and electromagnetic modalities such as ultrasound, laser, electrotherapy and finally exercise therapy consisting of muscle stretching and strengthening exercises. Although many treatment modalities may be used, few of them rest on scientific evidence and none have really been proven to be more effective than the others. The paucity of evidence on treatments for lateral epicondylalgia may stem from several sources, including the self-limiting nature of the condition, the lack of patho-physiological data, the methodological shortcomings of the current studies, and the existence of multiple factors which may influence the outcome.

Many soft tissue manipulations like Mill’s Manipulation of Cyriax have been successfully used in the treatment of lateral epicondylalgia. Recently one...
of the most popular of soft tissue techniques to gain notoriety is Active Release Technique—ART. ART is based on the observation of the anatomical arrangement of muscle fibers which makes them prone to reactive changes producing adhesions, fibrosis and local edema and thus pain and tenderness. Unfortunately, clinical trials on this technique are lacking and at this point, the popularity of ART® is based largely on anecdotal evidence. The aim of our randomized clinical pilot study was to compare the effectiveness of Active Release Technique—ART with the effectiveness of a conventional intervention for the management of lateral epicondylalgia.

METHOD

Between September and December 2010 patients were recruited for inclusion in our study in the College Of Physiotherapy, PIMS, Loni, India. They were referred to the physiotherapy OPD if the Orthopaedician had made a diagnosis of tennis elbow. Patients were included in the study if they complaints being present for at least 1-3 months. Exclusion criteria were: no limitation in range of motion, as determined by the investigator; bilateral complaints; a definite decrease in pain for the last 2 weeks, as described by the patient; severe neck or shoulder problems likely to cause or maintain the elbow complaints, as determined by the investigator; treatment for the current episode; and inability to fill out questionnaires. However, because our study was a preliminary study the number of requested patients was arbitrarily set at 30 patients.

The patient data (eg, demographics, co-morbidities) and baseline values of outcome measure were obtained. After obtaining informed consent, subjects were included in the study. Subjects were randomly assigned to 1 of 2 groups by lottery method: (1) a group that received Active Release Technique (interventional group) or (2) a group that received conventional intervention consisting of ultrasound and muscle stretching and strengthening exercises (control group).

Procedure:

15 Subjects in the interventional group were treated 2 times per week, with a maximum of 6 intervention sessions over the 3 week period of the study in addition to receiving conventional therapy for a total of 14 sessions. All the interventions were conducted by the same physical therapist, as soon as the complaints resolved, the intervention was stopped. The ART maneuver is a type of deep massage and was performed as follows. Each subject was seated and the therapist is working on the extensor carpi radialis longus and brevis muscles by applying pressure to the muscles distal to their attachment at the elbow. The patient starts with the elbow bent and wrist straight (fig. 1). As the therapist holds the muscles, the patient extends the elbow and pronates and flexes the wrist while the therapist moves the pressure proximally, attempting to release adhesions around and between muscle planes (fig 2). This part of the maneuver was performed approximately 15 times. The duration of the intervention session was approximately 10 minutes. No restrictions in the use of arm were imposed.
15 Subjects of the control group were treated using a protocol that was used in a previous large-scale trial on lateral epicondylalgia. During the 3 week intervention period, the subjects underwent a total of 14 intervention sessions. Every session included pulsed ultrasound treatment around the lateral humeral epicondyle. Pulsed ultrasound (20% duty cycle) for 7½-minutes was given with an intensity of 2 W/cm². When pain subsided, subjects were instructed in muscle strengthening and stretching exercises by the physical therapist and were told to perform the exercises at home twice daily. These exercises consisted of movements against resistance, rotational exercises, and occupational exercises. All sessions ended with stretching exercises of the wrist and elbow1,2,14,15. Subjects were instructed to use the affected elbow to their pain threshold. When pain had resolved, the intervention was stopped.

Outcome Assessment:

Outcome was assessed 14 days after the start of the intervention. The primary outcome measure was the Patient Rated Tennis Elbow Evaluation (PRTEE). A successful outcome was defined as a score nearer to “0”. The secondary outcome measure was Pain Free Grip Strength (PFGS) measured with Jamar Hand Held Dynamometer, an increase in the PFGS was considered a successful outcome.

Data Analysis:

Data were analysed using the unpaired ‘t’ test to compare the improvement between the two groups. Paired ‘t’ test was used to determine pre and post treatment effects. The ‘p’ value was noted for the variable and it was taken to be statistically significant if p<0.05.

RESULT

The two groups were almost similar at the baseline as the difference in the PRTEE scores and PFGS scores came out to be non-significant at Day 1. Demographically, all the two groups were also similar in terms of percentage of males and females in each group.

The two groups showed improvement in PRTEE score and PFGS scores on the subsequent day i.e. day 14. The difference of improvement with in both the groups was statistically significant between day 1 and day 14 as determined by paired ‘t’ test for PRTEE(p<0.001) and PFGS scores(p<0.001).

Unpaired ‘t’ test was applied to see the between-group differences. There was statistical difference in the improvements shown in the PRTEE score (p=0.0464, t= 2.084; 95% CI = 0.09 to 10.8) and the PFGS score between the two groups (p=0.0266, t= 2.341; 95% CI = -2.5 to -0.16).

DISCUSSION

Our study showed that Active Release Technique might have additional treatment effects compared with ultrasound, muscle stretching and strengthening exercises for management of lateral epicondylalgia over the short term. Differences between groups were found for the primary and outcome measurement (p<0.05) after 2 weeks of intervention, indicating Active Release Technique was more effective than the other interventions.

Historically, a popular choice for treating tendonitis had been deep friction massages. However as evidenced by the 2002 Cochrane review there is simply not a large enough sample size to draw any conclusions in regards to control of pain or improvement in function. The concepts of cross-friction techniques have since evolved into an augmented soft tissue mobilization15. Perhaps the
most popular of soft tissue techniques to gain recent notoriety is Active Release Technique or ART®. ART is most commonly used to treat conditions related to adhesions or scar tissue in overused muscles7,8. According to ART, as adhesions build up, muscles become shorter and weaker, the motion of muscles and joints are altered, and nerves can be compressed. As a result, tissues suffer from decreased blood supply, pain, and poor mobility3,5,8,10. This therapy is based on the observation that the anatomy of the forearm has traversing tissues situated at oblique angles to one another that are prone to reactive changes producing adhesions, fibrosis and local edema and thus pain and tenderness3,5,8,10. During active release therapy, the clinician applies a combination of deep digital tension at the area of tenderness and the patient actively moves the tissue through the adhesion site from a shortened to a lengthened position5. In order to treat extensor carpi radialis brevis, the clinician applies proximal tension distal to the lateral epicondyle while the patient extends the elbow and pronates and flexes the wrist. Involvement of the patient is seen as an advantage of ART, as people who are active participants in their own healthcare are believed to experience better outcomes3-5. A preliminary report on the use of ART® for a variety of upper extremity overuse syndromes found a 71% efficacy rate. Unfortunately, clinical trials on this technique are lacking and at this point, the popularity of ART® is based largely on anecdotal evidence3,4,5,8,10.

CONCLUSION

Active Release Technique was found to be a successful treatment approach in lateral epicondylalgia and it is capable of improving the functional activities and the pain free grip strength. The promising results of our study need replication in a large-scale randomized clinical trial that would include a control group and longer follow-up. The trial should be sufficiently powered and should compare Active Release Technique with the most commonly used and potentially effective conservative intervention strategies for lateral epicondylalgia. Validated outcome measures should be used and evaluated over the short term, intermediate term, and long term.

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Study of Cognitive Impairment in Parkinson's Patients and its Correlation with Freezing of Gait Episodes and Bradykinesia

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ABSTRACT

Background: The study was carried out to assess the cognitive impairment in Parkinson’s patients and to correlate it with Freezing of gait episodes and Bradykinesia.

Subject: 60 Adults (30- Parkinson’s patients; 30- Normal) between the age group of 45-81 were included in the study.

Method: A total of 30 Parkinson’s patients and 30 normal age matched adults were screened for the inclusion and exclusion criteria and were then evaluated for cognition using Montreal Cognitive Assessment Scale (MoCA)11. The result was correlated with Freezing of gait episodes and Bradykinesia.

Results: There was significant evidence of cognitive impairment in Parkinson’s patients when compared with normal age matched adults with Visuospatial skills, Language, Delayed recall being most affected components of the Montreal Cognitive Assessment Scale. There is also significant correlation of cognitive impairment in these patients with Freezing of gait episodes and Bradykinesia.

Conclusion: The result of the study emphasizes the need to assess cognition in Parkinson’s patients especially those experiencing Freezing of gait episodes and Bradykinesia to facilitate Rehabilitation process.

Key words: Parkinson, Cognition, Bradykinesia, Freezing of gait, MoCA

INTRODUCTION

Parkinson’s disease (PD) is a common neurodegenerative disorder. Pathologically, PD is defined as a loss of dopaminergic neurons in the substantia nigra, with the formation of alpha-synuclein positive Lewy bodies (LB) within the remaining neurons (Braak et al., 2002). In addition to degeneration of the dopaminergic system, other ascending subcortical neurotransmitter systems are affected as well as the cholinergic system (nucleus basalis of Meynert), the noradrenergic system (locus coeruleus), and the serotonergic system (dorsal raphe nuclei) (Jellinger, 1999a).

Contrary to the claim of James Parkinson who first described the disease that the intellect is preserved (Parkinson, 1817), the clear evidence from prior studies shows that cognitive impairment is common even in early PD and affects a variety of cognitive functions1,5,6,12,14,16,19,20,21,22,24,26,28. In many instances these impairments may not be clinically apparent, but are detectable with specific Neuropsychological tests. As the disease progresses, a substantial proportion of patients with Parkinson’s disease develop cognitive impairment thereby hampering the quality of life of as well as the health-economic status of patients and their care givers due to increased risk for nursing home admission.

PD patients even those with mild disease exhibit patterns of cognitive deficits that include decrements in planning, sequencing, concept formation, and working memory. These impairments are frequently reported by patients in terms of the disabilities they cause, such as difficulties in paying attention at work, problems handling more than one project at a time, inability to sequence, plan and organize tasks at work and home.
Early identification of PD patients at high risk of developing dementia has important clinical consequences for the management of these patients. Therefore, as a Physiotherapist it is essential to perform cognitive tests in these patients along with the motor assessment. It is frequently observed that cognitive assessment is neglected in these patients.

There is a strong link between gait and cognition. Executive functions seem to play a central role in gait disorders. Clinical implication of relationship between gait and cognition are that cognitive function and especially executive function should be assessed in patients with gait disorders such as freezing of gait.

Bradykinesia results from a failure of basal ganglia output to reinforce the cortical mechanisms that prepare and execute the commands to move. There are also abnormalities in sensory scaling and sensorimotor integration.

Hence, the need to correlate bradykinesia with cognition in Parkinson patients.

**MATERIAL AND METHOD**

**Materials**

1) Stopwatch
2) Table
3) Pen

**Method**

Study design: - Observational Cross-sectional study

**Procedure:**

A total of 30 Parkinson’s patients were selected from Nair hospital and Parkinson Disease and Movement Disorder Society (PDMDS) and 30 normal age matched adults were selected as a control group. The participants were then screened for the inclusion and exclusion criteria.

**Inclusion criteria:**

1) Patients suffering from Idiopathic Parkinson’s disease.
2) Patients having score <=10 on Hospital Anxiety and Depression Scale.
3) Normal adults in the age group of 45-81.

**Exclusion criteria:**

1) Patients having score >10 on Hospital Anxiety and Depression Scale.
2) Parkinson’s patients having incomprehensible speech.
3) Stage IV Parkinson patients (HOEHN and YAHR staging)

Participants were then evaluated for cognition by performing Montreal Cognitive Assessment Scale (MoCA) during the “on” period. Parkinson’s patients were also evaluated for Freezing of gait episodes and bradykinesia during the “on” and “off” period using the appropriate item of the Unified Parkinson’s Disease Rating Scale (UPDRS).

**Findings:**

The scores of MoCA showed statistically significant differences in cognition between adults suffering from Parkinson’s disease and the age matched controls. Also, there is a significant correlation between Freezing of gait episodes during “on” period and Bradykinesia during “off” period with cognition in these patients.

**Table 1.** Shows that there was no statistically significant difference in the demographic variables of control group and the Parkinson’s group.

**DISCUSSION**

Results of the current study show that cognitive dysfunction exists in patients with Parkinson’s disease and also there was a statistically significant correlation of Freezing of gait episode during “on” period and Bradykinesia during “off” period with this dysfunction. When assessed on several sub sets of MoCA i.e. Visuospatial skills, Naming, Attention, Language, Abstraction, Delayed recall adults with Parkinson’s disease showed marked dysfunction as compared to normal adults while Orientation was not affected in these patients.

While basal ganglia pathology and degeneration of dopaminergic neurons in the substantia nigra is regarded as central to the pathogenesis of PD, theories suggest that the diverse disturbances present in this disease is likely to involve disruption in functionally segregated neuronal circuits in different components of the basal ganglia, thalamus, and cerebral cortex. This model of basal ganglia function...
Table 3. Mean scores of Visuospatial skills, Naming, Attention, Language, Abstraction, Delayed recall and Orientation.

<table>
<thead>
<tr>
<th>Components</th>
<th>Group</th>
<th>Mean</th>
<th>Std Dev</th>
<th>95% C I Upper limit</th>
<th>95% C I Lower limit</th>
<th>p value</th>
<th>Difference is significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visuospatial skills</td>
<td>Parkinson's group</td>
<td>3.1</td>
<td>1.185</td>
<td>5.97</td>
<td>0.73</td>
<td>&lt;0.0001</td>
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<td>Control group</td>
<td>4.87</td>
<td>0.345</td>
<td>5.56</td>
<td>4.18</td>
<td>&lt;0.0018</td>
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<td>Parkinson's group</td>
<td>2.73</td>
<td>0.44</td>
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<td>&lt;0.0001</td>
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<td>Control group</td>
<td>3</td>
<td>1.82</td>
<td>6.64</td>
<td>-0.64</td>
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<td>-</td>
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<tr>
<td>Attention</td>
<td>Parkinson's group</td>
<td>5.2</td>
<td>0.996</td>
<td>7.192</td>
<td>3.208</td>
<td>&lt;0.0001</td>
<td>-</td>
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<tr>
<td></td>
<td>Control group</td>
<td>6</td>
<td>1.82</td>
<td>9.64</td>
<td>2.36</td>
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<td>Difference is significant</td>
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<tr>
<td>Language</td>
<td>Parkinson's group</td>
<td>1.1</td>
<td>0.803</td>
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<td>Abstraction</td>
<td>Parkinson's group</td>
<td>1.83</td>
<td>0.46</td>
<td>2.75</td>
<td>0.91</td>
<td>&lt;0.0254</td>
<td>-</td>
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<tr>
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<td>Control group</td>
<td>2</td>
<td>1.83</td>
<td>5.66</td>
<td>-1.66</td>
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<td>Difference is significant</td>
</tr>
<tr>
<td>Delayed recall</td>
<td>Parkinson's group</td>
<td>2.37</td>
<td>1.564</td>
<td>5.499</td>
<td>-0.758</td>
<td>&lt;0.0001</td>
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<td>3.93</td>
<td>1.258</td>
<td>6.646</td>
<td>1.414</td>
<td></td>
<td>Difference is significant</td>
</tr>
<tr>
<td>Orientation</td>
<td>Parkinson's group</td>
<td>6</td>
<td>1.82</td>
<td>9.64</td>
<td>2.36</td>
<td>&gt;0.9999</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Control group</td>
<td>6</td>
<td>1.82</td>
<td>9.64</td>
<td>2.36</td>
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<td>Difference is not significant</td>
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Table 4. Shows correlation of Bradykinesia during “off” period with the patient MoCA score

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Spearman’s correlation</th>
<th>p value</th>
</tr>
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<td>MoCA</td>
<td>30</td>
<td>22.17</td>
<td>3.43</td>
<td>-0.3869</td>
<td>0.0347</td>
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<td>Bradykinesia “off” period</td>
<td>30</td>
<td>2.97</td>
<td>1.19</td>
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Table 5. Shows correlation of Bradykinesia during “on” period with patient MoCA score

<table>
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<th>Parameter</th>
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<th>Mean</th>
<th>Std. Deviation</th>
<th>Spearman’s correlation</th>
<th>p value</th>
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<td>30</td>
<td>22.17</td>
<td>3.43</td>
<td>-0.2824</td>
<td>0.1306</td>
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<tr>
<td>Bradykinesia “on” period</td>
<td>30</td>
<td>1.87</td>
<td>1.28</td>
<td></td>
<td>Non significant</td>
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</table>

Table 6 Shows correlation of Freezing of gait during “off” period with patient MoCA score

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Spearman’s correlation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoCA</td>
<td>30</td>
<td>22.17</td>
<td>3.43</td>
<td>-0.1677</td>
<td>0.3757</td>
</tr>
<tr>
<td>Freezing of gait “off” period</td>
<td>30</td>
<td>1.33</td>
<td>1.21</td>
<td></td>
<td>Non significant</td>
</tr>
</tbody>
</table>

Table 7. Shows correlation of Freezing of gait during “on” period with patient MoCA score

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Spearman’s correlation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoCA</td>
<td>30</td>
<td>22.17</td>
<td>3.43</td>
<td>-0.4730</td>
<td>0.0096</td>
</tr>
<tr>
<td>Freezing of gait “On” period</td>
<td>29</td>
<td>0.45</td>
<td>0.87</td>
<td></td>
<td>Significant</td>
</tr>
</tbody>
</table>

involves five segregated circuits, of which three—the orbitofrontal, dorsolateral prefrontal, and anterior cingulate—appear integral to cognitive function. While dysfunction in the cortico-circuits may underlie cognitive deficits apparent on executive and other frontal tasks, the dopaminergic system is likely not the only neurotransmitter causing dis-rup-tion in this disease. 1,5,6,12,14,16,19,20,21,22,24,26,28

Results of the present study show evidence of impairment of Visuospatial skills in Parkinson’s patients and are thought to represent a dysfunction of fronto-straital neuronal circuit. Visuospatial impairments can be further classified into Visuocostructional skills and Visuoperceptual skills. Visuocostructional skills are tested by asking the subject to draw a clock showing time 10 past 11. 7 This test assess the functionality of both the prefrontal cortex and the posterior visual cortical areas. Visuoperceptual skills are tested by asking the subject to copy a cube. This test assesses the functionality of the posterior visual cortical areas. 2,7,10,27

Naming component is also seen to be affected in Parkinson’s patients. It has been mainly correlated with cortical activity in the anteromedial and posteromedial temporal cortex. Patients with Parkinson’s had difficulty in naming words rhinoceros as this name is used less often as compared to lion and camel showing difficulty in naming less commonly used words. Most frequently used words are stored in the cache memory and are more easily retrievable.
Attention dysfunction is prominent among the cognitive impairments described in PD and is probably closely related to the executive function impairment that is reported in these subjects. This hypothesis is supported by several studies showing that attention dysfunction appears most usually in connection to complex tasks requiring shifting and or sustained attention as well as mental calculations that require sustained mental tracking.20

In the Verbal fluency test patients need to use the cache memory to recollect the word with letter “F” that they might have come across before. Impairment in free recall memory appears to be more related to the defective use of memory stores due to working memory deficits, than a reduced capacity of storing/consolidating new information in the temporal lobes as is seen in Alzheimer’s disease.

There was a significant difference in abstraction component of the MoCA scale between Normal and Parkinson’s patients. Problems in abstraction could be due to delay in processing of information.

Delayed recall was also proved to be affected in Parkinson’s patients, possibly due to retrieval problems as opposed to the deficient encoding as seen in Alzheimer’s disease.

This may thus reflect a deficiency in internally cued search strategies due to the dysexecutive syndrome. In some patients recognition and recall both were affected supporting the studies that have suggested hippocampal pathology.15

Orientation is a function of the mind involving awareness of three dimensions: time, place and person. Lesions of brain stem and the cerebral hemisphere result in dis orientation and as these areas are not affected in Parkinson’s disease orientation is not affected in them.

Bradyphrenia which is considered mental equivalent of Bradykinesia is attributed to the slowing of information process. This process of information is similar for both motor and cognition. Thus, our study showed significant correlation between these two during the “off” period.8,13,16,21,29

Gait has been traditionally considered as a simple automatic motor activity that was independent of cognition. Spinal neuronal networks that include motor neurons and interneuron’s called “central pattern generators” allow generation of automatic and rhythmic motor activity patterns. These spinal networks are under the influence of basal ganglia and brainstem nuclei including pedunculopontine nuclei which plays a role in initiation and modulation of pattern generators. Basal ganglia and their connection with cortical regions through the cortico-subcortical loops play a central role in both movement initiation and cognitive aspects such as executive function. Thus, a significant correlation between freezing of gait episode during “on” period with cognition was observed in our study.3,4,13,16,17,25,29

CONCLUSION

There is prevalence of cognitive impairment in Parkinson’s patients with Visuospatial skills, Language, delayed recall being most affected components of the Montreal Cognitive Assessment Scale. Bradykinesia and Freezing of gait episodes which present as motor symptoms in Parkinson’s is found to be associated with cognitive dysfunction in these patients emphasizing the need to evaluate cognition in patients presenting with these symptoms.

Limitation of the study:
1. Small Sample Size
2. Convenience sampling.

ACKNOWLEDGEMENTS

I express my heartfelt gratitude to the Dean of Nair Hospital and the Staff and Colleagues of Physiotherapy Department, Dr. Maria Baretto (Coordinator, PDMDS), Dr. Gajbhare, Dr. Nerulkar, my family and my subjects for their support.

Conflict of Interest

We, Hutoxi Writer and Poorva Kulkarni, declare that there are no conflicts of interest and the study presented here is original work of the authors.

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Study of Trunk Movement Deficits in Golfers with Low Back Pain

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³Professor Gian Sagar College of Physiotherapy, Ram Nagar, Raipur, Distt. Patiala

ABSTRACT
Improper swing mechanics and sub-optimal physical fitness have been considered to be associated with the low back injuries in golfers. These factors may affect a golfer’s back by increasing spinal loads during the golf swing. Thus an understanding of the swing and physical characteristics simultaneously with the loads generated by their interactions in golfers with and without LBP can be used to analyse the mechanisms of low back injuries in golfers.

The purpose of this scientific paper is to study the prevalence of low back pain in golfers and to assess the trunk movement deficits. The physical characteristics assessed included trunk strength & flexibility.

The cross-section study evaluated 15 pairs of right-handed golfers matched by golf handicap equal to or lower than 20, between the ages of 25-65 years. Group 1 (history of low back pain greater than 2 weeks affecting quality of play within past 1 year) and Group 2 (no previous such history). The independent variable is group and the dependent variables are the trunk strength, range of motion & flexibility.

The mean age for the golfers with LBP was found to be 44.6 years. Trunk flexors, extensors & rotators of the subjects of LBP group showed less strength than their counterparts. The LBP group also had flexibility deficits along with a positive hamstrings tightness. The LBP group demonstrated less ROM in trunk rotation & an increased finger-to-floor distance on the non-lead side.

Golfers with LBP may suffer low back injuries due to the inappropriate combination of physical characteristics that prevents dissipation of the tremendous spinal forces and moments generated by the golf swing over time. Spinal instability may contribute to repetitive injuries and a progressive decline of core stability.

Key words: Golf; Low Back Pain; Strength; Flexibility; Swing

INTRODUCTION
Golf, as we know it today originated from a game played on the eastern coast of Scotland in the Kingdom of Fife during the 15th century. Players would hit a pebble around a natural course of sand dunes, rabbit runs and tracks using a stick or primitive club.

As the game has become more popular, different groups or types of golfers have appeared, including: occasional golfers; recreational golfers who play for health, pleasure, and social reasons on a regular basis; and professional golfers who represent only a minority of the golfing population.2

As per McCarroll et al,15 the annual prevalence of golf-related injuries in amateur players is estimated to be between 25.2 and 62.0%, with minor differences between the sexes. As per Sugaya et al,18 the number of golfers with a history of low back pain may be as high as 55%. Both professional and amateur golfers could suffer from low back injuries.9,11,14 A study by Gosheger et al9 showed that the most common injuries in professional golfers were back injuries, followed by wrist and shoulder injuries.

In a study done by Lindsay and Horton,12 a comparison of trunk motion during the golf swing between six professional golfers with LBP and six professional golfers without LBP was done. Golfers with LBP had less trunk rotational flexibility in the neutral standing position. As per Clark,4 Trunk and hip muscles are considered core muscles because they
work together to stabilize, move, and protect lumbo-
pelvic-hip complex during functional activities. During
a golf swing, the most active muscles are contralateral
external oblique, ipsilateral internal oblique and
latissmus dorsi, quadratus lumborum & rectus
abdominis. In general, the takeaway phase has the
lowest overall muscle activation, while the forward
swing/acceleration has the highest. However,
inefficient muscular stabilization of the lumbar spine
has been observed in patients with LBP by Hodges
and Richardson.10

Ninety percent of all Professional Golf Association
(PGA) Tour injuries have been to the cervical and
lumbar spine regions. As per McCarroll,13 low back
injuries range from 15.2 to 34.0% of all golf injuries,
and thus represent the most common musculoskeletal
complaint experienced by both amateur and
professional golfers.

During the 1990 competitive season, 59 % of the
injuries reported on the PGA Tour involved the low
back.16 Among amateur golfers, McCarroll et al15
reported that 244 of 708 surveyed players suffered low
back injuries, with 52% of men and 29% of women
experiencing back injuries. Gosheger et al found that on average,
low back injuries result in disability inhibiting golf
participation for ten weeks.9

The spine is instrumental in accomplishing the golf
swing. It is involved with the transmission of forces
and the coordination of activities between the upper
and lower extremities. As per Gracovetsky & Farfan,
in sports requiring exertion of the upper extremities
and trunk, such as golf, low back injuries are common.8

Golf swing has three main components, backswing
(slow component lasting for 800-1000ms), downswing
(early acceleration phase -250ms & just before ball-
impact 40-60ms), release & follow-through.20 Thistle19
acknowledged two general styles of golf swing:
modern & classic. The “Modern” golf swing
emphasizes on a large shoulder turn with minimal hip
turn. The “Classic” golf swing aims to reduce the X-
factor by raising the front heel of the foot during the
backswing to increase hip turn, reducing the
backswing, or a combination of the two. It is
characterized by an erect “I” finish with balanced
shoulders. X-Factor is the relative rotation of the
shoulders as compared to the rotation of the hips
during the backswing. It is a key factor in the
production of swing speed and distance.

The golf swing involves multiplanar rapid
movements of the trunk. Davis and Marras found that
trunk motion plays an important role in the
development of low back injuries, particularly when
motion occurs simultaneously in multiple planes.5

- The upper body rotates on the hips and pelvis
during backswing, and then uncoil forcefully for
ball impact and follow through.

- Golf swing restricts the hip turn to build torque in
the back and shoulders during the backswing for
maximum club head velocity at ball impact.

- In backswing, left side muscles produce lumbar
axial torque to the right, causing initial twisting of
the trunk from address to the top of backswing.
Downswing- Right side muscles create axial torque
to the left. This corresponds to the maximum spinal
loading of the anterior-posterior shear force, lateral
shear force, and axial torque.

Mechanism of injury involves the body being
pushed beyond its “elastic limit,” due to rapid spinal
rotation velocity during the golf swing. As per Hosea
and Gatt,11 this increases lumbar spinal forces that
produce tremendous amount of force and torque that
may injure lumbar spine cause mechanical LBP which
is generally localized to the lumbar area and associated
with significant muscle spasms due to back muscle
strain or spinal ligament sprain. It may begin gradually
with episodes of exacerbation and result in permanent
disability. Symptoms or other types of subjective
complaints are predominantly reported as coming
from the lead side of the spine and symptom
aggravation of right-side complaints usually occurs
from ball impact until the follow-through. Improper
swing mechanics and sub-optimal physical fitness can
produce even larger and abnormal forces to the lumbar
spine.7,11,14,17

Injury Causing Factors:

- Swinging a club under sub-optimal physical fitness
combined with inappropriate swing mechanics.

- S-Posture is characterized by Forman as an arching
of the lower back while standing over the ball at
address, causing a great deal of stress on the lower
back.5

- Golfer’s gait or stride involving over pronation of
the foot and ankle during the stride.

- Loss of mobility in aging golfers due to loss of X-
factor results in a progressive limitation in
takeaways.

- In an effort to increase club head speed, golfers use
excessive lateral weight shift of the lower body at
top of backswing, rather than rotating the pelvis
and finally finish the swing with trunk
hyperextension.
Tightness in the chest muscles and/or lats, and limited flexibility in thoracic area.

Other sources of injuries include being struck by clubs or balls, collisions between players & spectators or carts, falls.3

The purpose of this study was to study the prevalence of low back pain in golfers and to assess the trunk movement deficits in golfers with and without LBP. The physical characteristics assessed included trunk strength & flexibility.

Materials & methods

These comparison studies evaluated 15 pairs of right-handed golfers matched by golf handicap equal to or lower than 20, between the ages of 25-65 years. Group 1 (history of low back pain greater than 2 weeks affecting quality of play within past 1 year) and Group 2 (no previous such history). The independent variable is group and the dependent variables are the trunk strength, range of motion & flexibility.

INCLUSION CRITERIA:

Back Pain group

- Subjects had symptoms of mechanical LBP within two years prior to testing resulted in time lost from golf participation.
- The worst episode of LBP had a modified Oswestry questionnaire score equal to and greater than 24 and required treatment.
- LBP resulted from golf or was aggravated by golf.
- LBP localized over right or central lumbosacral area.

Healthy group

- Subjects must not have LBP within one year prior to testing.

Exclusion Criteria:

- History of previous back surgery, vertebral compression fracture, nerve root compromise
- Neurologic deficits, Current or past lumbar radiculopathy, symptoms of vertigo or dizziness
- After a written consent, a physical assessment was done. Group 2 filled out a modified Oswestry questionnaire, pain scale, and pain diagram. Following measurements were done:
- Lumbar range of motion-rotation using a standard goniometer, flexion & extension using tape measurement of C7 to S1 as reference.
- Trunk muscle strength using Oxford scale.
- Finger-to-floor distance & 90-90 SLR test for hamstrings tightness.

The study investigated the null hypotheses that the trunk movement & strength deficits do not occur in golfers with LBP. Differences in measurements analyzed using the one tail paired t-test.

Findings

The mean age of golfers with LBP was 44.6 years.

Trunk strength

Left-tailed paired t-tests were used to determine significant differences in means between golfers with and without LBP for all procedures.

Table 1. Trunk Strength

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>t-stat</th>
<th>t-critical at ( \alpha = 0.05 ) at d.f.=14</th>
<th>Null Hypothesis Accept / Reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flexion</td>
<td>-8.573</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>2</td>
<td>Extension</td>
<td>-10.311</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>3</td>
<td>Rotation (R)</td>
<td>-6.874</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>4</td>
<td>Rotation (L)</td>
<td>-9.798</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
</tbody>
</table>

The null hypothesis was rejected at statistical significance, \( \alpha = 0.05 \). Trunk flexors, extensors & rotators of LBP golfers showed less strength than their counterparts.

Trunk ROM & flexibility

Left tailed test used for trunk ROM & right tailed test finger to floor distance & hamstrings tightness.

Table 2. Trunk ROM

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>t-stat</th>
<th>t-critical at ( \alpha = 0.05 ) at d.f.=14</th>
<th>Null Hypothesis Accept / Reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trunk flexion</td>
<td>-7.678</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>2</td>
<td>Trunk extension</td>
<td>-7.783</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>3</td>
<td>Trunk rotation (R)</td>
<td>-5.315</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>4</td>
<td>Trunk rotation (L)</td>
<td>-9.321</td>
<td>-1.761</td>
<td>Reject</td>
</tr>
</tbody>
</table>

The null hypothesis was rejected at statistical significance, \( \alpha = 0.05 \).

In the LBP group, flexion and extension were reduced along with less ROM in trunk rotation of the non-lead side (left side). An increased finger-to-floor distance was found in the LBP group that indicates demonstrates deficit in lateral flexion. Hamstrings

Table 3: Trunk flexibility

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameter</th>
<th>t-stat</th>
<th>t-critical at ( \alpha = 0.05 ) at d.f.=14</th>
<th>Null Hypothesis Accept /Reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Finger to Floor (R)</td>
<td>9.626</td>
<td>1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>2</td>
<td>Finger to Floor (L)</td>
<td>10.800</td>
<td>1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>3</td>
<td>Hamstring (R)</td>
<td>9.985</td>
<td>1.761</td>
<td>Reject</td>
</tr>
<tr>
<td>4</td>
<td>Hamstring (L)</td>
<td>6.239</td>
<td>1.761</td>
<td>Reject</td>
</tr>
</tbody>
</table>
tightness, indicated by the knee flexion angles during active knee was observed to be increased in the LBP group.

CONCLUSION

The results of this study revealed that golfers with LBP demonstrated less trunk rotation strength, less trunk extension strength. It acknowledged that during swing, a flexed trunk angle must be maintained to make a proper turn back and return to the ball. Weak back extensors may not generate sufficient strength to counteract the flexion moment produced by the abdominal muscles, resulting in excessive loading and overuse injury. Additionally, the LBP group had less trunk rotation ROM toward non-lead side, reduced hamstring flexibility & increased finger-to-floor distance.

Spinal instability may contribute to repetitive injuries and a progressive decline of core stability. Thus, improving core stability is important for golfers, especially during the golf swing which can generate considerable amounts of load to the spine.

Swinging a club under sub-optimal physical fitness with inappropriate swing mechanics produces excessive forces to the lumbar spine. An inappropriate combination of physical characteristics prevents dissipation of the tremendous spinal forces and moments generated by the golf swing.

An understanding of these factors in golfers with and without LBP can be used to analyse the mechanisms of low back injuries in golfers.

REFERENCES

A Longitudinal Study to Analyse & Quantify Functional Capacity Post- Coronary Artery Bypass Grafting

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ABSTRACT

**Study Objective:** to analyze and quantify the Functional capacity in post-coronary bypass subjects by using six minute walk test on 6th and 13th post operative day by comparing their value with matched normal subject.

**Sample:** a convenient sample of 15 patients, 12 male and 03 female age group of 40-60 years who underwent coronary artery bypass grafting (CABG) included in this study. In group B, 15 age, sex, height and weight matched normal subjects were also taken to compare the data of patients to analyze the CABG patients functional capacity.

**Design:** a longitudinal quasi-experimental design.

**Methods:** the 6minute walk test (6MWD) was conducted according to standardized protocol on each of test days. Participants were told "the purpose of this test is to see how far you can walk in six minutes". Oxygen saturation, heart rate, blood pressure, respiratory rate and rate of perceived exertion was taken at the start and end of six minute walk test and distance covered in six minutes noted, similarly, 6 minute walk test was conducted on the matched normal subjects and the following distance noted.

**Results:** results showed significant increase in six minute walk distance over the period of time. The mean value of 6MWD on 6th post-operative day was 280 + 46 meter which increased to statistically significant level of 355 + 43 meters on 13th post operative day (p=0.00). When looking at change in 6MWD covered by CABG subjects and normal subjects on 13th post-op day, indicating the decrease in lag or improvement in 6MWD between CABG subjects and matched normal group. However, none of the patient reached to values of normal matched group by 13th post-op day.

**Conclusion:** This study help us suggest that the patient with this age group following CABG achieve functional capacity in the range of 3-5 MET’s and could easily perform activities in this range by 13th post op day. Further, understanding functional level will assist in determining patient’s need for rehabilitation services after CABG surgery.

**Key words:** Six Minute Walk Distance, Coronary Artery Bypass Grafting, Cardiac Rehabilitation
in most of the patients. This may be due to early discharge which limits the time to achieve an adequate functional level for the performance of many activities of daily living. Alternatively, it may be related to level of self-efficacy, in one’s ability to perform physical activity. High self-efficacy may result in overexertion during the vulnerable, early post discharge phase of recovery, whereas low self-efficacy may cause under exertion. Thus prior to prescribing safe and effective home exercise at discharge, it is essential to assess functional level to physical activity. Six minute walk test is an inexpensive and simpler submaximal exercise test commonly used for predicting one time measure of functional status by measuring the distance covered by walking on a hallway level within 6 minutes.

This study was undertaken to analyze and quantify the functional capacity in post- coronary bypass subjects by using 6 MWT, and comparing their values with values of age, sex, height and weight matched normal subjects.

METHODS

Subjects

A convenient sample of fifteen patients (male 12, female 03) in the age group of 40-60 years who underwent coronary artery bypass surgery were included in this study. Fifteen age, sex, height and weight matched normal subjects were also taken to compare the data of CABG patients to analyze the patients functional capacity. Prior to participating in this study, all subjects read and signed an informed consent approved by the University Committee on Research Involving Human Participants.

Space and Location

All the patients were recruited from Cardiothoracic and Vascular Surgery unit of All India Institute Of Medical Sciences, New Delhi and St. Stephen’s Hospital, Tis Hazari, Delhi, India.

Inclusion Criteria

• All patients who had undergone CABG.
• Age groups between 40-60 years.
• All subjects who had stable hemodynamics. The criteria which was used to analyze the stability of hemodynamics were as follows:
  • Stable arterial systolic and diastolic blood pressure, Stable cardiac rhythm.
  • Patients with BMI > 18 and < 25.
  • Early ambulated (second postoperative day) and independently walking patients.
  • Patients with New York Heart Association classification (NYHA): II and III.
  • Patients with left ventricular ejection fraction e’ > 45%.

Another fifteen, age, sex, height and weight matched normal individuals were selected based on their medical check-ups and evaluation which ruled out any disease process.

Exclusion Criteria

• Post operative heart failure requiring inotropes or intra-aortic balloon pump.
• Samples with ICU stay >4 days.
• ECG alert subjects with resting heart rate < 50 beats/min or > 110 beats/min.
• Marked hypotension (systolic blood pressure<90 or >200 mmHg or diastolic BP <60 mmHg or >110 mmHg).
• Patients with resting oxygen saturation < 90%.
• Patients with cerebro-vascular accident within last 12 months, or any other neuromuscular disorders that hinders with walking.
• Intra or post operative myocardial infarction, symptomatic angina or suspected cardiac tamponade: or ST/Q wave abnormalities.
• Patients unable to follow commands or anxious patients.
• Patients presenting with unstable angina or new chest pain or fainting.
• Patients with orthopedic problems in lower limb and spine.

Study Design

A longitudinal quasi - experimental design.

Instrumentation and Procedures

Equipments & Scales: Siemens micro O2 Pulseoximeter, Timer, Microtone deluxe Stethoscope, Sphygmomanometer, Chalks or pencil to mark distances, Modified Borg scale.


Outcome variable: functional capacity as measured by the distance walked on 6 minute walk test. Six minute walk distance was measured on day of discharge (6th day) and again 7 days after day of discharge (13th POD).

PROCEDURE

General Physiotherapy Management

All CABG subjects were seen by the physiotherapist before the surgery for preoperative assessment and
were given routine instructions for the postoperative regimen. Postoperatively, all patients received regular postoperative physiotherapeutic regimen from the 0-day itself as per the routine protocols. Following extubation on first postoperative day, patients were treated and assisted to perform deep breathing exercises, coughing and huffing through the required procedures/intervention, upper limb and lower limb activities. Subjects were ambulated once they were able to maintain a SpO2 of value at least 90% without supplemental oxygen at the room air and they were advised to walk twice or thrice daily as per the routine protocol and precautions. Thereafter, all the subjects followed the common exercises till 13th day. These exercises included light mobilization exercises in the form of different exercises and includes 10 repetitions of each exercise at moderate pace. The following are the exercises used:

1. Deep breathing exercises.
2. Incentive spirometer.
3. Arm and leg exercises.
4. Walking twice a day (for 15 – 20 minutes.).

All the selected subjects will be informed in detail about the type and nature of the study and were made to sign the informed consent. All the CABG subjects followed the common exercises. The 6-min walk test was conducted according to a standardized protocol on each of test days. Oxygen saturation, Heart rate, Blood pressure, Respiratory rate and rate of perceived exertion were taken at the start and end of the 6-min walk test and distance covered in 6 minutes noted. Similarly, 6 minute walk test was conducted on the matched normal subjects and the following distance noted.

**DATA ANALYSIS**

Data analysis was done using the software package of SPSS 14. The paired t-test was applied for within subject dependant variable. To assess the paired differences, paired sample test was performed, the significance level set for this study was 95% (p < 0.05). The unpaired t-test was used to examine the changes in 6 minute walk distance among treated group (CABG patients) and control group. To analyze significant changes, least significant difference t-test for equality of means was performed; the significance level set for this study was 95%. Freidman test was used to examine changes in the rate of perceived exertion (RPE) variable, which was measured at 4 intervals:

- pre 6 MWT on 6th post-op day
- post 6 MWT on 6th post-op day
- pre 6 MWT on 13th post-op day
- post 6 MWT on 13th post-op day

To analyse significant changes in the paired RPE scores, median as found by Freidman test was used and Wilcoxon Signed Ranks Test was applied.

**RESULTS**

Fifteen post -coronary bypass subjects were recruited, 20% of subjects were female (n =03) and 80% of subjects were males (n=12). Again, out of fifteen matched normal subjects, 20% of subjects were female (n =03) and 80% of subjects were males (n=12). The mean age of all the patients participated in this study was 51.5 ± 7.0 with the change of minimum 40 years to maximum age of 60 years.

| Table1. Changes in six minute walk distance within the coronary bypass subjects |
|-----------------------------|-----------------|----------|
| 6MWD | Mean ± S.D | t | p |
| 6th POD | 280.4 ± 46.1 | 7.800 | 0.000 |
| 13th POD | 355.7 ± 43.4 | | |

Pair-wise comparisons revealed that there is significant difference between the distance walked on 6th post-operative day and 13th post-operative day. (p=0.00). The mean value of six minute walk distance on 6th post-operative day was 280.4 ± 46.1 which was increased to statistically significant level of 355.7 ± 43.4 on 13th post-operative day (p<0.00).

Pair-wise comparisons revealed that there is significant improvement in the distance walked by coronary bypass subjects compared to matched normal group from 6th post-operative day to 13th post-operative day (p=0.00). The mean value of six minute walk distance on 6th post-operative day by coronary bypass subjects was 280.4 ± 46.1 and 584.9 ± 61.7 by matched normal subjects which was increased to statistically significant level of 355.7 ± 43.4 by coronary bypass subjects by 13th POD against 584.9 ± 61.7 by matched normal subjects (p<0.00).
DISCUSSION

The results of this study show that patients following uncomplicated coronary artery bypass surgery significantly improve in their functional capacity but the same still does not reach the functional capacity of matched normal people by 13th post-operative day. This strengthens our protocol of early analyzing the functional capacity of the coronary artery bypass patients which could be used in the perspective of formulating individualized safer and effective home exercise program.

There was a significant improvement in functional capacity as measured by six minute walk distance and rate of perceived exertion in coronary artery bypass patients from 6th post-operative day to 13th post-operative day. The subjective rating of exertion perceived by the person exercising is generally a sound indicator of relative fatigue to clinically determine intensity of exercise. The breathlessness and rate of perceived exertion scores on 13th post-operative day indicated that subjects find the prescribed walk test less stressful, as they could walk more distance with less rate of perceived exertion than on 6th post-operative day.

The statistically significant increase in functional capacity was due to increase in the parasympathetic tone and an improvement in cardiovascular autonomic control due to exercise conditioning resulting from mobilization exercises and regular physical activity. Also, in these coronary artery bypass subjects, the deconditioning of the muscles is seen which occurs with prolonged reduction of activity causing an increase in fatigue and shortness of breath on activity. Evidence supports that even low- to moderate-intensity activities performed daily increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity.

The results of this study correlated with the study conducted by Jaeger AA on the functional capacity after cardiac surgery in elderly patients who found that the functional capacity improved significantly after surgery till 1 year with improvements in most patients. Also another study by Hirschhorn AD who studied whether supervised moderate intensity exercise improves distance walked at hospital discharge following Coronary Artery Bypass Graft Surgery. The results showed that the walking and walking/breathing exercise groups had significantly higher 6 minute walk assessment distance than the standard intervention group at discharge from hospital. However, there was no significant difference between intervention groups for 6 minute walk assessment distance at four-week follow-up. He concluded that physiotherapy-supervised, moderate intensity walking program in the inpatient phase

<table>
<thead>
<tr>
<th>6th POD</th>
<th>SMWD Mean ± S.D</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG</td>
<td>280.4±46.1</td>
<td>15.2</td>
<td>0.000</td>
</tr>
<tr>
<td>Normal Subjects</td>
<td>584.9±61.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13th POD</th>
<th>SMWD Mean ± S.D</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG</td>
<td>353.7±43.4</td>
<td>11.7</td>
<td>0.000</td>
</tr>
<tr>
<td>Normal Subjects</td>
<td>584.9±61.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Table 2.** Changes in Six Minute Walk Distance between groups

- **Table 3.** Changes in Rate of Perceived Exertion, pre and post walk on 6th and 13th day

<table>
<thead>
<tr>
<th>RPE</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th POD before walk</td>
<td>2.07</td>
</tr>
<tr>
<td>6th POD after walk</td>
<td>3.63</td>
</tr>
<tr>
<td>13th POD before walk</td>
<td>1.73</td>
</tr>
<tr>
<td>13th POD after walk</td>
<td>2.57</td>
</tr>
</tbody>
</table>
following CABG improves walking capacity at discharge from hospital.  

Also, in our study, none of the subjects reached to the functional level of normal matched subjects by 13th post-operative day. Thus, emphasizing that continued care and cardiac rehabilitation is needed. The results of this study correlated with the study conducted by DiMattio MJ who studied functional status and correlates following coronary artery bypass graft surgery in women. The results showed that women experienced significant gains in functional status over 6 weeks, particularly between 2 and 4 weeks. Also, none of the women completely recovered or had regained baseline functional status by 6 weeks. They suggested that the finding that recovery is incomplete by 6 weeks, should be incorporated into discharge planning and follow-up for this patient population.

Ability to walk greater distances with low rate of perceived exertion, absence of clinically significant desaturation and absence of clinically significant changes in heart rate, blood pressure and respiratory rate help us suggest that patients with age group 40 – 60 years following coronary artery bypass surgery could walk easily by 355.7 ± 43.4 meters on 13th post-operative day. This also indicates that uncomplicated coronary artery bypass surgery patients are capable of performing activities requiring 3- 5 MET’s of energy expenditure as early as 13th post-operative day in the post operative regimen, as regards to physiotherapeutic protocol and advices for such patients.

FUTURE RESEARCH

Future research is needed for analyzing the return of functional capacity in post coronary bypass subjects compared to normal subjects matched on more criteria like co-morbid conditions and preexisting lifestyle habits. Simulation of this protocol to the wide variety of coronary artery bypass surgery (off pump, on pump, robotic surgery) and comparison between them can be applied for future research.

CONCLUSIONS

This study help us suggest that patients with age group 40 – 60 years following coronary artery bypass surgery achieve functional capacity in the range of 3-5 MET’s and could easily perform activities in this range by 13th post-operative day. This study will therefore help physiotherapy professionals in cardiopulmonary specialty to render safer and effective home exercise program at discharge. Analyzing the functional capacity could be used in the perspective of formulating a personalized rehabilitation program and more useful activity prescription to such patients. Further, understanding functional level will assist in determining patient’s need for rehabilitation services after CABG surgery.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

REFERENCES

A Comparative Study Between Muscle Energy Technique and Myofascial Release Therapy on Myofascial Trigger Points in Upper Fibres of Trapezius

Jay Sata
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ABSTRACT

**Background:** Neck Pain is very commonly shown by most people to be in the region of the back of the neck and between the bases of the neck to the shoulder, primarily indicating the upper region of the trapezius muscle. About two thirds of people will experience neck pain at some point in their lives. Prevalence is highest in middle age, with women being affected more than men. The prevalence of neck pain varies widely between studies, with a mean point prevalence of 13 % (range 5.9 - 38.7 %) and mean lifetime prevalence of 50 % (range 14.2 - 71.0 %). In some industries neck related disorders account for as many days of absenteeism as low back pain.

The myofascial trigger points have been described as a hyperirritable spot, usually within a taut band of skeletal muscles or in the muscles fascia. The spot is painful on compression and can give rise to characteristics referred pain, tenderness and autonomic phenomenon.

Myofascial release is a soft tissue mobilization technique, defined as “the facilitation of mechanical, neural and psycho physiological adaptive potential as interfaced via the myofacial system. Myofascial release which eliminates the fascia’s excessive pressure on the pain sensitive structure and restores proper alignment. Hence this technique is proposed to act as a catalyst in the resolution of trapezius spasm.

Muscle energy technique (MET) are manipulative procedures are designed to lengthen muscle and fascia and to mobilize joints. Because principles of neuromuscular inhibition are incorporated into this approach, another term to describe these techniques is “post-isometric relaxation”.

**Objectives:** To compare the efficacy of Muscle energy techniques and Myofascial release therapy on myofascial trigger points in upper fibres of trapezius.

**Methods:** Study included 52 (Fifty-Two) subjects with myofascial trigger points on upper fibres of trapezius. The subjects were randomly divided into 2 groups: Group A and Group B. Muscle Energy Technique ware given for Group A patients and Myofascial release therapy ware given for Group B patients. The subjects were treated for a period of 6 days a week, Once in a day. Pain was assessed by VAS score, Neck Disability by NDI score and Pain Threshold by PPT score.

**Results:** There is statistically significant difference in terms of the VAS, PPT, NDI score. The myofascial release group showed better decrease in pain, disability and increase in pain threshold.

**Conclusion:** Myofascial release proving better than the muscle energy techniques on myofascial trigger points of upper fibres of trapezius.

**Key words:** Myofascial Release Therapy, Muscle Energy Techniques, Myofascial Trigger Point

INTRODUCTION

In human anatomy, the trapezius is a large superficial muscle that extends longitudinally from the occipital bone to the lower thoracic vertebrae and laterally to the spine of the scapula (shoulder blade). Its functions are to move the scapulae and support the arm. Because the fibres of trapezius run in different directions, it has a variety of actions. Upper trapezius performs elevation and upward rotation of the scapula, as well as extension, lateral flexion and contra lateral rotation of the neck. The lower trapezius performs upward rotation, adduction and depression of the scapula. The middle trapezius performs the upward...
rotation and adduction of the scapula. The upper trapezius is also a secondary muscle of respiration. Garth R Johnson et al found that the EMG activity in the upper trapezius was always prevented when isometric loads were applied by shoulder shrugging and isometric pure moments were produced in coronal plane abduction and adduction.

The upper trapezius is often placed in a shortened position by poor ergonomics which creates shortness in the muscle. The trapezius is also activated by stressful thoughts and feeling or abnormal breathing pattern. With pain and tightness in the trapezius, patients may have symptoms of headaches, dizziness, neck pain and mid back pain.

One important event, which occurs early after injury, is muscle spasm. This feels like tightness in the muscles in that area, and is sometimes, but not always painful. The involvement of trigger points in almost all chronic pains is well established and yet many therapists either ignore or are not even aware of their existence. The myofascial trigger point in the trapezius is most commonly found at the midpoint of the upper border of the muscle. Satellite trigger points are seen in temporalis, masseter, splenius, semispinalis, levator scapulae and rhomboid major.

Myofascial trigger points can be acute due to immediate injury or chronic due to micro trauma over a long period of time. The underlying physiological mechanism of trigger points is not clearly understood. Several mechanisms have been proposed in the literature. Trauma either acute or chronic causes sarcoplasmic reticulum to tear and release calcium. This calcium and ATP causes the sarcomere to contract which shortens the muscle in a localized area producing taut bands. This generates high level of metabolic activity and ischemia in the area, thus the release of substances which cause hyperirritability of sensory nerve endings producing pain.

Trigger points are typically located by palpation. Simons described his criteria for identifying trigger points. These criteria include identification of taut band, a tender spot on the taut band, referred pain or altered sensation at least 2 cm beyond the spot, elicited by needle penetration or pressure held for 10 seconds, and restricted Range Of Motion in the joint cross by the muscle. The clinical examination of trigger points include three types of palpation – flat palpation to locate the spot of maximum tenderness with minimum pressure, pincer palpation to locate the trigger point and snapping palpation to elicit a local twitch response. An algometer is a useful tool to judge the amount of pressure that is required to produce the pain or referred symptoms.

**MATERIALS AND METHODS**

All patients were referred from the orthopedic Out Patient Department.

52 (fifty-two) patients in both sexes in age group of 20-50 years were divided in to two groups. Group A and Group B by simple random sampling method.

**Inclusion Criteria**

- Pain in neck
- Age group 20-50 years of either sex
- Clinically diagnosed cases of upper trapezius spasm from 3 weeks to 3 months
- Pain felt maximally over upper trapezius region.
- Active trigger point in the Trapezius
- Participants willing to participate in the study.

**EXCLUSION CRITERIA**

Subjects were excluded from the study if they had:

- Age below 20 or above 50 years of either sex.
- Patients having structural instability and degenerative conditions of cervical spine
- Torticollis
- Fibromyalgia
- Cervical spondylitis.
- Cervical disc prolapse.
- Subjects with impaired circulation.
- Posttraumatic individuals, neoplasms and infective conditions.
- Inflammatory conditions of cervical spine like RA, spondylitis.
- Patients who have undergone surgeries in and around the cervical spine.
- Unco-operative patients.

**Outcome Measures**

- Pain Intensity – Visual Analogue Score
- Neck Disability Index
- Pressure Pain Threshold – Pressure Algometer

**METHODOLOGY:**

**Assessment**

Pre-participation evaluation form consisted of VAS, NDL, PPT and assessment chart which included Age, sex, chief complain, presence of symptoms in one or both sides of neck, tenderness, pain, spasm present in the area of upper trapezius etc.

**Procedure**

Ethical clearance was obtained from the Ethical Clearance Committee of my College, prior to the study. Those who fulfilled the inclusion criteria
light resisted effort (30% of the available strength) to take the stabilized shoulder towards the ear (shrug movement) and the ear towards the shoulder. The double movement is important in order to introduce a contraction of the muscle from both ends simultaneously. The degree of effort should be mild and no pain should be felt.

The contraction is sustained for 10 seconds and released. Three repetitions with complete relaxation of 5 seconds, the practitioner gently move the head/neck into an increased degree of side bending, painlessly, and held in this position for at least 10 seconds and repeated 3-4 times.

The MET treatment was given once daily for 6 days.

• Group B: Myofascial Release

Positioning of the patients in sitting position.

Application: The therapist is in standing position behind the patient. Then with hands crossed with one hand placing on the shoulder and the other below the ear on the head of the involved side. The placement of the hands should be along the direction of the fibres. Local myofascial stretch for 20 seconds is given slowly and repeated 3-4 times.

Procedure is applied once daily for 6 days.

Clinical Intervention

Study participants were requested to continue normal activities and avoid any other forms of treatment for the duration of the study, apart from routine physician management. Subjects other than the designated protocol were not permitted to administer any other forms of electrotherapy or other techniques (steroids, acupuncture, or taping) during the intervention period of the trial.

• Group-A: Muscle Energy Technique

In this study Post facilitation stretching was used.

Post Facilitation Stretching:

• Position of patient:

The patient was in supine position with the arm lying alongside the trunk.

• Application:

The head/neck was side bent away from the side being treated to just the short of the restriction barrier, while the shoulder was stabilized with one hand and the other hand cups the ear/mastoid area of the same side of the head.

The Post Facilitation stretch was performed with practitioner’s arms crossed, hands stabilizing the mastoid area and shoulder. The patient introduced a

RESULTS

Fifty-two subjects were randomly divided into 2 groups: Group A & Group B. In Group A 25 subjects and in Group B 27 subjects.

Table 1.1 Age Distribution of the Subjects

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean ±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>25</td>
<td>30.80 ± 5.36</td>
</tr>
<tr>
<td>Group B</td>
<td>27</td>
<td>29.44 ± 5.38</td>
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</tbody>
</table>
Table 1.2. Results of Wilcoxon signed rank test for VAS (Within the Group)

<table>
<thead>
<tr>
<th>Group</th>
<th>T value</th>
<th>P value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>325</td>
<td>&lt; 0.0001</td>
<td>Highly significant</td>
</tr>
</tbody>
</table>

Table 1.3. Results of Wilcoxon signed rank test for NDI scale (Within the group): 

<table>
<thead>
<tr>
<th>Group</th>
<th>T value</th>
<th>P value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>325</td>
<td>&lt; 0.0001</td>
<td>Highly significant</td>
</tr>
<tr>
<td>Group B</td>
<td>378</td>
<td>&lt; 0.0001</td>
<td>Highly significant</td>
</tr>
</tbody>
</table>

Table 1.4. Results of Wilcoxon signed rank test for PPT scale (Within the group): 

<table>
<thead>
<tr>
<th>Group</th>
<th>T value</th>
<th>P value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>-321</td>
<td>&lt; 0.0001</td>
<td>Highly significant</td>
</tr>
<tr>
<td>Group B</td>
<td>-378</td>
<td>&lt; 0.0001</td>
<td>Highly significant</td>
</tr>
</tbody>
</table>

Wilcoxon Sum Rank Test (Mann Whitney 'U' Test) was applied for between-group comparison of Group A and Group B, and it is as follows:

- For VAS, U=174, U'=451, P= 0.0037. On comparing Group A and Group B for post-treatment VAS score, results showed significant difference in improvement in terms of VAS.

- For NDI, U=210.50, U'=464.50, P= 0.0175. On comparing Group A and Group B for post-treatment NDI score, results showed significant difference in improvement in terms of NDI.

- For PPT, U=145, U'=530, P= 0.0003. On comparing Group A and Group B for post-treatment PPT score, results showed extremely significant difference in improvement in terms of PPT.

CONCLUSION

It is concluded that there is significant difference in the effect of treatment between Muscle energy techniques and Myofascial release therapy on myofascial trigger points of upper fibres of trapezius with myofascial release proving better than the muscle energy technique.

ACKNOWLEDGEMENTS

I would like to thank Dr Mayur (Assistant Physiotherapist) and I am grateful to all my patients for their kind cooperation and willingness to participate in this study, without whom this study would not have materialized.

Conflict of Interest

The authors perceive no conflict of interest in this study.

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16. Myofascial Therapy, Sam Kegerreis, MS, PT, ATC Professor of Physical Therapy Krannert School of Physical Therapy, University of Indianapolis.


Quantifying EMG Activity of Trapezius Muscle During Empty Can & Full Can Tests

Kanupriya¹, Sumit Kalra²
¹Student ²Assistant Professor, Banarsidas Chandiwala Institute of Physiotherapy, Kalkaji, Delhi

ABSTRACT

Study Design: Correlational design.

Purpose: To quantify the EMG activity of the three fibers of the trapezius muscle during empty can & full can shoulder exercises/ tests.

Setting: College electrotherapy laboratory.

Subjects: 50 healthy subjects, age group between 20-30 years.

Materials: Full scale goniometer, EMG equipment- NeuroTrac™ ETS C 0120, a laptop- Dell, Self adhesive electrodes.

Methods: Subjects fulfilling the inclusion criteria were taken into consideration. The procedure was explained to the subjects and a written consent was taken after explaining the benefits and clearing the doubts of the subject regarding study. After ROM and muscle tension evaluation using manual muscle testing (MMT), and goniometry of the cervical spine and shoulder, subjects were recruited and electrodes were placed accordingly, for recording the trapezius muscle activity. After electrode placement the subjects were asked to perform two shoulder rehabilitation exercises that is, empty can & full can exercises. The subjects were instructed to perform, each of the above mentioned exercises with, holding of the exercise position, for 30 seconds which was followed by a rest period, and performance of the test.

Recording of the data was done, in between the exercise performance.

Data analysis: Mean and standard deviation were calculated from the EMG values, recorded for each fiber of the trapezius muscle during empty can and full can shoulder exercises/tests.

The coefficient of variation i.e. variability was computed using the statistical values (mean & standard deviation).

Result: The coefficient of mean variation ( variability) calculated was least for the lower trapezius muscle during the empty can shoulder exercise/test, it suggests that the EMG values for the lower trapezius muscle during empty can shoulder exercise/test is more compact, consistent, homogenous & is efficient.

Conclusion: The present study concludes that during the empty can & full can shoulder exercises/ tests a scapular stabilizing muscle i.e. trapezius was also activated along with the other rotator cuff muscles. Out of the two mentioned exercises/tests maximum activation was seen in the lower fibers of the trapezius muscle followed by upper & middle fibers during Empty Can exercise/test. However, during full can exercise, out of the three fibers of the trapezius muscle maximum activity was recorded from the lower fibers followed by upper & middle fibers.

Key Words: Empty can, Full can, Muscle activation.

INTRODUCTION

The biomechanical analysis of rehabilitation exercises has gained recent attention. As our knowledge of specific muscle biomechanics and function has increased, we have seen a gradual progression towards more scientifically based
rehabilitation exercises. Several investigators have sought to describe common rehabilitation exercises using kinematics, kinetics, and electromyography (EMG) data in an attempt to better understand the implications of each exercise on the soft tissues around the shoulder joint.1, 2

EMG studies have confirmed that no one exercise isolates the action of supraspinatus muscle from the other rotator cuff or deltoid muscles. The supraspinatus muscle is effectively activated in both the “empty can” and “full can” exercises. Based on previous electromyographic (EMG) studies the ‘Empty Can’ (EC) and ‘Full Can’ (FC) tests have been promoted as being able to isolate activity to supraspinatus. On this basis, the FC and EC tests have been reported as being diagnostic of supraspinatus dysfunction. However, there is evidence to suggest that these positions do not selectively activate supraspinatus, bringing into question the anatomic validity of these tests. This has implications for their use both as a diagnostic tool and as isolated strengthening exercises.

In clinical practice, physical examination tests of the shoulder commonly include range of motion, resisted muscle tests and orthopaedic special tests. Many recent publications have focused on the diagnostic validity (Beaudreuil, Nizard et al., 2009; Hegedus, Goode et al., 2008), and anatomic validity (Green, Shanley et al., 2008) of isolated clinical tests for shoulder pain. The reviewed study adds further to this body of evidence by investigating the anatomic validity of the EC and FC tests for selective activation of supraspinatus and FC tests are commonly used in clinical examination of the painful shoulder. Since these tests were first described, personnel from medical field have interpreted pain or weakness associated with one or both of these tests as being indicative of supraspinatus pathology (Jobe & Moynes, 1982). Both these tests are also frequently used as a strengthening exercise for supraspinatus, with clinicians believing that they are primarily strengthening the supraspinatus muscle.

The above study challenged both long-held assumptions with some interesting results. The known limitations of EMG notwithstanding, the methodology of this study appears sound. Their results clearly indicate substantial amounts of muscle activation in all rotator cuff muscles, as well as many global shoulder muscles (including all the three fibers of trapezius muscle) during the FC and EC tests, appearing to dispel previously held beliefs that these tests selectively activate the supraspinatus.

Description of the exercises/tests and positions used for the isometric EMG testing are as follows:

1. Empty can / Jobe Test or exercise: Subject’s arm abducted to 90° with neutral (no) rotation, and examiner provides resistance to abduction. The shoulder is then medially rotated and angled forward 30° (empty can position) so that patient’s thumbs point toward the floor in the plane of the scapula. Resistance to abduction is again given while the examiner looks for weakness or pain, reflecting a tear of the supraspinatus tendon or muscle, or neuropathy of the suprascapular nerve.

Isometric position: Shoulder abduction in the scapular plane with internal rotation and resistance applied at the wrist. Internal Rotation exercises for the shoulder will strengthen multiple stabilizing muscles.

Empty can exercise is completed from a range of motion of 0°-90° and then back down to starting position.

2. Full Can: This exercise is completed while standing. Also one’s arms at their waist, thumbs up while holding a weight. The individual raises their arms up from there a 30° angle anterior to the frontal plane (the frontal plane can be thought of as an imaginary sheet of paper that separates the anterior side of your body from the posterior side of your body). Once the arm is at shoulder width height, the individual pauses and then lowers them back down to starting position.

Isometric position: Shoulder abduction in the scapular plane (30° anterior to the frontal plane) with external rotation and resistance applied at the wrist

A study done by Boettcher CE, Ginn KA and Cathers I (2009): on The ‘empty can’ and ‘full can’ tests do not selectively activate supraspinatus, brought into question the anatomic validity of the tests mentioned above i.e. the empty can and the full can tests or exercises by an EMG based evidence in their results showing, While both the EC and FC tests activated supraspinatus to levels approximately 90% of their maximal voluntary contraction, eight other shoulder muscles were also activated to similarly high levels including other rotator cuff muscles (infraspinatus and upper subscapularis), scapular positioning muscles (upper, middle and lower traps, and serratus anterior), and abduction torque producing muscles (anterior and middle deltoid). They concluded that the EC and FC tests do not primarily activate supraspinatus and therefore, do not satisfy basic criteria to be valid diagnostic tools for supraspinatus pathology. Therefore, these tests should
not be interpreted as definitive tests for the clinical diagnosis of supraspinatus pathology, and if prescribed as a rehabilitative exercise, should be used with the knowledge they are not selectively activating supraspinatus.

Clinically, these results suggest that the production of pain during the EC or FC tests may implicate any or all of the other rotator cuff muscles, not only the supraspinatus. This fits with previous findings of reasonable levels of sensitivity (84-86%) for the FC and EC tests in detecting supraspinatus pathology, but much lower levels of specificity (50-57%) when compared with surgical findings (Hertel, Ballmer et al., 1996). Combined with the lack of anatomic validity demonstrated in the reviewed study, it is not surprising that the diagnostic value of these tests for ruling-in supraspinatus pathology (specificity) is poor.

Implications for use as a strengthening exercise.

The clinical rationale for prescription of a strengthening exercise is the presence of a strength deficit. In accordance with results of this study, the presence of weakness with the EC or FC tests may implicate a strength impairment affecting any of the rotator cuff muscles (or combination of cuff muscles), the scapula positioners (middle and lower trapezius and serratus anterior), or the abduction torque producers (deltoid).

The prescription of the EC or FC as a strengthening exercise will therefore activate all the rotator cuff and many scapulothoracic muscles to a significant proportion of their maximal voluntary contraction and will most likely result in similar strength adaptations to all these muscle groups.

It can be concluded that the EC and FC tests do not selectively activate supraspinatus and therefore lack anatomic validity as a diagnostic test for dysfunction of this muscle. Their use as a diagnostic test to rule-in supraspinatus lesions is therefore limited. Given the finding that all rotator cuff muscles are activated during these tests, a more appropriate interpretation may be that these tests could assist in ruling-out involvement of the rotator cuff given a negative test result. Due to high levels of activation of many rotator cuff and scapulothoracic muscles during the EC and FC tests, they are likely to be effective strengthening exercises for all these muscle groups; however, they will not selectively strengthen the supraspinatus muscle.4

Statement of question:
Is there any activity of the trapezius muscle during Empty Can & Full Can Exercises/Tests?

AIMS AND OBJECTIVE

In the earlier studies Supraspinatus muscle activation has been demonstrated with Empty Can & Full Can shoulder exercises/tests with no concern given to the Trapezius muscle. Therefore the aim of the present study is to check and quantify the EMG activity of the three fibers of the trapezius muscle (upper, middle, & lower) during Empty Can & Full Can shoulder exercises/tests.

METHODOLOGY

Number and Source
• 50 subjects were taken
• The study is conducted at Banarsidas Chandiwala Institute of Physiotherapy, Kalkaji, New Delhi.

Inclusion Criteria
• Male or female within age group 20-30 years

Exclusion Criteria
• Subjects with trigger points or tender point of trapezius muscle.
• Subjects with any musculoskeletal disorders that would limit performance of the trapezius action or ROM of the cervical spine.
• Skin disorders which would be irritated by EMG procedures.
• In presence of malignant tumours in or around the cervical spine/shoulder joint.
• In presence of recent fracture sites in or around the cervical spine or shoulder joint.
• Spinal deformities.
• Spinal contractures.
• All contraindications of EMG.

Instruments and Tool used
• Electromyographic equipment- NeuroTrac™ ETS C 0120
• A laptop- Dell
• Self adhesive electrodes-4, 50×50mm (VMVERITY, Medical Ltd
• Goniometer — full scale

Research Design
• It is a correlational design.
Variables
- Electromyography
- Exercises
- Time period

PROCEDURE

Subjects fulfilling the inclusion criteria were taken into consideration. The procedure was explained to the subjects and a written consent was taken after explaining the benefits and clearing the doubts of the subject regarding study. After ROM and muscle tension evaluation using manual muscle testing (MMT), and goniometry of the cervical spine and shoulder, subjects were recruited and electrodes were placed accordingly, for recording the trapezius muscle activity:

Electrode placement - Bipolar surface Electrodes were placed with a 2-cm interelectrode distance over the upper, middle, and lower portion of the trapezius.

For upper trapezius - Electrodes for the UT were placed midway between the spinous process of the seventh cervical vertebra and the posterior tip of the acromion process along the line of the trapezius.

For middle trapezius - The MT electrodes were placed midway on a horizontal line between the root of the spine of the scapula and the third thoracic spinous process.

For lower trapezius - The LT electrodes were placed obliquely upward and laterally along a line between the intersection of the spine of the scapula with the vertebral border of the scapula and the seventh thoracic spinous process.

After electrode placement the subjects were asked to perform two shoulder rehabilitation exercises that is, empty can & full can exercises. The subjects were instructed to perform, each of the above mentioned exercises with, holding of the exercise position, for 30 seconds which was followed by a rest period, and performance of the test.

Recording of the data was done, in between the exercise performance.
DATA ANALYSIS

- EXCEL 2007 is used for calculations.
- FORMULA USED —

**MEAN**:

\[
\text{Mean} = \frac{\text{sum of elements}}{\text{number of elements}} = \frac{a_1+a_2+a_3+...+a_n}{n}
\]

**STANDARD DEVIATION**:

\[
\sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} (X_i - \bar{X})^2}
\]

**COEFFICIENT OF VARIATION**

\[
\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Expected Return}}
\]

RESULT

Mean and standard deviation were calculated from the EMG values, recorded for each fiber of the trapezius muscle during empty can and full can shoulder exercises/tests.

The coefficient of variation i.e. variability was computed using the statistical values (mean & standard deviation) which were as follows:

During empty can-

Upper trapezius=38.6%, middle trapezius=53.70%, lower trapezius=36.3%

During full can-

Upper trapezius=40.3%, middle trapezius=51.3%, lower trapezius=44.6%

Since the coefficient of mean variation (variability) is least for the lower trapezius muscle during the empty can shoulder exercise/test, it suggests that the EMG values for the lower trapezius muscle during empty can shoulder exercise/test is more compact, consistent, homogenous & is efficient.
DISCUSSION

An early activation of stabilizing muscles at the scapulothoracic joint could help to increase the scapular stability to provide a stable platform during glenohumeral movements. Furthermore, it is suggested that the stabilizing action of the scapular muscles is essential for an adequate performance of the rotator cuff during upper limb elevation. If the scapular muscles better stabilize and synchronize scapular movements, this could increase the capacity of the rotator cuff muscles to stabilize the glenohumeral joint. Hence, scapular muscle training is an essential part of progressive shoulder rehabilitation and injury prevention exercise programs. In general, shoulder training is frequently performed to restore upper extremity function or to prevent shoulder injury. To achieve these goals, a multitude of exercises are used in clinical practice. Traditionally, the value of an exercise is based on the activation level at which the different muscles are activated. More specifically, it has been postulated that the timing of muscle activation of the scapular muscles is an important factor in the relationship between the dynamic muscular actions and the scapular kinematics.

CONCLUSION

The present study concludes that during the empty can & full can shoulder exercises/tests, a scapular stabilizing muscle i.e. trapezius was also activated along with the other rotator cuff muscles. Out of the above mentioned exercises/tests, maximum activation was seen in the lower fibers of the trapezius muscle followed by upper & middle fibers during Empty Can exercise/test. However, during full can exercise, out of the three fibers of the trapezius muscle maximum activity was recorded from the lower fibers followed by upper & middle fibers.

LIMITATIONS OF THE STUDY

- The number of subjects taken in the study was 50; rather more than this could have been taken
- The age group taken in the study is from 20-30 years; rather a larger age group should have been taken.
BIBLIOGRAPHY


Socio-Economic Barriers to Maternal Health Care in Rural Bangladesh

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ABSTRACT

Objective: To outline the specific socio-economic barriers to maternal health faced by Bangladeshi women.

Study Design: Review and Analysis of Literature

Background: Bangladesh is a country with over one third of the population living in poverty and another one third living just above poverty level. The World Health Organization (2010) indicates that Bangladesh has poor prenatal and postpartum care, nutritional deficiencies, high incidence of non-skilled birth attendant utilization, and the second highest maternal mortality and morbidity rates next to sub-Saharan Africa. Women living in Bangladesh are at high risk for maternal mortality and morbidity in the postpartum period directly related to socio-economic status.

Conclusion: The need for socio-economic relief for women living in rural Bangladesh remains an issue that needs to be addressed to fully address maternal health and maternal morbidities in the postpartum period.

Key Words: Postpartum, Maternal Health, Morbidity, Mortality, Bangladesh, Socio-Economic

INTRODUCTION

Bangladesh is a country with over one third of the population living in poverty and another one third living just above the poverty level. The World Health Organization (WHO) indicates that Bangladesh has poor prenatal and postpartum care, nutritional deficiencies, high incidence of non-skilled birth attendant utilization, and the second highest maternal mortality and morbidity rates next to sub-Saharan Africa.

The United Nations Millennial Development Goal 5 (MDG5) for 2015 focuses on improving maternal health by improving QOL for women in developing countries, including Bangladesh. One of the MDG5 strategic goals is to improve access to prenatal and postpartum programs that effectively reduce the morbidities associated with postpartum maternal health. However, there is currently no information on the specific religious, cultural and socio-economic barriers experienced by women living in Bangladesh that may limit access to these programs. Bangladeshi women are already at high risk for post-partum disorders such as infection, hemorrhage, urologic dysfunction, and pelvic pain. Without this information, Bangladeshi women may be at an even higher risk for postpartum problems.

To determine the specific needs of this community, it is important to understand the medical needs, local practices, and perceptions of pregnancy, birth, and the postpartum period and how they are affected by culture and religious beliefs. Gender-equity theories propose that empowerment for women begin with access to social, health and nutrition services economic opportunities. However, in Bangladesh, social, health, nutrition, and economic opportunities are severely diminished for many women.

Apart from the cultural and gender barriers for women living in rural impoverished regions, women who are at or below poverty level who need obstetric services have limited access to resources because of extended travel time to the nearest hospital. Therefore, research is needed to determine the specific pregnancy-related health care needs of women living in Bangladesh.

The purpose of this paper is to shed light upon the
socio-economic risk factors that compound postpartum morbidities of Bangladeshi women essential to developing future programs developed by governmental and non-governmental organizations, physicians, physical therapists, and other health care practitioners in Bangladesh.

Decreasing the Maternal Mortality and Morbidity Rates

A review of the literature using CINAHL, Proquest Nursing, and PubMed databases and the search terms of “Bangladesh”, “women”, “postpartum”, “mortality”, and “morbidity” was conducted. The maternal mortality rate in Bangladesh is defined as the “death of a woman during pregnancy, childbirth, or within the 42 days after delivery”[6]. Women living in rural Bangladesh are vulnerable to complications during pregnancy and postpartum with over half of women reporting one or more complications, including: preeclampsia, UI, urinary tract infection, and other infections according to a research study utilizing three related questionnaires with two stage sampling approach to both rural and urban areas in Bangladesh and over 103,000 women[7].

In Bangladesh, women’s skilled prenatal and postpartum care is focused on those living in urban areas and in the upper wealth quintile[8]. Skilled birth attendants are mostly unavailable in rural areas with the majority of births taking place at home in the presence of a family member or other unskilled birth attendants[9]. Untrained family members and friends provided 75% of birth and immediate postpartum care and did not involve the services needed for safe, effective, and efficient care. In the same study, only 22% of rural Bangladeshi women and 27% of urban Bangladeshi women in the lowest wealth quartile reported having medically attended care, with the high cost of care being the most commonly cited reason for lack of skilled care. This lack of basic skilled care places women at high risk for prenatal, delivery, and postpartum risk of complications. Studies have been performed on nutrition, cost, educating skilled birth attendants, and prenatal programs, but little has been done to complete the spectrum of reproductive care by addressing women in the extended postpartum period[10].

Maternal deaths are associated with infection, pregnancy induced hypertension (preeclampsia), septic abortion, urinary dysfunction, and hemorrhaging with over 80% occurring during the postpartum period[11,12]. Skilled prenatal and postpartum education has been linked to improved outcomes and decrease in maternal morbidity and mortality in several studies[13,14]. One study recommended skilled prenatal and postpartum education and care as integral to reducing of the risk factors for infection, pregnancy induced hypertension, hemorrhaging, incontinence, pain, and long term pelvic disorders as evidenced in retrospective meta-analysis in both developing and developed countries[15]. However, skilled birth attendants are mostly unavailable in rural areas where the majority of births take place in the home in the presence of a dais, a traditional birth attendant with no medical training[16].

One method to improve maternal health care is the adoption of prenatal and postpartum education and care specific to the needs of women living in Bangladesh. A study by Kalim et al (2009), in 80 Bangladeshi women in two different districts, found a significant relationship between maternal years of education, literacy rates, and utilization of skilled birth attendants to the maternal mortality rates of each community[17]. The community with higher literacy and education and corresponding higher utilization of skilled birth attendants (over 20%) reported significantly less maternal deaths (351/100,000) in Khulna compared with the lower literacy and education rates and low use of skilled attendance (less than 10%) for women in Syhlet (471/100,000)[8]. In the same study, Kalim et al (2009), explored the postpartum complaints most often reported by the Bangladeshi women. Pain, prolapse, prolonged labor, placental tears, hemorrhage, and eclampsia were among the top complications reported in the postpartum period, all of which relate directly to a decrease in QOL for women and place them at risk for other maternal morbidities. While skilled birthing attendants may be sufficient to provide safe birthing methods for women living in Bangladesh, they lack the resources and knowledge to evaluate the physical problems commonly associated with the postpartum period.

Barriers to Maternal Health Care

Malnutrition & Risky Birth Practices

Malnutrition and risky birth practices compound the problems that exist because of a lack of prenatal and postpartum care. The national average body mass index (BMI) of Bangladeshi women is <18.5 (BMI norm reference=19-25), overall measuring below the malnourished level, making the Bangladeshi woman more vulnerable to postpartum complications than women with adequate nourishment[18]. A survey of 26,424 pregnant women living in Bangladesh and found that 35-38% of pregnant women had a body
mass index less than 18.5, weighed 48-49 kg and over 50% were anemic. In one study of over 2,000 pregnant women who were calcium supplementation given during pregnancy resulted in 60-70% decrease in preeclampsia and hypertension, two of the most common morbidities leading to maternal death for women living in the subcontinent. However, another study involving over 4,000 non-calcium deficient women living in the United States who were given calcium supplementation were studied at a later date and no significant reduction in preeclampsia or hypertension. This dichotomy in research findings may suggest a special and specific role that calcium supplementation has for women living in poorer regions of the world, where malnourishment is severe. 

Nutritional deficiencies play a substantial role in the maternal well-being, complications during the prenatal and postpartum period, as well as during delivery. Nutritional deficiencies including Vitamin D, B12, A, iron and folate in women living in Bangladesh should be considered when studying QOL for women during the postpartum period to retrieve a comprehensive understanding of all underlying confounding variables that influence maternal health and well being. Zinc may also play an important role in reducing risk of severe birthing problems such as premature rupture of membranes, placental abruption, prolonged labor and severe lacerations, although this has not been studied for Bangladeshi women.

Access

In rural areas of Bangladesh, many women are living in poverty are unable to afford medical care and most do not have access to any skilled postpartum care. Furthermore, physicians in Bangladesh elect C-section births more often than necessary as shown in the overall increase in C-section rates reported by the World Health Organization from 2.5% in 2004 to between 15-25% in 2010. The women who undergo such surgical procedures do not understand or overlook the resulting postpartum implications and financial hardships. The reports on the overall health status of women living in rural Bangladesh indicate that nearly 40% of the rural population has basic access to health care and only 12% are receiving some form of postpartum care. In a retrospective study by Koenig et al (2007), it was reported that 48% of the 103,000 Bangladeshi female subjects studied did not receive any type of prenatal or postpartum care. Rural areas provide several barriers to patients that prevent women from receiving prenatal and postpartum care compared to their urban counterparts. Distance, quality, and cost are a few of the most prominent barriers that have exhibited direct negative impact on maternal morbidities and mortality for patients in developing countries.

Non-skilled birth attendants are the only option for many women living in rural regions who are forced to give birth at home because of cultural, monetary, or social expectations. The risk of postpartum morbidities increases because of implementation of the risky birth practices of non-skilled birth attendants. Examples of these practices include: multiple vaginal examinations, practice of “forced gagging to expel the placenta” coupled with heavy pressure (the attendant’s knee or full arm with body weight) on the abdomen or utilizing an object, internal version to change the placement of the baby during delivery, pulling on the umbilical cord, and manual removal of the placenta. These practices cause unnecessary trauma potentially creating postpartum complications such as damage to the perineum, urinary tract, uterus, and other internal visceral structures along with an increased risk of infection.

Socio-economic Status & Geographical Location

Rural areas provide several barriers to patients that prevent women from receiving prenatal and postpartum care compared to their urban counterparts. Distance to health care facilities, quality of services available in local rural health facilities, and cost of prenatal and postpartum care are a few of the most prominent barriers that have exhibited direct negative impact on maternal morbidities and mortality for patients in developing countries.

Socio-economic factors play an important role in birth mode choice by physicians and patients living in Bangladesh. In a retrospective study of 20,000 births in several developing countries, including Bangladesh, women in the wealthiest quintile who had access to prenatal care were more likely to undergo a C-section. Another study of 2164 women regarding inequity in maternal health services in Bangladesh, showed a substantial difference between women according to socio-economic status when considering skilled birth attendance, C-section as mode of birth delivery, and
receipt of postpartum care.31

The National Institute of Population Research and Training (NIPORT) reported that 60% of Bangladeshi women complained of complications related to pregnancy and childbirth (National Institute of Population Research and Training. The large number of complications reported by women living in Bangladesh and the rise of C-section deliveries, may be contributing to the consistent rise in the maternal mortality rate.32

The MDG5 proposes a decrease in maternal mortality ratio by increasing C-sections by the year 2015.33 However, because of the deep socio-economic inequalities that exist within Bangladesh, This goal may be disproportionately target the wealthiest socio-economic quintile, who are able to pay for private hospital care where the majority of C-sections are performed. The poor and undereducated tend to be much less affected.34

In Bangladesh, choice of C-section in Matlab, a region with over 21% CSD in 2001, were more likely to be wealthier women with higher education, with history of high number of prenatal visits, who did not necessarily have a medical need and may lose value in attempts to address the maternal mortality and morbidity rates.35 This relationship of increased C-section with prenatal care in Matlab may indicate an indirect emphasis of the prenatal programs in teaching the benefits of C-section compared to normal vaginal delivery by physicians and organizations that aim to fulfill the goals of improving maternal care by providing antenatal programs for women.

Cost Comparisons by Birth Mode

Cost of care is another prohibitive factor, especially in the rural areas where transportation to a healthcare facility may be several hours by rickshaw or cost of care at the hospital may exceed the family’s yearly income of $590. Real solutions need to be explored for these women to be able to set a standard of care that will be cost effective, culturally accepted, practical, efficient and effective. First, however, there remains a need to explore the actual problems that exist in the postpartum period for women outside of nutritional deficiencies which have been thoroughly explored, compare the effects of mode of birth delivery among cesarean section and vaginal birth delivery on QOL for Bangladeshi women living in rural areas.

The literature suggests that socio-economic factors also play an important role in determining access to surgical options such as C-section. Wealth, defined by the National Demographic Health Survey, is based upon household assets and divided into three quintiles: poor quintile, middle quintile, and wealthiest quintile.36 Only women in the upper wealth quintile have access to caesarean (C-section) services in most regions. This leaves those in the poor and middle quintiles without access to C-sections when indicated, and places them at high risk for mortality and morbidities during delivery and in the postpartum period.

The cost of postpartum care following C-section has been studied in the context of linked postpartum visits with type of birth mode, with results indicating an increase in postpartum visits by 7% and increase in total cost of postpartum care when C-section is performed compared to normal or assisted vaginal delivery modes. Cost analysis of a sample in Madagascar showed an that C-section was cost prohibitive and although reduced maternal mortality rate overall, it increased infant mortality rate by 18%.37

Studies from various developing countries have also shown a substantial burden to families when C-section is considered from a cost perspective. For example, one study of 133 post-partum women living in Islamabad, Pakistan estimated the average monthly household income for families was $149 US dollar equivalents (10,000 rupees at the time of publication) and the average cost of C-section was $161 US dollar equivalents (10,868 rupees) compared to vaginal delivery cost of $79 US dollars (5278 rupees).38 In another study of 438 women living in Kathmandu, the willingness of women to pay for C-section ($157 for normal vaginal delivery and $171 for C-section pre-delivery and $71 NVD and $236 CS post-delivery) compared with vaginal delivery was studied pre and post birth, with resulting increase in reports of willingness to pay for C-section birth post delivery by women indicating a perceived increased value of C-section.39 This study may indicate a higher perception of the value of C-section by the women immediately after birth.

Cost is a major prohibitive factor in delivery options and postpartum care for women living in Bangladesh. If postpartum care can be disseminated within the home environment or local district region, cost effective programs may be established by reducing transportation costs of the patient and creating preventive programs to reduce the risk of co-morbidities.
CONCLUSION

Women living in Bangladesh are at high risk for maternal mortality and morbidity in the postpartum period because of socio-economic barriers. Malnutrition, anemia, poverty, lack of skilled birth attendants, and limited prenatal and postpartum care are some of the issues facing women living in rural Bangladesh. There remains a need for socio-economic relief and policy changes, specific to maternal health in Bangladesh, to fully address maternal mortality and morbidity rates.

REFERENCES


Effect of Sensory-Specific Balance Training in Elderly

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ABSTRACT

Background: Postural control depends upon the ability to extract peripheral sensory inputs, integrating this information within the central nervous system (CNS), coordinate and execute an appropriate motor response. Age related changes in the ability to adjust to alteration in sensory information contribute to impaired postural stability. The purpose of this study was to investigate the effect of sensory-specific balance training on balance in elderly.

Aims: To study the effect of sensory-specific balance training on the balance in elderly.

Settings and design: Prospective longitudinal comparative study carried out at tertiary care hospital, Mumbai.

Materials and Methods: 60 healthy elders were randomly assigned balance training and fall prevention education group. Sensory specific balance training was given for period of 4 weeks. Participants were reassessed at end of 4 weeks. Outcome measures were modified: Clinical Test for Sensory Interaction on Balance, Fullerton advanced balance score, activities specific balance confidence scale and 1 RM.

Statistical analysis: Wilcoxon Signed rank test and Mann Whitney test were used to analyze the difference between the balance scores within group and intergroup

Results: Balance improved significantly in all four conditions of mCTSIB scale following sensory specific balance training(p<0.001) Improvements were seen in Fullerton Advanced Balance score(p<0.001) and Activities Specific Balance Confidence Scale score(p<0.001) but there was no improvement in 1 RM(p>0.001)

Conclusion: From the study it can be concluded that sensory-specific balance training can bring about a significant improvement in balance without any change in the muscle strength.

Key words: Modified CTSIB, Healthy Elderly, Sensory Specific Balance Training.

INTRODUCTION

Postural control depends on the ability to extract peripheral system inputs, integrate this information within the CNS, coordinate and execute an appropriate motor response.

In addition to showing decline in function within the specific sensory systems, research from many laboratories has indicated that some older adults have more difficulty than younger adults in maintaining steadiness; under conditions wherein sensory information for postural control is severely reduced.

One method used to evaluate the contribution of various sensory inputs to postural control and the integrity of the integrative mechanisms within the CNS is Modified Clinical Test of Sensory Interaction on balance.¹

AIM

To study the effect of sensory-specific balance training on the balance in elderly.

MATERIAL

• Medium density foam (10cm)
• Vestibular ball
• Measuring tape
• Metronome (100 bpm)
• Stopwatch
• Stool
• 6” high bench
METHOD

Type of study: Prospective longitudinal comparative study.

Sample size: 60 community dwelling individuals above the age of 65 years.

Inclusion criteria: Healthy adults of age >65 years.

Exclusion criteria: Any musculoskeletal condition involving lower limbs, neurological disorders, cardiovascular condition, systemic disorders, vestibular conditions

Use of any type of assistive device. Uncorrected visual conditions

Participants over 65 years of age and healthy, volunteered. They were recruited from Physiotherapy OPD after screening for inclusion criteria. Assessment consisted of Modified Clinical Test for Sensory Interaction on Balance, Fullerton Advanced Balance Scale, Activities Specific Balance Confidence Scale and 1 RM.

FINDINGS

Kolmogorov-Smirnov test (with Lilliefors’ correction) used for normality testing of data. The data was not found to be normally distributed hence non-parametric tests were used for data analysis.

• Mann-Whitney test was used for intergroup comparison.
• Wilcoxon Signed Rank test was used for intragroup comparison.

DISCUSSION

The results indicate that the ability of older adults to reintegrate sensory inputs is augmented following sensory specific training and this effect is, not likely attributable to an increase in lower extremity strength or activity level.

The significant improvement in all conditions of Modified Clinical Test for Sensory Interaction on Balance, may be argued that enhanced signal arising at level of proprioceptive receptors may account for sensory –specific balance classes were held 3 times per week for 1 hour each for a period of four weeks. The exercise protocol followed the Fall Proof Program which emphasizes static and dynamic balance exercise with transition between different sensory conditions.

The somatosensory system was stressed by giving balance activities on a firm surface with eyes closed. Vestibular system stressed by giving balance activities on compliant surface with eyes closed. Visual system stressed by giving balance activities on compliant surface with visual fixation. Progression was done by reducing the base of support, by adding a secondary task.

30 participants were assigned Fall Prevention Education group. They were assessed on first day and intensive fall prevention education was given on one to one basis and reassessed after 4 weeks.
Table 3. Comparison of Pre & Post mCTSIB conditions between two groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sensory specific balance training</th>
<th>Fall prevention education</th>
<th>Mann–Whitney test applied</th>
<th>U</th>
<th>p-level</th>
<th>Difference is-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-mCTSIB Condition 1 (sec)</td>
<td>Median IQR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-mCTSIB Condition 1 (sec)</td>
<td>30.00 0.00</td>
<td>80.00 7.80</td>
<td>376.0 0.274</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-mCTSIB Condition 2 (sec)</td>
<td>25.57 9.57</td>
<td>22.29 7.11</td>
<td>367.6 0.223</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-mCTSIB Condition 3 (sec)</td>
<td>11.23 8.08</td>
<td>15.03 9.97</td>
<td>365.5 0.212</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-mCTSIB Condition 4 (sec)</td>
<td>5.20 3.87</td>
<td>7.23 8.06</td>
<td>342.5 0.112</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-mCTSIB Condition total (sec)</td>
<td>72.82 26.02</td>
<td>74.40 29.94</td>
<td>424.0 0.701</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-mCTSIB Condition 1 (sec)</td>
<td>30.00 0.00</td>
<td>30.00 7.99</td>
<td>254.0 1.940E-03</td>
<td>Sig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-mCTSIB Condition 2 (sec)</td>
<td>30.00 0.00</td>
<td>22.80 7.00</td>
<td>127.0 1.795E-06</td>
<td>Sig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-mCTSIB Condition 3 (sec)</td>
<td>27.60 7.99</td>
<td>14.11 10.90</td>
<td>74.0 2.714E-08</td>
<td>Sig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-mCTSIB Condition 4 (sec)</td>
<td>20.12 7.95</td>
<td>7.76 6.72</td>
<td>18.0 8.021E-08</td>
<td>Sig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-mCTSIB Condition total (sec)</td>
<td>104.48 16.10</td>
<td>75.84 27.60</td>
<td>62.0 8.862E-09</td>
<td>Sig</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*NS: Not Significant, *Sig: Significant

Statistical analysis was done using Wilcoxon Signed Rank Test showed significant differences in all conditions higher in SSBT than FPE group.

Table 4. Comparison of mCTSIB, FAB & ABC in Sensory specific balance training group

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sensory specific balance training</th>
<th>Wilcoxon Signed Rank Test applied</th>
<th>Median IQR</th>
<th>Z</th>
<th>p-level</th>
<th>Difference is-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-mCTSIB</td>
<td>72.82 26.02</td>
<td>-4.782 1.732E-06</td>
<td>1.00</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-mCTSIB</td>
<td>104.48 16.10</td>
<td>-4.784 1.717E-06</td>
<td>1.00</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-FAB</td>
<td>9.00 7.00</td>
<td>-4.791 1.659E-06</td>
<td>1.00</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-FAB</td>
<td>19.50 7.00</td>
<td>-4.703 2.561E-06</td>
<td>1.00</td>
<td>Significant</td>
<td></td>
<td></td>
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<tr>
<td>Pre-ABC</td>
<td>67.34 20.44</td>
<td>-4.784 1.717E-06</td>
<td>1.00</td>
<td>Significant</td>
<td></td>
<td></td>
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<tr>
<td>Post-ABC</td>
<td>69.69 19.25</td>
<td>-3.1082 0.0019</td>
<td>1.00</td>
<td>Significant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical analysis done using Wilcoxon Signed Rank Test showed significant difference in the pre and post intervention measures for mCTSIB, FAB & ABC in Sensory Specific Balance Training group.

Table 5. Comparison of Pre & Post hip extensors & abductors and Knee extensors1RM in Sensory specific balance training group

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sensory specific balance training</th>
<th>Wilcoxon Signed Rank Test applied</th>
<th>Median IQR</th>
<th>Z</th>
<th>p-level</th>
<th>Difference is-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Hip extensors (kg)</td>
<td>5.00 1.00</td>
<td>0.000 1.000</td>
<td>Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Hip extensors (kg)</td>
<td>5.00 1.00</td>
<td>0.000 1.000</td>
<td>Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Hip abductors (kg)</td>
<td>6.00 1.00</td>
<td>-0.572 0.564</td>
<td>Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Hip abductors (kg)</td>
<td>6.00 1.00</td>
<td>-0.572 0.564</td>
<td>Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Knee extensors (kg)</td>
<td>7.00 0.50</td>
<td>0.000 1.000</td>
<td>Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Knee extensors (kg)</td>
<td>7.00 0.50</td>
<td>0.000 1.000</td>
<td>Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical analysis was done using Wilcoxon Signed Rank Test showed no significant difference in per and post hip extensors & abductors and knee extensors 1RM in sensory specific balance training group.
postural improvements. A study performed by Westlake on Sensory-specific balance training on older adults—Effect on position, movement and velocity sense at the ankle\(^7\), showed a short term improvement in velocity sense but no improvement in movement and position sense may be achieved following a balance exercise intervention. With only one of three proprioceptive measures indicating improvement with training, it was difficult to ascribe training effect at peripheral level. But, without sufficient physiological evidence from the receptor isolation techniques, such as microneurography, the possibility of an increase in the discharge of these receptors cannot be discounted.

A probable explanation is an increase during the training intervention, in attention allocated to sensory cues (explicit learning), which eventually led to a less attentionally demanding recovery of postural stability (implicit learning)\(^8\).

Several authors\(^9,10\) have proposed impaired balance in elderly lies in age related changes in central integration mechanisms. During exercise intervention in present study sensory inputs were manipulated by altering the support surface or by reducing the sensory redundancy of visual and vestibular system; these manipulation force the participants to effectively reweigh remaining inputs within the CNS.

Evidence of similarly enhanced central integration following sensory training has been found in studies demonstrating improved stability during the manipulation of somatosensory, vestibular or visual systems or all these by use of sensory organization test.

The neurological basis of intersensory interaction, for postural control is not fully understood. An interaction among the visual, vestibular and somatosensory system could occur wherever convergence of the sensory inputs may be found. In turn, sensory convergence is found at many levels of CNS, including the vestibular nuclei, the thalamus, the cerebellum and the cerebrum.

The vestibular nuclei in the brainstem receive peripheral sensory information from neck proprioceptive afferents and the labyrinth. Visual and vestibular interaction also occurs at vestibular nuclei.\(^11\) This effect has been correlated with the activity of the neck and the leg extensor muscles. Thus, sensory convergence occurs in the vestibular nuclei and intersensory interaction result in the modulation of the neuron activity and subsequent adjustment of the muscle activities related to postural control.

An interaction among sensory systems also occurs at higher level in the central nervous system. For example, due to interaction of the visual and vestibular inputs a person perceives visually detected object motion as self motion. Straube and Brandt\(^12\) found that, patients with lesion in the primary visual cortex (i.e. Homonymous hemianopsia) or the vestibular cortex (e.g. Tumours) did not exhibit object motion induced body tilt. Thus, direct visual and vestibular sensory interactions appear to occur within the cerebral cortex.

Outputs from the vestibular nuclei and the cerebral cortex converge in the cerebellum\(^13\). The vermal cortex of the anterior lobe of the cerebellum is intimately related to the neuronal structure involved in the postural control. Patient with deficits in the anterior lobe of the cerebellum have demonstrated deficits in the postural control. Nashner and Grimm demonstrated that cerebellar patients lost their ability to adapt and control postural muscle response gains. Due to the fact that cerebellum receives input from both the motor cortex and spinal cord and that postural control deficits are associated with cerebellar lesions, the cerebellum could play an important role in motor learning (adaptation) and that sensory interaction necessary for postural control.

In current study, it was determined that older adults could significantly improve their postural stability under complex sensory training conditions.

This result suggests that the integrative ability of the higher brain center was enhanced. Other studies have demonstrated that higher brain centers retain the plasticity at the molecular level and that practice can induce the modulation of neuronal activity in the cerebellum\(^14,15\).

For this study, it is possible that the older adults were able to optimize intersensory interaction within the higher brain centers, where in turn increased the sensory convergence occurred followed the sensory balance training. Thus, the older adults were able to reweigh their sensory inputs and to select reliable sensory information for postural control under changing sensory conditions. Since, the cerebellum receives both the ascending inputs from the spinal cord and descending inputs from the cerebrum, it is a likely candidate as the control center for this improvement.

The functional significance of the results of this study is evident because of improvement in the Fullerton Advanced Balance Scale scores in the intergroup comparison between the balance training
group and the Fall Prevention Education group. These results demonstrate the responsiveness to the training.

Improvement in postural stability and balance lead to increase in balance confidence post intervention in the exercise group. The decrease in balance confidence in the education group may be explained by discussion centered on effective means of reducing fall risk. An increase awareness of the topic may have underscored the apprehension experienced during functional balance task until changes be implemented. Two recent studies examining the effectiveness of fall prevention education reported similar finding, with almost half of the participants demonstrating increase in fear of falling and 28% increase in one or more falls at follow up.

While the study has demonstrated the improvement in balance following sensory specific balance training in healthy elderly, further research may include a group of elderly with declining balance to assess the effect of training and also the carry over effect of the training in elderly.

**CONCLUSION**

From the study it can be concluded that sensory-specific balance training can bring about a significant improvement in balance without any change in the muscle strength.

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A Comparative Study of Early Intervention Programme vs Home Intervention Programme in Preterm Infants

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ABSTRACT

Background: Prematurity as defined by the World Health Organization (WHO) is a baby born before 37 weeks of gestation counting from the first day of the last menstrual period. Infants born at early gestational ages (<32 weeks), when compared with later ages (32-36) weeks scored lower on tests of gross motor development. So mild abnormalities detected in first few months would improve with early intervention programme.

Methods: The preterm infants born before 37 gestational weeks and having APGAR score above 7 (after 5 minutes) were randomly selected and divided into two groups (N=15). Early developmental intervention programme was given to one group and home intervention programme was given to other group (control group). The outcome measure was Gross Motor Function Measure.

Results: According to the need of the study unpaired t-test was applied and significant improvement was seen.

Conclusion: Greater improvement in motor performance of preterm infants who received the early intervention programme when compared with home intervention was revealed.

Keywords: Preterm, Motor Development, Gross Motor Function Measure, Motor Delay, Early intervention, Home intervention

INTRODUCTION

‘Prematurity’ as defined by the World Health Organisation (WHO) is a baby born before 37 weeks of gestation counting from the first day of the last menstrual period. There are three main classes: babies born before 37 weeks are premature babies, babies born between 35 and 37 weeks are moderately premature, babies born between 24 and 28 weeks are very premature. Preterm infants are at greater risk of reduced rate of physical growth, language development delay, balance and motor co-ordination deficits.

Between 3% and 4% of babies are born preterm. Almost all of them weigh less than 2500 gram and therefore, also known as low birth weight babies. They provide the great majority of work in neonatal units and it is in this group that 60% of all neonatal deaths occur. Among the developing countries India has a very high evidence of preterm labor i.e. 23.3% and the rate of preterm birth is approximately 21%. It has been estimated that 9.6% of all births were preterm in 2005, which translates to about 12.9 million birth definable as preterm. The regional toll of preterm birth is particularly heavy for Africa and Asia where over 85% all preterm birth occurs.

Preterm birth has been considered to be one of the risk factors for developmental disabilities. The preterm infants has poor quality postural stability and mobility which may be related to differences in experiences such as longer hospital stays, neurological impairment associated with medical complications or immobility due to constraints of medical technology. The motor delay in infants has capitivated the interest of researcher. Study related to physiotherapy is gaining great importance in recent years to prevent motor delay and deciding early interventions for infants. Therefore, development programs for this preterm born infant population are thought to be of value to compensate for the disadvantages of their preterm birth.
Although the cause of most spontaneous preterm birth is not identified, some predisposing factors are known. They include: Chronic Preeclampsia (High B.P pregnancy), chronic medical illness (Heart or Kidney), Infections (group B streptococcus, urinary tract infection, vaginal infection, infection’s of fetal / placental tissue), drug use (cocaine) and alcohol, abnormal structure of uterus, previous preterm birth maternal age below 18 years and multiple pregnancy 18. Being born prematurely places the infant at a higher risk of complications that are specific to a preterm infant. The shorter the length of gestation the greater the risk for complications 1.

The preterm infant's central nervous system is not fully developed at birth and the acquisition of motor control and skill follows upon a progressive change in the nervous system. Nerve fibres grow new connections between the nerve cells and neurotransmitters become operative, brain growth is characterized by changes in synaptic connections apparently depending upon stimulation and use 10.

“Early intervention” is a term commonly used to encompass a system of services delivered to children with, or at risk for, developmental delays in the early stage of life. These services include physical, occupational, psychological and speech therapy, family support, counseling and education. Benefits of early intervention have been repeatedly demonstrated through quality research studies. Early intervention programs are designed to enhance the developmental competence of participants and to prevent or minimize developmental delays. Children targeted for early intervention may either include environmentally or biologically vulnerable children, or those with established developmental deficits. There is growing concensus based on the best available evidence that early interventions can exert moderate positive effects 2.

Physiotherapists have several choices in providing developmental intervention for preterm born infants. It has been shown that appropriate activities during early period of life may play important role in muscle fibre differentiation and subsequent hypertrophy as well as being effective in promoting the infant’s further development during the first year of life 9.

Home programs include intervention which is being taught to the parents for the benefit of their premature infants. Home programs and parent education have been integrated into developmental follow up programs. Manual for parents have been developed to emphasize the elements of the programs 23.

The aim and objective of the study is to evaluate the efficacy of early developmental intervention programme over the home intervention programme in preterm infants.

**METHODS**

**Study design:** A randomized controlled trial was conducted to evaluate effect of early intervention programme and home intervention programme in preterm infants.

**Study settings:** The study was performed at outpatient department of Physiotherapy, inpatient department and outpatient department of Pediatrics at Gian Sagar Medical College and Hospital, Ram Nagar, Banur

**Procedure:** Ethical approval for this study was obtained from Institution Ethics Committee, Gian Sagar Medical College and Hospital, Ram Nagar, Rajpura, Distt. Patiala. 30 preterm infants were selected for the study. The inclusion criteria of this study was baby born before 37 weeks gestation, APGAR score above 7, birth reflexes normal and no post natal, peri natal and anti natal trauma. The exclusion criteria of the study included those subjects having any congenital abnormality, twins, triplets and child undergone any surgery. Subjects selected from pre assessment form were then allocated in to two groups (N = 15 in each group). All subject’s care takers read and signed an informed consent form for participation in the study.

**Interventions:** A developmental physiotherapy programme was specially selected and modified for both the groups of preterm infants in this study. The protocol was once a day, thrice a week, 30-40 minutes per session for 4 months. To maintain the consistency of intervention provided for each infant, the number of activities per month and aims of activities in each month were the same for each intervention infant at each specific age. Subjects in group A was given with early intervention programme. Subjects in group B undergone home intervention programme.

**Outcome measure:** The outcome measure was Gross Motor Function Measure. The GMFM is a clinical tool to evaluate change in gross motor function in children. The motor skills in GMFM are typical of normal developmental milestone. The assessment for both the groups was done on monthly basis after
giving the interventions. The score sheet for each subject was maintained on regularly.

Since the home intervention programme consisted of a program of home based activities, demonstrations and practice session were provided to infants primary care-givers to ensure the correct performance at home. The first intervention was provided after the discharge from hospital. Subsequent interventions were provided at one, two, three and four month’s age. Prior to presenting the new home programme to the care-givers, evaluation of the previous month’s home programme was being done.

**Early intervention programme (Group A)**

0-1 Month: - To make infant enjoy various position.
(Instruction in the use of variety of positions like prone lying and side lying for playing and sleeping.

1-2 Month: - To promote eye following to strengthen the neck muscles. (With the child’s head over the edge present him with interesting visual and auditory stimuli, slightly above him and also in front of non preferred side).

Carrying in supported sitting position over the therapist arm.

2-3 Month: - Bring the shoulder of infant toward the spine-this provokes him to head raise. (If the child persists in abnormal turning provokes him to head raise to one side, then extend the shoulder girdle on the opposite side to provoke head turn and rise to that side).

Weight bearing on forearm will also help the child’s head control. (Give adequate support the child chest to prevent him hunching his shoulder).

**Home intervention programme (Group B)**

0-1 Month: - To make infant enjoy various position.
(Instruction in the use of a variety of positions for playing and sleeping).

1-2 Month: - Assisted kicking

2-3 Month: - Place wedge on a table so that child can see someone face when he looks up to promote neck extensors.

**RESULTS**

The mean gestational age of subjects was 33.25 weeks, with 37.2% females and 58.9% males. The data obtained was tabulated and statistically analyzed. All data was expressed as mean ± standard deviation. Standard deviation was useful in comparing variability of two series and to find out which series was more consistent, more stable and more variable. Depending upon the nature of study, size of sample and nature of hypothesis unpaired t- test was applied.

The figure is showing the difference between gross motor function measure of group A (early intervention group) and group B (home intervention group). The mean score of group A is 14.33 and for group B is 12.43. The combined standard deviation and standard error is 1.018 and 0.356 respectively. From these values t calculated is 5.27 which is more than t tabulated.

**DISCUSSION**

In this study, effect of intervention programme in preterm infants was seen. The gestational age, birth weight showed no significant differences between the two groups. The mean birth weight of subjects in early developmental intervention group (2046.6 g) was little higher than the home intervention group (1890.625 g). Other factors like triplets or more, any congenital abnormality (cardiac or orthopedic) and APGAR below 5 were excluded from the study. In short, early intervention group and home intervention group were comparable.

In our study the improvement in the motor development of early intervention group was better than home intervention group indicating the effect of motor development programme.

**Early intervention in premature infants can lower the risk of motor delay:** As a result the more immature the brain, the greater the plasticity15. From the first day of life, children begin using their bodies to learn about the world around them. It has been suggested that
sensory and motor experiences are the basis for all intellectual functioning for approximately the first 2 years of life. As children continue to mature, their reliance on physical interactions with people and objects remains strong. Motor skills are an essential component of development for all children.

Early intervention plays a significant role in achieving milestone in preterm infants according to their chronological age. It helps in enhancing child’s motor skills. Early intervention also helps in preventing secondary problems and further developmental delay which may otherwise result in difficulties in feeding, inappropriate movement patterns and interfering with normal development and deformities. The present study therefore supports other reports of effectiveness of intervention during the early life of infants born preterm.

The beneficial effect of intervention program when offered to a similar population of preterm born infants was also proved. Another study stated the importance of physical therapy treatment in preterm infants. These studies significantly support our study.

The monthly assessment is done by Gross Motor Function Measure. Assessment is an ongoing procedure which identifies the child’s unique needs and needs related to the development of the child and nature extent of early intervention services that are needed by the child and the child’s family.

In infants and young children, motor development and development of cognition, language, behavior and emotion supplement each other and are closely related. Therefore early rehabilitation of preterm has changed from the treatment of individual system to a wide range of plans, all round guidance. Regular follow up can discover beneficial results.

Limitations: The sample size of the study is small. The subjects were selected as babies born before 37 weeks of gestation. The further sub classification of the subjects would have been done into moderate preterm and extremely preterm because there is lot of difference between infant born at 35 weeks gestation and infant born at 27 weeks gestation. More over there was certain practical difficulties during giving interventions to the child like uncooperation etc. And due to limited resources sophisticated measures cannot be used for detection of motor development.

Implication: The study can be implicated in term infants also where there is any chance of motor delay. Although there are several researches being done which shows both benefits and limitations of the interventions. This study proves the benefit of early developmental intervention in preterm infants to facilitate motor development. Early interventions can prevent motor delays. This protocol can be used in low birth weight or extremely low birth weight infants. It can be used in cerebral palsy, downs syndrome or any neuromuscular disorder which leads to motor delay. The protocol should be followed as compulsory follow up so as to get adequate benefit of the intervention.

CONCLUSION

Effectiveness of early intervention programme and home intervention programme was examined in preterm infants using a randomised controlled trial. Greater improvement in motor performance of preterm infants who received the early intervention programme when compared with home intervention was revealed. These are helpful in strengthening the health of baby and also promoting the development of high risk infant. Thus, the follow up early intervention programme was found to be useful in promoting motor performance of preterm infants during the early stage of life.

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control in pre term infants in the first six months. Physical and Occupational Therapy in Pediatrics, 13; 1-17.
A Study to Compare the Effectiveness of Conventional Treatment Versus Temporomandibular Joint Mobilization in Patients with Temporomandibular Joint Disorders

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ABSTRACT

Background: Temporomandibular disorders (TMDs) refers to a group of disorders affecting the temporomandibular joint (TMJ), masticator muscles and the associated structures. These disorders share the symptoms of pain and limited mouth opening due to oral sub mucosal fibrosis (OSMF). So in each group taken both type of patients, 10 patients having TMJ pain and 10 patients having OSMF. Patient having TMJ pain given conventional therapy in form of Ultrasound and isometric exercises and patients having OSMF given Ultrasound and stretching exercises.

Mobilizations are indicated when the assessment has illuminated any of the following: pain, progressive limitations of functional mobility, post arthroscopic TMJ surgery, reversible joint hypo mobility, or muscle guarding or spasm.

Objectives: To study the effects of a TMJ mobilization programme in relieving pain and on improving maximal mouth opening in patients with TMJ disorders.

Methods: Study included 40 patients with temporomandibular disorders between age group 20-40 years. The subjects were randomly divided into 2 groups: Group - A and Group - B. They were treated for 3 weeks, 6 days a week once daily. Pain was assessed by Visual Analogue Scale and maximal mouth opening was measured as an objective outcome with the special scale.

Results: Results showed significant improvement in VAS and in maximal mouth opening in both groups. Comparison of Group A and Group B was done with Wilcoxon Rank sum test (Mann Whitney U test) and unpaired t-test, Group B showed significant improvement in VAS (P=0.0047) and in maximal mouth opening (P=0.0383)

Conclusion: TMJ mobilization programme along with conventional physical therapy intervention is more effective in relieving pain and improving maximal mouth opening than conventional physical therapy alone in patients with temporomandibular disorders.

Key words: TMJ mobilization, OSMF, TMJ Ankylosis

INTRODUCTION

Temporomandibular disorders (TMD), or temporomandibular joint syndrome, is the most common cause of facial pain after toothache. In the past, many physicians called this condition TMJ syndrome.

Highest incidence is among young adults, Furthermore, unlike similar diseases of other joints, which also have a greater female predilection but occur post-menopausal, a large proportion of women with TMDs are between twenty and forty years of age. The reasons for this marked sexual dimorphism and age distribution remain unclear.

The three cardinal symptoms of TMJ disorders are: facial pain, restricted jaw function and joint noise. Simple treatment, involving self-care practices, rehabilitation aimed at eliminating muscle spasms, and restoring correct coordination, is all that is required. Non-steroidal anti-inflammatory analgesics (NSAIDs) should be used on a short-term, regular basis and not on an as needed basis.

The treatment of chronic TMD is difficult and there are various surgical treatment options available depending the course of the disease like Arthroscopic surgery and Open surgery which include Hemi or Total plastic replacement (arthroplasty), disk repositioning and placation, and Myrhaug technique.
ORAL SUBMUCOSAL FIBROSIS

Oral sub mucous fibrosis (OSMF) is a chronic debilitating disease of the oral cavity characterized by inflammation and progressive fibrosis of the sub mucosal tissues. OSMF results in marked rigidity and an eventual inability to open the mouth. The buccal mucosa is the most commonly involved site, but any part of the oral cavity can be involved, even the pharynx. Symptoms of oral sub mucous fibrosis include the following:

• Progressive inability to open the mouth (trismus) due to oral fibrosis and scarring
• Oral pain
• Dryness of the mouth

The treatment of patients with OSMF at a very early stage, cessation of the habit is sufficient. Most patients with OSMF present with moderate-to-severe disease, which is irreversible. Medical treatment is symptomatic and predominantly aimed at improving mouth movements. Treatment strategies include steroids, placental extracts & hyaluronidase. Surgical modalities that have been used include simple excision of the fibrous bands, split-thickness skin grafting following bilateral temporalis myotomy or coronoidectomy, nasolabial flaps and lingual pedicle flaps.

Physical therapy: The main goal of physical therapy is to stabilize the joint and restore its mobility, strength, endurance, and function.

• Stretching exercises: Physical therapy using muscle-stretching exercises for the mouth may be helpful in preventing further limitation of mouth movements. This is often combined with medical and surgical therapy.
• Ultrasonic treatment: Ultrasonic waves produce tissue heating at a deeper level than moist heat. To be effective, ultrasonic treatment should be done every other day, using about 1 watt/cm² for approximately 10 minutes over the affected muscles and joints.

Rationale and Indications for Use of Isometric Exercise:

• To prevent or minimize muscle atrophy.
• To develop postural or joint stability.
• To develop static muscle strength at particular points in the ROM

The Use of Manual Therapy as a Treatment Technique: Mobilizations are indicated when the assessment has illuminated any of the following: pain, progressive limitations of functional mobility, post arthroscopic TMJ surgery, reversible joint hypomobility, or muscle guarding or spasm. Shin BC et al (2007) investigated the effects of combining manual therapy and acupuncture on the pain and maximal mouth opening (MMO), which were associated with temporomandibular joint dysfunction.

• Grades I and II are primarily used for treating joints limited by pain. The oscillations may have an inhibitory effect on the perception of painful stimuli by repetitively stimulating mechanoreceptors that block nociceptive pathways at the spinal cord or brainstem levels. These nonstretch motions help move synovial fluid to improve nutrition to the cartilage.
• Grades III and IV are primarily used as stretching maneuvers.

MATERIAL AND METHODS

STUDY DESIGN

An interventional study

STUDY SETTING

This study was conducted in the Institute where I am working. All the patients were referred from orthopedic hospitals and dental hospitals.

SAMPLE DESIGN:

Simple random sampling

STUDY DURATION

The patients were treated in physiotherapy department, daily (6 days/week) for a period of 3 weeks, one session daily. The patients also performed the exercise programmes at home.

SAMPLE SIZE

The sample size of 40 patients was divided into two groups.

Group A: 20 patients. (20 patients further divided into two subgroups of 10 patients)

Group B: 20 patients. (20 patients further divided into two subgroups of 10 patients)
INCLUSION CRITERIA:
- Pain in TMJ
- Patients diagnosed as oral sub mucous fibrosis by qualified dental surgeon or ENT specialist (stage 3)
- Age: 20-40 years
- Sex: both sex
- Patients who are able to comprehend command
- Patients who are willing to participate in the study

EXCLUSION CRITERIA:
- Fracture around TMJ
- Any surgical procedure around TMJ
- Dislocation or subluxation of TMJ
- Any neurological disorder.
- Malignancy or referred pain of cervical origin

MATERIALS USED IN THE STUDY
- Consent form
- VAS Scale
- Millimeter Ruler
- Tongue blades
- Data collection sheet
- Coupling gel and spirit
- Cotton swabs
- Treatment couch
- Paper, Pen
- Canon Power Shot A470 Digital Camera.

INSTRUMENTS
- Mouth opening device
- Ultrasound Machine

METHODOLOGY

ASSESSMENT
Pre participation evaluation form consisted of VAS for patients having TMJ pain and MAXIMAL MOUTH OPENING (MMO) for patients having restricted mouth opening due to OSMF and assessment which included chief complaint, history etc & grades of mobilization.

CLINICAL INTERVENTION:
Study participants were requested to continue normal activities and avoid other forms of treatment for the duration of the study, apart from routine physician management.

GROUP A - Control group
Patients were given Conventional therapy.
Total 20 patients in this group.
10 patients of TMJ pain given Ultrasound and isometric exercises.
10 patients having OSMF given Ultrasound and stretching exercises.

Group B - Experimental Group:
Patients were given mobilization along with Conventional therapy.
Total 20 patients in this group, 10 patients having TMJ pain and 10 patients having OSMF.
10 patients having TMJ pain given Maitland mobilization and conventional therapy in form of Ultrasound and isometric exercises.
10 patients having OSMF given Maitland mobilization and conventional therapy in form of Ultrasound and stretching exercises.

The treatment for each group was continued for 3 weeks. Clinical examination were done with the exactly same protocols after the treatment period i.e. at the end of 3 weeks to measure VAS for TMJ pain patients and MMO in OSMF patients in both control and experimental group.

Treatment Protocol for Osmf Patients
ULTRASOUND: Mode: Pulsed, Frequency: 3 MHz, Intensity: 0.5 Watt/cm² Duration: 3-5 minutes/session. The radiated area was 5 cm² over the affected part of TMJ. Use of mouth opening device to provide stretch during application of US.

STRETCHING EXERCISES
1) With the use of mouth opening device
Patient’s position: supine. Mouth opening device was placed between upper and lower teeth if there is unilateral involvement and between incisors in
bilateral involvement and gradually open the mouth using lever of device. Held for 20 seconds. 4-5 repetitions per session. Active mouth opening exercise performed in between the stretch.

2) Active – passive stretching

**Patient’s Position: supine or sitting**

The patient is instructed to actively open the mouth as wide as possible within the pain free limit, as slowly as she/he can 2-3 times. The opening position should be held for 5 seconds followed by relaxation in the rest position for 5 seconds.

In passive stretch patient is instructed to actively open the mouth. Then finger pressure is applied by therapist to the maxillary and mandibular dentitions with use of thumb and index finger.

Stretching exercises should be performed at home using tongue blades for 5-10 minutes 3-4 repetitions 4 times in a day.

**ULTRASOUND**

Mode: Pulsed
Frequency: 3 MHz
Intensity: 1 Watt/ cm²
Duration: 3-5 minutes/ session

The radiated area was 5 cm² over the affected part of TMJ.

**ISOMETRIC EXERCISES**

Resistance applied to the opening, closing, lateral and protrusive movements. Hold for 6-10 seconds for 10 times for each movement.

**MAITLAND MOBILIZATION**

For group B along with conventional treatment Maitland mobilization given.

1) **Caudal glide:**

**Patient’s position: supine or sitting**

Therapist’s position: stands at patient’s side. Hand and forearm are placed around patient’s head, Fixating head against the table. With the thumb in the mouth over the left inferior molars and with the fingers outside around the patient’s jaw.

Movement – while maintaining the forearm in a straight line, apply traction caudally.

2) **Ventral glide:**

The therapist’s hand placements are same as above.

The therapist’s hand translates the mandible anteriorly after giving distraction.

It can be given extra orally by applying the pressure by using the pulp of the thumbs put posterior to the head of the mandible and applying pressure anteriorly

3) **Medial- Lateral glide:**

**Patient’s position: supine or sitting**

Therapist: stands at patient’s side. Hand and forearm are placed around patient’s head, Fixating head against the table. With the thumb on medial aspect of body of mandible near the right inferior molars, with the fingers wrapped around jaw.

Movement: with the thumb force the mandible laterally, simultaneously there is medial glide of contralateral side.

All these glides can be performed extra orally if there is insufficient mouth opening.

It can be given extra orally by applying the pressure from the lateral side of the head of the mandible towards medially using pulp of the thumbs.

2-4 repetitions of mobilization per treatment. 6-10 movements.

**DOSAGE**

For patients having TMJ pain – grade I- II mobilization. For patients having OSMF –grade III— IV mobilization
RESULTS

Data analysis was performed manually as well as by using Graph Pad Prism 5.03 software.

Table 1.1. Age distribution of the patients having pain

<table>
<thead>
<tr>
<th>Age</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (years)</td>
<td>26.40</td>
<td>26.30</td>
</tr>
<tr>
<td>SD</td>
<td>4.401</td>
<td>6.334</td>
</tr>
</tbody>
</table>

Table 1.2. Age distribution of the patients having restricted mouth opening

<table>
<thead>
<tr>
<th>Age</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>SD</td>
<td>4.401</td>
<td>6.334</td>
</tr>
</tbody>
</table>

Table 1.3. Comparison of pre treatment and post treatment pain scores as on VAS within Group A and Group B

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre treatment</th>
<th>Post treatment</th>
<th>W value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td>5.80</td>
<td>1.549</td>
<td>3.70</td>
<td>1.252</td>
</tr>
<tr>
<td>Group B</td>
<td>4.70</td>
<td>1.337</td>
<td>1.90</td>
<td>0.9944</td>
</tr>
</tbody>
</table>

Since the data was not normally distributed, Wilcoxon matched-pairs signed test was applied for comparison of pre treatment and post treatment pain scores as on VAS within Group A and Group B.

For group A, the Sum of all signed ranks W = 55.00 and the two-tailed p value is 0.0051, considered extremely significant.

For group B, the Sum of all signed ranks W = 55.00 and the two-tailed p value is 0.0053, considered extremely significant.

Table 1.4. Comparison of post treatment VAS score between Group A and Group B

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>W value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>3.70</td>
<td>1.252</td>
<td>142</td>
<td>0.0047</td>
</tr>
<tr>
<td>Group B</td>
<td>1.90</td>
<td>0.9944</td>
<td>68</td>
<td></td>
</tr>
</tbody>
</table>

Since the data was not normally distributed, Wilcoxon ranked sum (Mann-Whitney) test was applied for comparison of post treatment VAS score between Group A and Group B.

Sum of ranks in group A = 142.00 and sum of ranks in group B = 68.00.

The two-tailed p value is 0.0047, considered significant.

Data Analysis of Maximal Mouth Opening

Table 1.5. Comparison of pre treatment and post treatment maximal mouth opening within Group A and Group B

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre treatment maximal mouth opening (in mm.)</th>
<th>Post treatment maximal mouth opening (in mm.)</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Group A</td>
<td>22.00</td>
<td>3.742</td>
<td>26.20</td>
<td>2.974</td>
</tr>
<tr>
<td>Group B</td>
<td>20.30</td>
<td>4.644</td>
<td>31.10</td>
<td>6.262</td>
</tr>
</tbody>
</table>

Paired t test was applied for comparison of pre treatment and post treatment maximal mouth opening within Group A and Group B.
For group A, \( t = 3.500 \) with 9 degrees of freedom and the two-tailed p value is 0.0067, considered extremely significant.

For group B, \( t = 9.970 \) with 9 degrees of freedom and the two-tailed p value is <0.0001, considered significant.

Table 1.6: Comparison of post treatment maximal mouth opening between Group A and Group B

| Group   | Mean ± SD | \( t \) value | p value
|---------|-----------|---------------|--------
| Group A | 26.20 ± 2.974 | 2.235 with 18 d.f. | 0.0383 |
| Group B | 31.10 ± 6.262 | | |

Unpaired t test was applied for comparison of post treatment maximal mouth opening between Group A and Group B.

\( t = 2.235 \) with 18 degrees of freedom and the two-tailed p value is 0.0383, considered significant.

FOR GROUP A:

| Scale | Pre treatment Mean ± SD | Post treatment Mean ± SD | W / t value | p value
|-------|-------------------------|--------------------------|-------------|--------
| VAS   | 5.800 ± 1.549           | 3.700 ± 1.252            | 55          | 0.0051 |
| MMO   | 22.00 ± 3.7427          | 26.20 ± 2.974            | 3.500 (9 d.f.) | 0.0067 |

FOR GROUP B:

| Scale | Pre treatment Mean ± SD | Post treatment Mean ± SD | W / t value | p value
|-------|-------------------------|--------------------------|-------------|--------
| VAS   | 4.700 ± 1.337           | 1.900 ± 0.9944           | 55          | 0.0053 |
| MMO   | 20.30 ± 4.644           | 31.10 ± 6.262            | 9.970 (9 d.f.) | <0.0001 |

On Comparing Between Group A and Group B:

| Scale | p value
|-------|--------
| VAS   | 0.0047 |
| Maximal mouth opening | 0.0383 |

The p values are significant, which suggests that there is statistically significant difference between the groups A and B.

It was concluded that TJM treatment is significantly effective in relieving pain and improving mouth opening in patients with TMJ Disorders.

CONCLUSION

It is concluded that both the groups showed significant improvement in pain and mouth opening. But TMJ Mobilization along with Conventional Therapy showed significant improvement in pain and on mouth opening than conventional physical therapy alone.

ACKNOWLEDGEMENTS

I would like to thank Dr vinit (Assistant Physiotherapist) and I am grateful to all my patients for their kind co-operation and willingness to participate in this study, without whom this study would not have materialized.

Conflict of Interest

The authors perceive no conflict of interest in this study.

REFERENCES

INTRODUCTION

Heart Failure is a pathological state in which an abnormality of cardiac function is responsible for the failure of heart to pump at the rate commensurate with the requirements of metabolizing tissues or can so do with from an abnormally elevated filling pressures. In India, 18.8 million people (i.e.1.76% population) are known cases of heart failure. The Incidence is 1.57 million people/year (i.e.0.15% of population). It represents growing health problem. Despite currently available pharmacological strategies advances in surgical management, prognosis for patients with overt heart failure remains dismissal. About half of patients with heart failure die within 4 years of diagnosis and among group of advanced failure more than 50% die within one year. In addition to development and implementation of cost effective program that prevent development of heart failure, there is also need for development of palliative Care along with individualized and supportive care. To this will acknowledge the positive role of Cardiac Rehabilitation in treating Heart Failure.

Need for the study: There is very limited research available showing the contributory role of Home Walking Exercise program alone as modality of exercise training in Left ventricular failure patients. Walking is an aerobic activity that is a part of every individuals daily living. It does not require specialized equipments, setup and is cost effective and realistic. In such situations, the effectiveness of Home Walking Exercise programs and possible outcomes in the Functional Status and Quality of life needs to be demonstrated.

AIM

To study the Effect of Home Based walking rehabilitation on 6 Minute Walk distance and Quality of Life in Left Ventricular Failure patients.

OBJECTIVES

To study and compare improvement in 6 Min Walk Distance and LVD-36 (QOL) after 8 weeks of training in LVF.

Study Design: Prospective Randomized Controlled Trial

Place of study: Physiotherapy Cardiopulmonary Rehabilitation OPD, Cardiovascular and Thoracic Centre, Seth G S Medical College & KEM Hospital, Parel, Mumbai 400012

ABSTRACT

A randomized control trial wherein 50 Left ventricular failure patients were included with ejection fraction 15-40%. A home based exercise programme was designed on the basis of 6MWD for the training group and the control group carried out usual activities with no specified programme for 8 weeks. Outcome measures were 6MWD and QOL using LVD36 pre and post programme. In the training group, 6MWD increased from 329.6±120.63 mts to 394 ± 122.82mts (p<.001). This increase is highly statistically significant and indicates improvement in exercise performance. In control and training groups, LVD-36 score decreased (p=0.011 and <0.001) suggestive of improved quality of life. On comparison training group showed greater improvement in quality of life (p=0.001).

Key words: Left Ventricular Failure, Exercise, Walking, QOL
Inclusion Criteria:

Total seventy patients were screened and the first Fifty patients in NYHA Class I-III and Left ventricular ejection fraction between 15%-40% were recruited from the Cardiology OPD of Seth G S Medical College & KEMH.

Exclusion Criteria:

Patients with acute myocardial infarction or recurrent angina (in last one month), arrhythmia and any known musculoskeletal, neurological or systemic disorders which would interfere with ambulation were excluded from the study.

METHODOLOGY

Patients were educated about the protocol and the possible benefits from it. Informed consent was taken from the patients. They were then randomly divided into two groups, Training and control group. 6MWT was performed in an indoor corridor of 30 mts as per ATS guidelines. LVD-36 Questionnaire a 36 item questionnaire for patients with LVdysfunction was used to assess quality of life. Responses to LVD 36 are dichotomous, (true/false). True responses are summed and expressed in % out of 36, so that 100% is the worst score and 0 the best. Questionnaire was filled by the patient after explaining, time to complete was 5 minutes.

For 8 weeks the Training Group, underwent Home based walking exercise Program designed on the basis of 6MWD. Home walking exercise program was advised once a day, everyday. Daily walking program of 30 min with gradual progression of intensity every 2 weekly (percentage of 30 min distance calculated from the distance covered in 6MWT) was advised. Information from the diary was used as validity check of the intervention.

Control Group, underwent “Usual Activity” where they were instructed to maintain their normal daily activities without any specific exercise prescription. At the end of 8 weeks 6MWT and LVD-36 score before and after 8 weeks was analyzed using paired t-test and intergroup analysis was done using unpaired t-test. The data was normally distributed.

| Table 1. Baseline Demographic and Clinical Characteristics (N=50) |
|-----------------|-----------------|-----------------|
| Characteristics | N=25 Training group | N=25 Control group |
| Male/Female     | 23/2            | 23/2            |
| Age (Mean±SD)   | 53.16±6.06      | 55.16±3.184     |
| Etiology: Ischemic | 21/25        | 22/25          |
| IDCM            | 4/25            | 3/25            |
| LVEF% 10-20%    | 6/25            | 7/25            |
| LVEF% 25-30%    | 10/25           | 7/25            |
| LVEF% 35-40%    | 9/25            | 11/25           |
| Mean ± sd 0.30±0.06 | 0.31±0.05   |
| NYHA CLASS-I    | 3               | 5               |
| II              | 17              | 15              |
| III             | 5               | 5               |
| MEDICATIONS     |                 |                 |
| Diuretics       | 18/25           | 20/25           |
| ACE inhibitors  | 20/25           | 18/25           |
| B-blocker       | 21/25           | 11/25           |
| Digoxin         | 6/25            | 4/25            |
| Oral HGA        | 4/25            | 2/25            |

| Table 2. Comparison Pre and Post 8 week |
|------------------|------------------|------------------|
|                  | Control Group    | Training group   |
|                  | 0-wk             | 8-wk             | 0-wk             | 8-wk             | p-value   |
| 6 MWD            | 341.6±75.26      | 341.6±75.25      | 329.6±120.63     | 344.2±122.85     | 0.091     |
| LVD-36           | 0.51±0.141       | 0.52±0.141       | 0.51±0.137       | 0.26±0.086       | 0.001*    |
| RPE (fatigue)    | 3.88±1.17        | 4.12±1.01        | 3.92±1.15        | 1.32±0.749       | 0.001*    |
| RPE dyspnoea     | 3.60±0.92        | 4.12±1.01        | 3.92±1.15        | 1.32±0.749       | 0.001*    |
| RPE dyspnoea     | 3.60±0.92        | 4.12±1.01        | 3.92±1.15        | 1.32±0.749       | 0.001*    |

| Table 3. Intergroup Comparison |
|-------------------------------|------------------|------------------|
| Intergroup comparison         | Control          | Training         |
| p-value|                  |                  |
| 6 MWD | 0.52±0.141       | 0.208±0.086      | 0.001*           |
| LVD-36 | 0.51±0.141       | 0.139±0.141      | 0.001*           |
| RPE (fatigue) | 3.60±0.92 | 3.60±0.92        | 0.001*           |
| RPE dyspnoea | 3.60±0.92 | 4.12±1.01        | 0.001*           |

follow up with both the groups was maintained to clarify questions about the prescribed protocol, encouraging adherence to the protocol in training group and with Control group to check the status of the condition in order to alleviate the psychological impact of conversation.

OBSERVATION AND DATA ANALYSIS

Baseline data (Table 1) was comparable with no significant differences between the two groups. Intragroup change in 6MWD and LVD-36 score before and after 8 weeks was analyzed using paired t-test and intergroup analysis was done using unpaired t-test. The data was normally distributed.
**DISCUSSION**

In Heart Failure there is inability of the heart to meet the demands of the tissues, which results in symptoms of fatigue and dyspnea on exertion progressing to dyspnea at rest. Exercise intolerance is defined as the reduced ability to perform activities that involve dynamic movements of larger group of muscles, due to symptoms of fatigue and dyspnea. Factors responsible for Decreased exercise tolerance are Central and Peripheral (Abnormal endothelial functions, blood flow, muscle metabolism, distribution of cardiac output), abnormal ventilatory responses, altered Neuro-hormonal regulation & autonomic control.

Benefits of exercise training include improvement in exercise tolerance, amelioration of symptoms and improved quality of life. Exercise training in Heart Failure has varied from High intensity to low intensity, i.e. from 50% to 80% of maximal capacity. The modalities used for training has varied from use of treadmill to cycle ergo meter. Modes of exercise training has also been variable, i.e. from only aerobic exercises, combined endurance and resistance training, only resistance training. Home walking exercise program as a mode of exercise training has not been widely prescribed and hence lacks more evidences. Our study has used a low intensity home walking exercise program for training purpose of left ventricular failure patients. Exercise prescription allowed the patients to start the regime at a percentage lower than 53% of age predicted maximum heart rate and then gradually progress.

Based on Guyatt’s report of a minimum important distance difference i.e. >99 feet (30.5 m) in patients with heart failure, the increase of 60 m in training group is clinically meaningful. Though all patients in Training group showed improvement, only 20% of control group showed increase in 6MWD which is not statistically significant. The significant increase in 6 MWD of Training Group (p<0.001) can be attributed to the effects of Exercise training on skeletal muscles metabolism and Anaerobic Threshold. Exercise training especially including lower limbs causes changes in cytochromal O2 uptake by muscles at anaerobic threshold, hence delaying its onset and hence delaying onset of fatigue. It improves flow dependant relaxation of peripheral arteries and this beneficial effect can translate into increased blood flow to the skeletal muscles, hence causing washout of lactic acid and increasing O2 uptake by the skeletal muscles. In heart failure there is abnormal endothelial functions, i.e. there is decrease in endothelium dependant vasodilating endothelins. This is responsible for the lack of peripheral vasodilatation in response to the exercise stimuli leading to decreased blood flow to the exercising muscles. With training there is increase in the release of these vasodilating endothelins e.g. NO. Increase in the blood flow to the leg muscles helps in effective extraction of oxygen and delaying the onset of fatigue and hence improving exercise performance.

The score for fatigue in control group increased in the period of 8 weeks which is statistically significant. (p=0.002) Anaerobic metabolism occurs early in patients with LVF. Patients of LVF show decrease in Oxidative Type I fibres and increase in Glycolytic Type II fibres. In addition glycolytic enzymes also decrease especially mitochondrial enzymes. Improvement in the scores of fatigue in the training group (p<0.001) is highly statistically significant and can be explained on the basis of studies as mentioned earlier. The score for Dyspnea in the control group has shown statistically significant rise which indicates deterioration of symptoms (p=0.011). Dyspnea in patients with LVF can be explained on the basis of the following facts: decreased activity and...
strength of of respiratory muscles leading to ventilation perfusion mismatch, presence of ergoreflex i.e. Stimulation of arterial chemoreceptors and afferent fibres originating from muscular receptors sensitive to local metabolic products. Training group showed improvement in the dyspnea scores which is statistically highly significant. (p<0.001)

The mechanism of delayed ventilatory response to exercise is explained by the fact that with exercise training there is increase in maximal sustainable ventilatory capacity, maximal voluntary ventilation and these changes are attributed to attenuation of Ergoreflex. Post Rehabilitation the LVD-36 Scores have decreased in the training group. The components that showed maximum affection were the ones that reflected Fatigue and Dyspnea. Scores of Fatigue and Dyspnea reflect on the scores of LVD-36. Hence in Training group decrease in the scores of fatigue and dyspnea has caused the decrease in the scores of LVD-36, which is an indication of improved quality of life. Improvement in the symptoms improves the feeling of self support and confidence.

CONCLUSION

From this prospective RCT it can be concluded that, a low level, Home Walking Exercise Program has Positive effects on function performance indicated by 6MWD and Quality of life indicated by LVD-36 Questionnaire.

Clinical Implication:

As this study demonstrates that a low intensity Home Based Walking Exercise program for stable LVF patients is effective in improving the functional status and perception of symptoms leading to improved quality of life. Hence clinicians should consider the use of home walking exercise programs as Phase II cardiac rehabilitation, especially for those who cannot have access to hospital based cardiac rehabilitation.

ACKNOWLEDGEMENT

We are heartily thankful to all our patients, the staff of PT School and Centre, KEM hospital, who supported us from the preliminary stages of the project.

Interest of conflict: We, M.P.Jiandani, R. Reddy, Mehta A and A.Nabar state that there is no conflict of interests with other people or organizations about our work.

REFERENCES

14. Physical training improves endothelial


Effect of Exercise on Postural Kyphosis in Female after Puberty

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ABSTRACT

This study was conducted to determine the effect of exercise on postural kyphosis in female after puberty. Fifty girls after puberty complained from postural kyphosis (diagnosed by orthopedist) from preparatory and secondary schools in Giza, participated in this study. Their ages ranged from 13 to 18 and their thoracic kyphosis angle was more than 40 degrees and less than 60 degrees. Girls evaluated by the Formetric II instrument in spinal shape analysis laboratory at the Faculty of Physical Therapy, Cairo University, evaluation done before and after 6 weeks of the exercise program. Duration of the study was from July 2011 to December 2011. The obtained results showed a statistically highly significant decrease (P<0.01) in thoracic kyphotic angle after performing the exercises. Accordingly, it could be concluded that the exercise is very effective in correcting female’s postural kyphosis after puberty.

Key words: Postural Kyphosis, Puberty, Formetric II, Thoracic Kyphosis

INTRODUCTION

Posture is the alignment and maintenance of body segments in certain positions, such as standing, lying or sitting. It is thought that there is an optimal posture for any given task. Considerable deviations from optimal posture are thought to be aesthetically unpleasant, adversely influencing muscle efficiency and predisposing to musculoskeletal or neurological pathologic conditions¹.

Kyphosis which occurs to compensate the breast development in girls after puberty due to carrying heavy schoolbags, participating in competitive sports and wrong posture can be cured with early diagnosis. If this kyphosis isn’t cured with an early diagnosis it can cause psychosocial problems².

Postural kyphosis, the most common type, normally attributed to slouching, can occur in both the old and the young. In the young, it can be called ‘slouching’ and is reversible by correcting muscular imbalances. In the old, it may be called ‘hyperkyphosis’ or ‘dowager’s hump’. About one third of the most severe hyperkyphosis cases have vertebral fractures. Otherwise, the aging body tends towards a loss of musculoskeletal integrity, and kyphosis can develop due to aging alone³.

Postural kyphosis is a type that mainly becomes apparent in adolescence. The onset of postural kyphosis generally is slow. It’s more common in girls than in boys. Poor posture or slouching may cause stretching of the spinal ligaments and abnormal formation of the bones of the spine (vertebrae). Postural kyphosis is often accompanied by an exaggerated inward curve (hyperlordosis) in the lumbar spine. Hyperlordosis is the body’s way of compensating for the exaggerated outward curve in the upper spine. Although rare, kyphosis can lead to serious health problems, such as physical deformity, breathing difficulties or damage to internal organs that are affected by the postural changes. Adolescent girls with poor posture are at a greater risk of postural kyphosis. Postural kyphosis doesn’t progress and may improve on its own. Exercises to strengthen back muscles, training in using correct posture and sleeping on a firm bed may help. Pain relievers may help alleviate any pain⁴.

Adolescent girls between the ages of 9.5 and 14.5 years have a period of rapid bone growth. The onset of menses contributes to the acquisition of peak bone mass and is improved by regular balanced exercise and good diet. Postural kyphosis is rather easily corrected with education about proper posture and some retraining on how to sit and stand correctly. Treatment does not need to include casting or bracing. However, strengthening the back muscles can help with proper
posture. Learning correct body mechanics to maintain erect posture that counteracts the effects of the kyphosis. Doing regular non-jarring exercises, such as swimming and maintaining high levels of activity are thought to be useful advice in the management of postural kyphosis.

Postural kyphosis may occur in both old and young people. In the young, it can be called ‘slouching’ and is reversible by correcting muscular imbalance. In the old, it may be called ‘hyperkyphosis’ or ‘dowager’s hump’. About one third of the most severe hyperkyphosis cases have vertebral fractures. Otherwise, aging process tends to cause loss of the musculoskeletal integrity. Kyphosis can develop due to aging alone.

Scheuermann’s kyphosis is a type that is seen in some families and it appears during the teenage years. It is significantly worse cosmetically and can cause pain. It is considered a form of juvenile osteochondrosis of the spine, and is more commonly called Scheuermann’s disease. It presents a significantly worse deformity than postural kyphosis. A patient suffering from Scheuermann’s kyphosis cannot consciously correct posture because apex of the curve located in the thoracic vertebrae is quite rigid. The patient may feel pain at this apex that may be aggravated by physical activity and long periods of standing or sitting. This can have a significantly detrimental effect on such patients, as their level of activity is curbed by their condition; they may feel isolated or uneasy amongst peers if they are children, depending on the level of deformity. Whereas in postural kyphosis the vertebrae and disks appear normal, in Scheuermann’s kyphosis they are irregular, often herniated and wedge shaped over at least three adjacent levels. Fatigue is a very common symptom, most likely because of the intense muscle work that has to be put into standing and/or sitting properly. The condition seems to run in families.

Congenital kyphosis is a type that some babies are born with because their spinal column did not develop correctly in the womb. Vertebræ may be malformed or fused together and can cause further progressive kyphosis as the child develops. Surgical treatment may be necessary at very early stage and can help maintain a normal curve in coordination with consistent follow ups to monitor changes. However, the decision to carry out the procedure can be very difficult due to the potential risks to the child. A congenital kyphosis can also suddenly appear in teenage years, in children with cerebral palsy and other neurological disorders.

Nutritional kyphosis can result from nutritional deficiencies, such as in cases of vitamin D deficiency which leads to thinning in the bones and resulting in curving of the spine as the child’s body weight increases.

Positions and postures usually adopted by women can become habitual patterns. Early education and training of body mechanics normally tend to help in forming positive postural habits, optimal muscle balance and skeletal alignment. Adolescent girls have a period of rapid bone growth between the ages of 9.5 and 14.5 years. It is important to choose an exercise for kyphosis that corrects the weakness in the muscles extending up to the spine as well as forward head posture, to achieve good postural alignment and reduce strain on the muscle of the back.

Competitive sports can stress the musculoskeletal system of adolescent and young adult women, causing injuries and pain with the development of postural changes. Conditions commonly associated with this age group are patellofemoral problems, traction apophysities, ankle injuries, compartment syndromes and other acute and overuse injuries. Spinal problems include scoliosis, thoracic kyphosis and spondolythesis. Adolescents are particularly susceptible to growth plate injuries, especially in the mid-pubertal period, in addition to long-bone stress factors and avulsion fractures.

SUBJECTS, MATERIALS AND METHODS

Fifty patients after puberty complained from postural kyphosis (diagnosed by orthopedist and confirmed by Formetric II instrument) selected from preparatory and secondary schools in Giza shared in this study. The design of this study was one-group pre- test post-test design. Informed consent form had been signed from each patient before participating in the study. Duration of the study was from July 2011 to December 2011. Their thoracic kyphosis angles were more than 40 degrees and less than 60 degrees. All patients were free from chest diseases, scoliosis and previous trauma to the spine, pelvis and lower limbs. All patients did not take any medications that might affect the neuromuscular functions at least three months before or during the study course. Weight-
Height Scale was used for measuring the body weight and height of each girl participating in the study to calculate the subject’s body mass index. The diagnosis of postural kyphosis was done for each patient by orthopedist before the beginning of the study and was confirmed by measuring thoracic kyphosis angle by Formetric II instrument. The design of this study was one-group pre-test post-test design. Duration of the study was from July 2011 to December 2011. The patients were evaluated by the Formetric II instrument in spinal shape analysis laboratory at the Faculty of Physical Therapy, Cairo University, before and after performing an exercise program for 6 weeks, Fig. 1.

Exercise Program

Each patient participated in a daily supervised 6 weeks exercise program.

1. Warming up phase:
   a. Diaphragmatic breathing exercise from crock lying position.
   b. Posture correction exercises:
      i) Posture correction exercise from crock lying position.
      ii) Posture correction exercise from supine lying position.
      iii) Posture correction exercise from sitting position.
      iv) Posture correction exercise from standing position.

2. Stretching exercise:
   a. Pectorals major muscles stretching from sitting position.
   b. Hip flexors stretching from standing position.
   c. Hamstring muscle stretching from long sitting position.

3. Thoracic spine mobilization exercises:
   a. Thoracic extension from relaxed prone lying position.
   b. Thoracic extension from sitting position.
   c. Thoracic extension from standing position.

4. Resistance training exercises:
   a. Stabilization exercise for the scapulae from prone lying position.
   b. Back extensors from prone lying position.

5. Cooling down phase for 10 minutes.
   a. Diaphragmatic breathing from crock lying position.
   b. Costal breathing from crock lying position.

6. Advices for good posture:
   a. Ideal sitting position on a stool.
   b. Ideal standing position.
   c. The right way of lifting a weight.

The Student t-test was used to compare between pre and post treatment results.

RESULTS

A - Physical characteristics of the girls.

The ages of the girls ranged from (13-18) yrs, with a mean value of (15.43 ± 1.70) yrs; their weight ranged from (50-59) kgs, with a mean value of (54.77 ± 2.36) kgs, their height ranged from (148-163) cms, with a mean value of (154.80 ± 3.69) cms, and their body mass index (BMI) ranged from (21.35 - 24.56) kg/m², with a mean value of (22.86 ± 0.87) kg/m² (Table 1).

Table 1. Demographic data of the girls.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs.)</td>
<td>13.00</td>
<td>18.00</td>
<td>15.43</td>
<td>1.70</td>
</tr>
<tr>
<td>Weight (kg.)</td>
<td>50.00</td>
<td>59.00</td>
<td>54.77</td>
<td>2.36</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>148.00</td>
<td>163.00</td>
<td>154.80</td>
<td>3.69</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>21.35</td>
<td>24.56</td>
<td>22.86</td>
<td>0.87</td>
</tr>
</tbody>
</table>

B - Kyphotic angle (MAX) of the girls.

Before starting the treatment program the thoracic kyphotic angle ranged between (41 - 45) degrees with a mean value of (43.13 ± 3.11), while after the treatment program it was ranged between (36 - 44) degrees, with a mean value of (39.67 ± 2.02) (Table 2, Fig. 2).

Table 2. Mean value of kyphotic angle (MAX) measured pre- and post-exercise in the girls.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-exercise</th>
<th>Post-exercise</th>
<th>t-value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>43.13 ± 3.11</td>
<td>39.67 ± 2.02</td>
<td>15.67</td>
<td>0.01**</td>
</tr>
</tbody>
</table>
DISCUSSION

The results of this study found that, there was a statistically highly significant decrease (P<0.01) in thoracic kyphosis angle and trunk length after the performance of the exercise program on the girls.

The results of this study agree with those of Kendall and McCreary11 who found that adolescent postural kyphosis leads to increase in thoracic kyphosis and trunk length through the unnecessary tension that comes from the stretching of the para spinal muscles especially the erector spinae muscle and the elongation of the posterior longitudinal ligament, supraspinous and intraspinous ligaments of the thoracic spine. That was concluded by those authors in the study conducted in one of the preparatory school girls to determine the prevalence of postural kyphosis in middle aged adolescents by using the inclinometer as a way of measurement to the thoracic kyphotic angle.

Results of this study agree with those of Fardon12, who found that a combination of posture correction exercises and breathing exercises could help in decrease tension and pain associated with postural kyphosis and establish good posture habits in girls after puberty.

The results also agree with those of Stephen et al.13 who recommended stretching the pectorals major muscle to maintain flexibility, decrease thoracic kyphosis and trunk length in cases of adolescent postural kyphosis together with back mobilization exercises and specific resistive training to strengthen the scapular muscles and back extensors muscles.

The results of this study also, agree with those of Magee14, who found that, during the adolescent spurt of growth, changes in body proportions occur to adjust to gravity. The pelvic tilt decreases to 20-30 degrees. The knees are slightly bent, but the earlier hyper extension of the spine is not necessary to balance a prominent abdomen. Posture becomes less mobile and the postural patterns become stabilized. If proper adaptive mechanisms fail, an adolescent “round shoulders” may be present with a neck projected forward and exaggerated thoracic kyphosis. That was stated in the study which had been done by this author to study the effect of the early education on practicing good postures in daily living and all activities early before puberty in the middle aged school girls.

The results of the current study are also supported by those of Hawes, Nies and Kershaw, Ashton and Schultz15 who have found that following growth spurts and body development, particularly breasts development could increase thoracic kyphosis, trunk length, shift the centre of gravity away from the spine, and increase muscular effort required to maintaining balance. Early education and training in body mechanics can help to form positive postural habits and help in developing and maintaining optimal muscle balance and skeletal alignment.

Also the results of the study were supported by Weiss and Turnbull [4], who found that adolescent girls have a period of rapid bone growth between the ages of 9.5 and 14.5 years. The onset of menses contributes to the acquisition of peak bone mass and is enhanced by regular exercise and good diet.

The results of this study disagree with the results of Gatterman16, who found that postural kyphosis in girls after puberty will not get any worse with time and does not need any therapeutic intervention.

CONCLUSION

On the basis of the data obtained in the present study, we conclude that exercise is very effective in correcting female’s postural kyphosis after puberty.

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Effect of Nerve Mobilization on Vibration Perception Threshold in Diabetic Peripheral Neuropathy

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ABSTRACT

Purpose of the study: To determine the effects of Nerve Mobilisation on Vibration Perception Threshold (VPT) in Diabetic Peripheral Neuropathy.

Materials and Methods: 30 male subjects with VPT ≥ 25, mean height of 175.93 and mean weight of 82.53 kg on the basis of thorough assessment and after signing informed consent were randomly divided into experimental and control group. The vibration perception Threshold was measured on all the four points on the plantar aspect of the foot i.e. pulp of the toe and 1st, 3rd and 5th metatarsal heads bilaterally for both the groups on Day 1 prior to treatment.

The subjects in the experimental group were given Tibial nerve mobilization bilaterally. This procedure was continued for a total of 21 days. The subjects in the control group were not given any intervention.

Dependent Variables: VPT readings at great toe and 1st, 3rd and 5th metatarsal head.

The subjects in both the groups were reassessed for Vibration Perception Threshold on the 21st Day. The post-test measurements of VPT were then compared with the pre-test ones and the appropriate data analysis was done.

Results: It was found that the subjects who were given tibial nerve mobilization showed reduction in VPT scores.

Conclusion: Nerve mobilisation may be an effective technique for delaying the diabetes related peripheral neuropathy, if detected at its earlier stages. This will ultimately help in preservation of the vibration sense of the foot and consequently reduce or delay the incidence of the devastating effects such as foot ulceration which may lead to foot amputation.

Key words: Diabetic Peripheral Neuropathy, Vibration Perception Threshold, Nerve Mobilization.

INTRODUCTION

Diabetic Peripheral Neuropathy (DPN) is a common complication estimated to affect 30-50% of individuals with diabetes. Chronic sensorimotor distal symmetrical polyneuropathy is the most common form of Diabetic Peripheral Neuropathy. Polyneuropathy can lead to sensory loss, muscle weakness and pain. The typical presentation includes burning sensation and numbness in the feet. The onset is so gradual that the disease may go undetected for years. Neuropathic pain may be severe when present; however it is reported to occur in only 11.1% to 32% of individuals with polyneuropathy. Diabetic Peripheral Neuropathy leads to a number of impairment and functional limitations, individuals with Diabetic Peripheral Neuropathy are at highly vulnerable for ulceration and subsequent lower extremity amputations.

The lifetime risk of a person with diabetes developing a foot ulcer may be as high as 25% whereas the annual incidence of foot ulcers is 2%. Non traumatic lower-extremity amputations are a devastating complication of diabetes. As many as 15% of people with diabetes will have such amputations during their lifetime.

AIMS OF THE STUDY

To determine the effects of Nerve Mobilisation on Vibration Perception Threshold in Diabetic Peripheral Neuropathy.
METHODOLOGY

30 male subjects with the Vibration Pressure Threshold ≥ 25, mean height of 175.93 cm (SD: 6.87) and mean weight of 82.53 kg (SD: 9.29) on the basis of thorough assessment and with the following criteria were recruited from the outpatient department at Amar Hospital, Patiala.

Inclusion Criteria
1. Age 40-65yrs
2. Vibration perception threshold e ≥ 25 volt
3. Subjects having diabetes since three years.
4. Presence of bilateral distal peripheral neuropathy
5. Subjects on antihyperglycemic drug (glimepride)
6. Type-2 Diabetes Mellitus.

Exclusion Criteria
1. Poor glycemic control.
2. Bakers cyst
3. Autonomic disease
4. History of Trauma
5. Any neurological disorder
6. Leprosy/ skin disease
7. Nerve sheath ganglia
8. Any skin lesion
9. Claudication
10. Smoking
11. Alcohol

The subjects who met the inclusion/exclusion criteria were made to sign an informed consent & then randomly recruited to following groups:
Group I : Experimental group
Group II: Control group

The vibration perception threshold was measured on day 1 prior to treatment for which the subject was made to lie supine on the treatment couch. His both feet were exposed and examined for the presence of any skin lesion. Then the machine was held with the traction balanced vertically on the various points of the foot such as pulp of the toe and 1st, 3rd and 5th metatarsal heads bilaterally. After this the voltage was gradually increased on the base unit until the patient could perceive the vibration. If the subject was unable to detect the vibration at the maximum voltage of 50 Volts, then a value of 51 Volts was used for statistical analysis. A value of 25 Volts and above was considered as indicative of a subject at the risk of foot ulceration.

Tibial Nerve Mobilisation
The subject was made to lie supine on the treatment couch. The tibial nerve mobilization was given in the following steps for each foot.

1. Dorsiflexion of the foot,
2. Eversion of foot along with extension of the toes and stretch on the plantar fascia, followed by
3. Straight leg raise (amplitude was adjusted according to the subjects response to stretch).

The tibial nerve was mobilized for a total duration of 10 minutes once in a day. Each repetition was held for a duration of 30 seconds with one minute rest interval between them. This procedure was continued for a total of 21 days.

The subjects in the Control group were not given any intervention. The subjects in both the groups were reassessed for Vibration Perception Threshold on the 21st Day. All the subjects were educated about the foot care and no follow up was kept. The post- test measurements of VPT were then compared with the pre - test ones and the appropriate data analysis was done.
DATA ANALYSIS

Paired t test was used to calculate the significant difference between pre and post intervention within same group & Unpaired t test was used to calculate the difference between pre and post intervention in different groups.

RESULTS

For the right great toe, the t value (1.429) is statistically non significant.

For the left great toe, the t value (1.149) is statistically non significant.

For the right 3rd metatarsal head, the t value (1.535) is statistically non significant.

For the left 3rd metatarsal head, the t value (1.306) is statistically non significant.

For the right 1st metatarsal head, t value (2.416) is greater than the critical value of t (2.14) this indicates that the differences between two value is statistical significant.

For the left 1st metatarsal head, t value (0.650) is statistically non significant.

For the right 5th metatarsal head, the t value (1.636) is statistically non significant.

For the left 5th metatarsal head, the calculated t value (1.006) is statistically non significant.

For the right great toe, the t value (5.557) is greater than the critical value of t (4.140) which shows statistically highly significant changes.

For the left great toe, the t value (2.499) is greater than the critical value of t (2.14 ) which shows statistically highly significant changes.
Graph 5. Comparison of Pre and Post Vibration Perception Threshold (VPT) values (volt) Pre and post tibial nerve mobilization (both) for right and left great toe.

For the right 1st metatarsal head, the calculated t value (3.748) is greater than the critical value of t (2.977) which shows statistically significant changes.

For the left 1st metatarsal head, the calculated t value (5.244) is greater than the critical value of t (4.140) which shows statistically significant changes.

Graph 6. Comparison of Pre and Post Vibration Perception Threshold (VPT) values (volt) Pre and post tibial nerve mobilization (both) for Right and Left 1st Metatarsal head.

For the right 3rd metatarsal head, the t value (2.285) is greater than the critical value of t (2.145) which shows statistically significant changes.

For the left 3rd metatarsal head, the t value (4.181) is greater than the critical value of t (4.140) which shows statistically highly significant changes.

Graph 7. Comparison of Pre and Post Vibration Perception Threshold (VPT) values (volt) Pre and post tibial nerve mobilization (both) for Right and Left 3rd Metatarsal head.

For the right 5th metatarsal head the t value (3.062) is greater than the critical value of t (2.977) which shows statistically highly significant changes.

For the left 5th metatarsal head the critical value of t (4.140) which shows statistically highly significant changes.

Graph 8. Comparison of Pre and Post Vibration Perception Threshold (VPT) values (V) Pre and post Tibial nerve mobilization (both) for Right and Left 5th Metatarsal head.

At right great toe, the difference in value of t is (4.677) is greater than the critical t value (3.674) which shows statistically highly significant changes.

At left great toe, the difference in the value of t is (3.081) is greater than the critical t value (3.674) which shows statistically highly significant changes.
Graph 9. Compares the difference between initial and final VPT (V) scores for control and experimental group at right and left great toe.

At right 1st metatarsal head, the difference in the value of t is (4.517) is greater than the critical t value (3.674) which shows statistically highly significant changes.

At left 1st metatarsal head, the difference in the value of t is (3.081) is greater than the critical t value (3.674) which shows statistically highly significant changes.

Graph 10. Compares the difference between initial and final VPT (V) scores for control and experimental group at right and left 1st metatarsal head.

At right 3rd metatarsal head, the difference in the value of t is (3.159) is lesser than the critical t value (3.674) which shows statistically highly significant changes.

At left 3rd metatarsal head, the difference in the value of t is (4.324) is greater than the critical t value (3.674) which shows statistically highly significant changes.

Graph 11. Compares the difference between initial and final VPT (V) scores for control and experimental group at right and left 3rd metatarsal head.

At right 5th metatarsal head, the difference in the value of t is (3.555) is lesser than the critical t value (3.674) which shows statistically highly significant changes.

At left 5th metatarsal head, the difference in the value of t is (5.989) is greater than the critical t value (3.674) which shows statistically highly significant changes.

Graph 12. Compares the difference between initial and final VPT (V) scores for control and experimental group at right and left 5th metatarsal head.

DISCUSSION

This study was conducted on the subjects having type 2 diabetes mellitus. The study was carried out for 21 days. Compliance of the subjects for such a period was a problem especially in the light of the fact that some patients may not be able to control their sugar levels as per the standards of Medical Council of India. The various reasons for this could be psychological stress, lack of diet control, sedentary life...
style and the resistance of the body to the drugs. This loss of glycemic control can lead to macro and microvascular complications such as Retinopathy, Peripheral neuropathy, Nephropathy, Cerebrovascular accidents (stroke), Coronary artery disease. The present study is an attempt to know the effects of nerve mobilization in diabetic peripheral neuropathy which may help prevent its progression and overcome its devastating effects such as foot ulcers.

The intragroup comparison indicates that there was a significant improvement in the Vibration Perception threshold on all the four points bilaterally in the subjects of Experimental group at the end of 21st Day whereas no significant changes were found in the control group except on 1st metatarsal head on right side.

The intergroup comparison indicates that there was a significant difference of Vibration Perception Threshold in the experimental group as compared to the control group.

The findings of the study were supported by Robert and Butler, (2005). In their review article they have summarized that the symptoms associated with peripheral neuropathy are produced by sensitized nociceptors in neural connective tissues, a sensitized pain neuromatrix, myelin changes and axonal degeneration. The consequent endoneural edema and intraneural fibrosis leads to marked degradation in myelin content and axon structure. They proposed that neurodynamic mobilization techniques can be effective in addressing peripheral neuropathic states. It is hypothesized that these therapeutic movements can have a positive impact on symptoms by improving intraneural circulation, axoplasmic flow, neural connective tissue, viscoelasticity and by reducing sensitivity of abnormal impulse generating sites. This may have lead to changes in the VPT in the present study.

Gary et al., (1993) have found that peripheral nerves healed faster when they were stretched. On histological assessment they confirmed an increase in myelin synthesis. This finding may account for the improvements seen in the present study.

In their study on principles of Michael et al., (2007) have recommended that neuromobilization be performed in the earliest possible stage of disease i.e. before the occurrence of irreversible morphological changes. Neuromobilization should involve the entire length of the nerve trunk. In the present study an attempt has been made to detect the early changes of diabetic peripheral neuropathy using VPT measurements followed by mobilization of whole length of tibial nerve so that the progressive nature of the neuropathy can be delayed up to some extent.

Lundborg, (1970) in their study concerning the effect of stretching on peripheral nerves has revealed that blood supply is completely blocked when neural tissue is excessively stretched thus a procedure must correspond to the patient’s condition and should never cause pain. The number, duration, frequency of impulses is determined on the basis of subjects response. Similar procedure was followed in the present study as amount of stretch was determined by the subjects response.

Sarkari and Multani (2007) in their study have found neural mobilization to be effective in reducing pain and improving ROM.

Antonella et al., (2002) have concluded that both the rearfoot and forefoot pressures are increased in the diabetic neuropathic foot, however, forefoot is more involved in severe diabetic neuropathy which leads to foot ulceration. Keeping this in view in the present study we have attempted to mobilize the tibial nerve as it branches to supply most of the forefoot which is susceptible to foot ulceration.

CONCLUSION

The conclusion of the present study is that nerve mobilization may be an effective technique for delaying the diabetes related peripheral neuropathy, if detected at its earlier stages. This will ultimately help in preservation of the vibration sense of the foot and consequently reduce or delay the incidence of the devastating effects such as foot ulceration which may lead to foot amputation.

REFERENCES


A Study of Immediate Effects of Taping in Patients with Knee Osteo-arthritis

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¹Lecturer, ²Professor & Director, Pad. Dr. D.Y. Patil College of Physiotherapy Nerul, Navi Mumbai

ABSTRACT

Introduction:
Osteoarthritis - or degenerative joint disease (DJD) - is a common rheumatological disorder. In view of limited cure of the disease, management of symptoms is the mainstay of treatment which aims at reducing pain and limiting functional impairments. Knee taping is believed to relieve pain by improving alignment of the patello-femoral joint and/or unloading inflamed soft tissues.

Material & Method:

• Aims & Objectives: To study the immediate effects of taping on pain in patients with osteoarthritis of the knees by assessing the VAS score on four activities of daily living: walking, squatting, ascending and descending stairs and on functional disability tests like walking speed, Time Get Up and Go test and step test.

• Study Design: Hospital based Longitudinal Study

Subjects:
Inclusion criteria: Patients with unilateral or bilateral knee pain, clinically and radiologically diagnosed grade 1 and grade 2 osteoarthritis, (according to Kellgren and Lawrence classification) as patello-femoral and/or tibio-femoral osteoarthritis of knees were included. Exclusion criteria: Knee instability, acute stage osteoarthritis, Rheumatoid and other knee arthritis.

• Study Factors:

  Intervention: Patellar Taping by McConnell technique and Tibio-femoral taping by Mulligan Technique.

  Outcome factors: Post taping Pain measurement by VAS Scale, Observed Disability Measures like TUG (Timed Get Up and Go test), Walking speed, and Step test.

Results: Sixty subjects enrolled with mean age of 57.17 years. Pain relief using VAS scores on the 4 activities i.e. walking, squatting, ascending stairs and descending stairs, TUG scores, Step test scores and Walking Speed showed statistically significant improvements after taping in both unilateral and bilateral OA knee subjects.

Conclusion: Knee taping significantly improve pain and disability in individuals with osteoarthritis of the knees as an immediate effect.

Key words: Knee Osteoarthritis, Taping, McConnell Technique, Mulligan Technique

INTRODUCTION
Osteoarthritis is a common degenerative joint disease affecting approximately 4% of the world’s populace, predominantly observed at the age of 50 years in men and 40 years in women. Pain and physical...
disability are apparent in almost half of the patients with radiographic disease. Since limited progress has been made towards curing the disease, management of symptoms is the mainstay of treatment which aims at reducing pain and limiting functional impairments.

The patello-femoral compartment in knee osteoarthritis can cause severe pain, particularly when the patient is using stairs, squatting, or kneeling. Malalignment of the patella, with consequential abnormal force distribution on the lateral facet, is the cause of this symptom. Knee taping relieves pain by improving alignment of the patello-femoral joint and/or unloading inflamed soft tissues. Taping benefits not only pain but various physical impairments in patients with Patello-femoral Pain Syndrome. The present study evaluates the effectiveness of knee taping in improving the disability in knee OA via beneficial effects on pain and physical impairments.

MATERIAL & METHODS

Aims & Objectives

• To evaluate the immediate effect of taping on pain in patients with osteoarthritis of the knees by assessing the VAS score on four activities of daily living: walking, squatting, ascending stairs and descending stairs.

• To evaluate the immediate effects of taping on the walking speed, Timed Get Up and Go test and step test in patients with osteoarthritis of the knees.

Study design

This was a Tertiary care Hospital based Longitudinal Study

Subjects:

Inclusion criteria

Clinically and radiologically diagnosed cases of patello-femoral and tibio-femoral osteoarthritis of both Unilateral and bilateral knees were included.

Exclusion criteria

1. Knee instability
2. Acute stage osteoarthritis
3. Grade 3 and 4 osteoarthritis
4. Rheumatoid arthritis
5. Psoriatic arthritis
6. Gout
7. Previous knee surgery
8. Cutaneous diseases preventing taping

Study Factors

• History and clinical examination regarding swelling, posture, gait of patient, patellar tracking and rotational abnormalities were noted.
• Clarke's test was performed to confirm patello-femoral arthritis.

INTERVENTION

• Taping for patella
  Before taping, patellar shifts, tilts, rotations were checked. The restricted glides were noted and the patella was taped accordingly. McConnell medial patella taping was done to realign the patella. In addition, a second strip of tape was applied to correct tilts. (Figure 1)

• Mulligan taping for the knee
  A diagonal tape was applied as per the Mulligan method of taping the knee. (Figure 2)
OUTCOME FACTORS

- **Pain measurement**
  Pain relief was assessed on 0-10 Visual Analogue Scale (VAS) on each of the four activities: walking, squatting, ascending stairs and descending stairs.

- **Walking speed**
  Reduced gait velocity is a common feature of locomotor disability in knee OA, walking speed was measured at a self-selected pace on a level surface. Participants walked barefoot along an 8m walkway. A stopwatch was used and the distance covered by the patient in 1 minute was noted. Walking velocity was calculated by the formula distance/time in meters/second.²

- **Step test**
  Step test is a functional, dynamic test of standing balance with known reliability and validity. Barefooted in front of a 15 cm step, participants stood on the osteoarthritic limb, whilst stepping the opposite foot on and off the step as many times as possible over 15 seconds. The number of times the participant could place the foot on to the step and return it to the floor was recorded, with higher scores indicating better balance.

- **Timed up and go (TUG)**
  TUG is a validated and reliable test of function in older individuals. Participants were instructed to rise from a standard arm chair, walk for 3 meters, come back and return to the chair and sit down again, whilst being timed by a stop watch. Participants performed the test barefoot, once only and at their own pace.

STATISTICAL ANALYSIS

The pre and post taping parameters were compared using parametric Student’s t-test for statistical change in the outcome.

FINDINGS

Total 60 subjects were enrolled with the mean age of 57.17 years, with range 35-95 years and male female ratio of 1:4.

UNILATERAL OSTEOARTHRITIS

Pain Relief

Pain relief using VAS on the 4 activities i.e. walking, squatting, ascending stairs and descending stairs was done prior to taping and improvement in pain was evaluated immediately. The pain scores showed statistically significant improvements after taping. (Table 1)

Table 1. Showing Improvement in the VAS on walking, squatting, ascending stairs and descending stairs in Unilateral OA knee

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre (Right)</th>
<th>Pre (Left)</th>
<th>Post (Right)</th>
<th>Post (Left)</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>5.017</td>
<td>5.017</td>
<td>2.567</td>
<td>2.567</td>
<td>2.036</td>
<td>1.324</td>
</tr>
<tr>
<td>Squatting</td>
<td>6.427</td>
<td>6.427</td>
<td>3.833</td>
<td>3.833</td>
<td>1.791</td>
<td>1.642</td>
</tr>
<tr>
<td>Ascending</td>
<td>5.733</td>
<td>5.733</td>
<td>3.933</td>
<td>3.933</td>
<td>2.417</td>
<td>1.775</td>
</tr>
<tr>
<td>Descending</td>
<td>5.467</td>
<td>5.467</td>
<td>2.767</td>
<td>2.767</td>
<td>2.360</td>
<td>1.711</td>
</tr>
</tbody>
</table>

The Observed disability measures i.e Timed Get Up and Go Test (TUG), Step Test and Walking Velocity showed statistical improvement in all 3 disability measures, post-taping. (Table 2)

Table 2. Improvement in the TUG, Step test and Walking Velocity in unilateral OA knee

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre (Right)</th>
<th>Pre (Left)</th>
<th>Post (Right)</th>
<th>Post (Left)</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUG Test</td>
<td>30.413</td>
<td>30.413</td>
<td>10.950</td>
<td>10.950</td>
<td>3.901</td>
<td>3.419</td>
</tr>
<tr>
<td>Step Test</td>
<td>30.690</td>
<td>30.690</td>
<td>8.667</td>
<td>8.667</td>
<td>1.242</td>
<td>1.493</td>
</tr>
<tr>
<td>Walking</td>
<td>30.079</td>
<td>30.079</td>
<td>0.947</td>
<td>0.947</td>
<td>0.145</td>
<td>0.196</td>
</tr>
</tbody>
</table>

Bilateral Osteoarthritis

Statistically significant improvements in Pain Scores (Table 3) and observed disability measures (Table 4) were observed post tapping in Bilateral Osteoarthritis cases also.

Table 3. Improvement in the VAS on walking, squatting, ascending stairs and descending stairs in Bilateral OA Knee

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre (Right)</th>
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<th>Post (Left)</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>5.067</td>
<td>5.067</td>
<td>4.250</td>
<td>4.250</td>
<td>2.127</td>
<td>2.216</td>
</tr>
<tr>
<td>Squatting</td>
<td>6.083</td>
<td>6.083</td>
<td>4.283</td>
<td>4.283</td>
<td>1.930</td>
<td>1.897</td>
</tr>
<tr>
<td>Ascending</td>
<td>5.763</td>
<td>5.763</td>
<td>5.133</td>
<td>5.133</td>
<td>2.023</td>
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<tr>
<td>Descending</td>
<td>5.467</td>
<td>5.467</td>
<td>5.333</td>
<td>5.333</td>
<td>2.070</td>
<td>2.097</td>
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</tbody>
</table>

Table 4. Improvement in the TUG, Step test and Walking Velocity in Bilateral OA knee

<table>
<thead>
<tr>
<th>Parameters</th>
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<th>Post (Left)</th>
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<th>p value</th>
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</thead>
<tbody>
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<td>3.901</td>
<td>3.419</td>
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<tr>
<td>Step Test</td>
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<td>30.690</td>
<td>8.667</td>
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<td>1.242</td>
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<tr>
<td>Walking</td>
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<td>0.947</td>
<td>0.947</td>
<td>0.145</td>
<td>0.196</td>
</tr>
</tbody>
</table>
Knee osteoarthritis is prevalent worldwide and almost half of the patients with radiological disease have symptoms like pain and physical disability. The interventions range from oral medications, physiotherapy management to knee replacement. The conservative management is aimed to reduce pain and limit functional impairment, which needs inexpensive interventions with minimum side effects. Knee taping is one such strategy which has been evaluated in the present study.

Knee taping improves disability by its beneficial effects on pain and physical impairments and improving quadriceps force, knee joint kinematics and onset timing of vasti, which was observed in the present study, as evaluated by VAS on four activities namely walking, squatting, ascending stairs and descending stairs in both unilateral and bilateral osteoarthritis.

Patello-femoral joint degeneration predominantly affects the lateral compartment, leading to patellar mal-alignment, and this is in turn associated with increased peak patello-femoral contact pressures and loading of the lateral facet. Therapeutic tape may ease pain by improving patellar alignment. Taping may provide neural inhibition via large fiber input to the anterior knee because large fiber input sensory signals are transmitted faster to the brain than pain signals, the large fiber input from the tape may override the pain signals. Therefore the patient may experience a decrease in the perceived pain. Obviously, this is speculative and further study is needed to determine the effect of patella taping on neural inhibition (eg. Hoffman reflex). Some have suggested that the mechanical advantage of the quadriceps is maximized because of increased leverage by the patella via a medial shift as it returns to the trochlear groove of the femur.

Although a mechanical advantage may be achieved by the quadriceps when the patella is repositioned, the associated reduction in pain experienced by the individual may allow a more comfortable quadriceps contraction.

Another hypothesis is that patellar taping improves proprioception and the sense of mechanical stability of the patella to promote normal knee function. Under the influence of patellar taping, altered afferent input from the muscular, ligamentous, articular, and cutaneous structures in and around the patello-femoral joint may improve proprioceptive functions in patients with patello-femoral pain syndrome. The improved knee joint biomechanics, such as extensor moment and power, quadriceps torque, and knee flexion angles, have been reported in several studies. The altered neural input implicated in these findings does not necessarily equate with improved muscle function, but it does appear that patellar taping is associated with an increased ability to generate muscle performance regardless of the mechanism of pain alteration, it does appear that clinicians may effectively and immediately reduce patello-femoral pain with patellar taping.

Dynamic standing balance, as evaluated by Step test, also improved significantly in the present study, which is similar to Hinman study. This improvement could not be attributed to concurrent pain reduction but could be due to sense of support after therapeutic tape which improves confidence in knee, resulting in taking more steps with contra lateral limb or limb with less pain while standing on symptomatic limb. Similar improvement was noted in the study done by P.L. Chen et al., wherein it was concluded that taping can reduce pain and improve the ratio of Vastus Medialis Oblique/Vastus Lateralis for the mechanism of patellar stability in patients with patello-femoral pain syndrome during stair climbing.

Timed Up and Go test and walking velocity, also show significant improvement in the present study. Powers et al., investigated the effects of patellar taping on stride characteristics and joint motion in patients with patello-femoral pain syndrome. Patellar taping had a small but statistically significant increase in loading-response knee flexion under all conditions. The authors stated that this increase in loading-response knee flexion may have enhanced the patients’ willingness to load the knee joint, which may improve shock absorption, quadriceps activity, and tolerance to increased patello-femoral joint reaction force.

Our study have limitations like absence of a comparative group, non calculation of sample size and not providing rest time between test conditions. The
cumulative effect of multiple testing procedures could have resulted in participant fatigue and symptom exacerbation causing alterations in the results.

CONCLUSION

To conclude knee taping significantly improve pain and disability in individuals with osteoarthritis of the knees as an immediate effect. Knee taping is a simple and inexpensive strategy. It provides an additional option to physiotherapists in conservatively managing osteoarthritis of the knees. Knee osteoarthritis is a chronic disease, hence evaluation of long term effects of knee taping is recommended.

Conflict of Interest: None

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The Effects of Upper Limb Exercises on Hand Writing Speed

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ABSTRACT

Introduction: Hand writing is an essential tool required by students. It is a complex process which involves close coordination between musculo skeletal and nervous systems.

Objective: To assess the effectiveness of upper limb exercises on handwriting speed.

Methodology: An interventional prospective study involving undergraduate students. Structured exercise programme was held five days a week (for about 20 minutes) for 4 weeks. Writing speed, strength of palmar pinch grip and upper limb coordination was measured at beginning, two and four weeks later.

Results: At the beginning hand writing speed was 23.9 wpm. The pinch grip strength and coordination of upper limb were, 3.8kg and 8.6 (pegs/15 seconds) respectively. Exercise programme showed statistical significant improvement in all 3 areas measured. There was a 21% improvement in hand writing speed, 41.7% improvement in Pinch grip strength of dominant hand and 11.9% improvement in upper limb coordination.

Conclusions: Uppers limb exercise programmes can be used to improve the hand writing speed.

Key Words: Upper Limb Exercise, Hand Writing Speed,

INTRODUCTION

Writing is one of the most unique features of humans’ cultural development. Writing continues to be an essential life skill, in daily-life, as a form of communication, archiving, expression of creativity and knowledge. Therefore it is an essential skill one should possess in today’s context and it forms an integral part of a student’s life whether primary, secondary or tertiary.

Handwriting is a complex, fine motor skill, where fine, precise, coordinated movements occurs in the extremity. It is a complex integration of muscular, skeletal and neurological systems together. Many factors influence handwriting such as anatomy of extremity, general health, mental acuity, writing instrument and surface.¹ During the process of handwriting most of the movements come from the forearm while shoulder provides the power with minimum movement occurring at fingers and wrist.²

Strength and flexibility of the muscles, the position of the pen grip and the overall posture of the writer, affects the final output. The most common pen-holding position, is by keeping the pen between the index and middle fingers, and held in place by the thumb using palmar pinch grip. Joint position sensation is the most important factor in determining handwriting.³ Though it seems paradoxical, since small muscles having better control, the shoulder-girdle group, once trained, does the job better.³

Handwriting speed varies with age. Study on a group of Australian school children showed that handwriting speed to be 33, 34, 38, 46 and 52 (wpm) for students of grade 3, 4, 5, 6 and 7 respectively.³ It also showed that skills such as word spacing and letter size decreased gradually with advancing age.
Writing speed of teenagers improve rapidly parallel to their physical maturity. Girls on average achieve a maximum writing speed earlier than boys. The average rate is 14.7 wpm for girls and 13.8 wpm for boys. A range of writing speeds between 10 and 20 wpm is considered normal for normal 15 year old. Hedderly called one with an average speed of around 15-wpm as “those pupils writing at a speed.” Those with a speed of 8 wpm or less will almost certainly be handicapped.5

According to teacher estimates, approximately 11% to 12% of female and 21% to 32% of male school-aged children have handwriting difficulties. Slow handwriting may be due to delays in information processing, difficulties with spelling, improper motor co-ordination and adopting labor intensive writing styles.6 Furthermore, research has indicated that slow handwriting leads to avoidance of writing thus resulting in low self-esteem, evading school work and possibly ending with learning difficulties and behavior problems.7 Better hand writing speeds will help in quick assimilation of knowledge and perform well at examinations thus achieving higher academic grades.8 However, unfortunately the efforts taken by teachers, parents and students to improve hand writing skills and speed are poor and schools lack necessary tools.5

Graham et al9 showed that training could improve handwriting speed and legibility in Grades 1-9 students. Similar results were shown by Kao10 when he studied a group of twelve undergraduates. Nadine and co workers studies 16, first and second grade Australian students in a handwriting training session at school for 45 minutes once a week for 8 weeks and showed that legibility, form, alignment, size, spacing, and speed improved.11

This study attempts to find the effects of strengthening and coordination exercises of distal upper limb muscles on handwriting speed in a group of undergraduate students of University of Colombo, Sri Lanka.

MATERIAL AND METHODS

Study design

The descriptive cross sectional experimental study involving randomly selected 40 (20 male and 20 female physiotherapy undergraduate students of University of Colombo. Any student with a congenital or acquired anatomical or functional defect of either upper limb was excluded. The study was approved by the ethical review committee of faculty of Medicine, University of Colombo. Informed written consent was obtained.

Writing speeds of the subjects were measured at the beginning, at two weeks and at the end (4 weeks) of the exercise programme. Exercises were designed to strengthen the muscles involved in handwriting. Each subject did ten types of exercises for about 20 min. on each day, 5 times a week (Appendix 1).

Strength of palmar pinch grip was measured using pinch grip dynamometer13 and coordination of upper limbs was measured by using Perdue peg board test,14 at same time hand writing speed was measured. All assessments were done by a single investigator (KVKC).

Hand writing speed measurement

Subjects were given a single audio recording in English medium, and were asked to transcribe on a A4 sheet in two minutes. Test was done in a single lecture room with similar writing surface and seating facilities. At the end the number of words was counted and writing speed was calculated.

Pinch grip force measurement

Pinch Grip dynamometer, ranging from 0-10 Kg, was used for the measurement. Subjects stood in up right posture in front of the examiner with shoulders abducted to 0° and neutrally rotated, elbow flexed to 90° and the wrist and forearm kept in neutral position. At each time three measurements of the pinch grip of the dominant upper limb was measured. The median value was obtained. A single dynamometer was used throughout the study.

Coordination measurement

The Perdue peg board was used for the measurement of coordination of dominant upper limb. Subject sat on a chair in upright posture in front of the table. The non dominant hand was rested on the ipsilateral thigh. The number of pegs placed on the peg board in 15 seconds was measured. At each occasion it was done three times and median value was taken. Same instrument was used throughout the test. Both Pinch grip dynamometer and Perdue peg board test had been validated for such use.15

Data analysis

Descriptive statistics were used to present data. Measurements at the beginning and at the end were
compared using paired t-test. A p<0.05 (2-tailed test) was considered to be significant. Correlation between hand writing speed and exercise parameters were calculated by Pearson rank order correlation. Data are presented according to gender as well as whole population. Statistical analysis was done using SPSS version 17 for windows XP.

RESULTS

The study population consisted of 40 physiotherapy undergraduate students (males 20). The mean age of the study population was 23.4(1.1) years and the mean age of the male and female subjects were 23.2(1.1) and 23.6(1.0) years respectively. Thirty eight were right hand dominant and 2 male subjects were left hand dominant.

Table 1 shows the mean hand writing speed of the study population and for each gender at different time intervals of the study period. At the beginning the overall mean hand writing speed was 23.9±5.1 wpm. After four weeks of exercise it increased to 28.9±4.7 wpm. Table 2 shows the results of the Pinch grip strength analysis of the study population. Mean Pinch grip strength of the dominant hand of the study population was 3.8±1.7kg. At the end of 4 weeks it increased to 5.3±1.9kg. Table 3 shows the data of the assessment of coordination of dominant upper limb of the study population. Mean coordination of dominant upper limb of study population was 8.6±1.5 pegs/15sec. At the end of 4 weeks it improved to 10.1±0.97 pegs/15sec.

Table 4 shows the results of the comparison of the three measurements for the whole population at the beginning and end of 4-week exercise programme. All showed statistically significant improvement. When data of individual genders were compared, they also showed statistically significant improvement (data not shown). Similar comparison was done for all three measurements at beginning and at 2 weeks after commencement of the programme. They also showed statistically significant improvement in 3 areas in both gender groups (data not shown).

The whole study group showed a 21.1% improvement in hand writing speed with the male subjects showing 25.1% and the female subjects showing a 17.2% improvement. Pinch grip strength of the whole population improved by 41.7%. Improvement was higher in female students (44.9%) than in male students (39.9%). Coordination of the upper limb showed an 11.9% improvement in the

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<tr>
<th>Table 1. Hand writing speed of all subjects, and by gender at beginning, midpoint and end of intervention.</th>
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<td><strong>End of study period</strong></td>
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<th>Table 2. Pinch grip strength of all subjects, and by gender at beginning, midpoint and end of intervention.</th>
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<th>Table 3. Coordination of the dominant hand of all subjects, and by gender at beginning, midpoint and end of intervention.</th>
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whole group and 12.7% and 24.07% in male and female respectively. All were statistically significant.

There were insignificant positive correlations between hand writing speed with pinch grip strength ($r=0.052$, $p=0.752$) and hand writing speed and upper limb coordination ($r=0.218$, $p =0.176$).

**DISCUSSION**

Handwriting is an essential skill required in the educational setting and the speed of handwriting will have an impact on outcomes. Only ten types of exercises were included in our exercise programme considering the feasibility and compliance. Exercises were user friendly and participants enjoyed. There were no exercise related complications.

Handwriting speed is commonly measured as the average number of words written per minute. Our data were in agreement with data produced by Graham and co workers. In that study females had a higher handwriting speed (24.3 wpm) compared to males (23.5 wpm). Also it was reported that legibility was higher in girls and speed was higher in right hander’s than left hander’s. There were only 2 left hander’s in our study and was not possible to compare. However, the two in our study showed considerable increase in writing speed (by 4 & 8 wpm) following the exercise programme. The reason why a left hander has a slower speed is not clear. Probably the direction of writing could have made an influence. Conventional writing direction, left to right, is set for the right hand person who will write away from the body, but a left hand person has to write towards the body and that could make some obstruction during the latter part of completion of a line hindering the speed. Researching more on this area would enable to identify appropriate positioning of the hand and instruments to improve speed. Improved legibility may, however, result in reduced speed, thus taking more time to complete an assignment. Therefore, a correct balance between speed and legibility need to be identified. In our study all had clear hand writing but we did not make a formal evaluation.

Despite the small sample size, our data has confirmed that exercise improves hand writing. Shoemaker et al, observed an 11.8% improvement in handwriting speed after 18 exercise sessions. Similar to our data Zivani and co workers reported higher hand writing speeds in boys. Pinch grip strength showed a 41.7% (1.6kg) improvement ($P<0.005$) following 4 weeks of exercise. Rogers and co workers in their work showed an increase of 3.6 kg ($p < 0.002$) and 2.9 kg ($p < 0.0005$) in right and left hand isometric grip respectively. Literature shows that function of the hand can be improved by exercise not only in healthy individuals but also in disease conditions as well.

Although at the beginning, males (9.1 pegs/15 seconds) demonstrated higher value of coordination than females (8.1 pegs/15 seconds), at the end of the training programme female’s had a better coordination than their male counterparts. The overall improvement in coordination was 24.07% in females and 12.7% in males. Work by Satheesha and co workers showed improvement in dominant hand coordination in a group of patients recovering from cerebral tumor. The positive relationship between handwriting speed with pinch grip strength and upper limb coordination are in agreement with other studies.

Due to many factors this study was confined to 4 week duration and limited to 10 exercises. It would be interesting to find out the outcomes by increasing the duration of exercise period and also by changing the number of exercises and identifying the best. Less number of exercises would increase the compliance and especially if such programmes are intended to introduce to school children.

According to Peterson and Nelson, improving legibility should precede attempts to improve writing

### Table 4. Comparison of Pre and post (end of 4 weeks) hand writing speed, pinch grip strength and coordination for the whole group.

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<th>Mean</th>
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<td><strong>Hand Writing Speed</strong></td>
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<tr>
<td>Pre</td>
<td>23.91</td>
<td>40</td>
<td>5.07</td>
<td>0.802</td>
<td>-7.876</td>
<td>39</td>
<td>&lt;0.001</td>
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<td>Post</td>
<td>28.95</td>
<td>40</td>
<td>4.71</td>
<td>0.745</td>
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<td><strong>Pinch grip strength</strong></td>
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<td>Pre</td>
<td>5.77</td>
<td>40</td>
<td>1.72</td>
<td>0.272</td>
<td>-7.529</td>
<td>39</td>
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<tr>
<td>Post</td>
<td>5.33</td>
<td>40</td>
<td>1.87</td>
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<td><strong>Coordination of the dominant hand</strong></td>
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<td>Pre</td>
<td>8.58</td>
<td>40</td>
<td>1.50</td>
<td>0.237</td>
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<td>Post</td>
<td>10.13</td>
<td>40</td>
<td>0.97</td>
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speed. Even though current study focused on handwriting speed it is important to identify legibility which is an important component in handwriting parameters perhaps difficult to correct at this age.

**Summery**

Handwriting speed, pinch grip strength and upper limb coordination can be improved after upper limb exercise programme. While males showed greater improvement in handwriting speed, females demonstrated greater improvement in pinch grip strength and upper limb coordination. Although not significant, positive correlations were seen between handwriting speed with pinch grip strength and upper limb coordination. These data need to be affirmed by studies involving more subjects from different age groups, especially primary school children to incorporate such training programmes in their school curricular. Similarly it would be interesting to study how such structured programmes would be useful in training individuals with different handicap states.

**Appendix 1- Types of exercises used in the programme**

1. Strengthening exercise for Brachioradialis — dumbell exercise
2. Strengthening exercise for wrist extensors - dumbell exercise
3. Strengthening exercise for Biceps - dumbell exercise
4. Coordination exercise for hand muscles — crumble a piece of cloth
5. Endurance exercise for hand muscles — finger meld
6. Endurance exercise for hand and forearm muscles — praying exercise
7. Endurance exercise for hand muscles — straight finger flexion
8. Coordination exercise for hand muscles — reciprocal movement of the fingers
9. Coordination exercise for hand and forearm muscles— drawing exercise
10. Coordination exercise for hand and forearm muscles - clapping

**REFERENCES**

To Study the Effect of Gluteus Maximus Activation in Sub Acute Mechanical Low Back Pain

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ABSTRACT

Introduction: Patients with low back pain (LBP) present at different points in its genesis, with symptom severity and effects on quality of life a major factor in the timing of presentation. Gluteus maximus, biceps femoris along with paraspinal muscles are the most important muscles of the group. There is group action of all these muscles in a particular sequence which is necessary for smooth spinal movements and stabilized spine during dynamic state of the body.

Methodology:

Study design: Experimental

Study setting: Gian Sagar Medical College and Hospital Patiala

Sampling: Random sampling technique

Sample size: 30 patients in group A which is control group and 30 patients in group B which is experimental group.

30 patients were included in 2 groups each group 1 was treated with routine physiotherapy as control group whereas group 2 was treated with routine physiotherapy along with gluteus maximus activation (isometric contraction of gluteus maximus in lengthened position). Outcome measures were taken in terms of VAS scale before and after the treatment daily for 10 days.

Result: Group 2 treated with gluteus maximus activation got relief early than group 1 although group 1 also got relief but took more number of days when compared with group 2.

Conclusion: Gluteus maximus activation should also be considered while treating mechanical low back pain.

Key words: Mechanical low back pain, Gluteus maximus activation, Lumbopelvic junction.

INTRODUCTION

Patients with low back pain (LBP) present at different points in its genesis, with symptom severity and effects on quality of life a major factor in the timing of presentation. LBP of up to 4 weeks duration may be considered acute because of the relatively slow recovery experienced by some patients, most of whom nonetheless suffer no permanent sequelae. Episodes of LBP lasting longer than 12 weeks are generally considered chronic. Even when LBP is consistent with a minor soft-tissue strain, it can be severely painful, occurring with associated spasm that may remarkably limit functional capacity.

Patients may be particularly concerned about the level of pain, which seems to them to indicate a serious problem. Where appropriate, patients can be reassured that LBP episodes typically resolve without permanent sequelae. The history and physical examination remain the primary tools for assessing patients with LBP because most patients will not demonstrate appreciable findings on imaging or other studies such as laboratory tests. The history is possibly more useful than the physical examination in ruling out occult serious diseases as recommended by Roger C, (2007) in recommendations for low back pain which were approved by American College of Physicians and the American Pain Society.
Lifting tasks and forward flexion movements are often related to lower back problems. It is possible that those who suffer back problems have a different muscle activity pattern during these types of movements than those who have healthy backs. Leinonen et al (1998) examined the electromyographic (EMG) activity of the gluteus maximus (GM) biceps femoris (BF) and paraspinal (PS) muscles and they observed that there is certain pattern of muscle action during flexion and extension of the spine. Gluteus maximus, biceps femoris along with paraspinal muscles are the most important muscles of the group. During the early phase of forward flexion the paraspinal and biceps femoris muscles get activated together. By the end of flexion, all three muscles are active and during extension all three are also active. However, the key difference between back patients and the healthy controls is the amount of gluteus maximus activity. During flexion gluteus maximus activity is significantly shorter and during extension the gluteus maximus activity ends earlier. This means that the gluteus maximus of the back patients switch on later and turns off sooner during the flexion extension movement.

This study will explore the effect of isometric contractions of gluteus maximus in patients of low back pain on the level of pain on VAS scale. There are recommendations of including gluteaus maximus strengthening in the rehabilitation of the patient with low back pain but there is no data on the immediate effect of isometric contraction of this muscle especially when there is spasm of spinal and surrounding muscles.

**Problem Statement:**

**Need Of Study:** In routine physiotherapy treatment protocols the importance of gluteus maximus activation is overlooked. This study will help in establishing the efficacy of gluteus maximus activation in relieving pain in sub acute mechanical low back pain.

**Aim Of The Study:**

To establish the role of gluteus maximus strengthening in sub acute low back pain.

**HYPOTHESIS:**

**Null hypothesis:**
Gluteus maximus activation does not help in reducing the pain in mechanical low back pain.

**Alternate hypothesis:**
Gluteus maximus activation helps in reducing pain mechanical low back pain.

**REVIEW OF LITERATURE**

The lumbar spine is composed of bone, cartilage, ligaments, nerves, and muscle. These anatomical components give the spine form and function. The alignment of the lumbar spine is con-trolled by its bony and ligamentous structures. This architecture enables the lum-bar spine to achieve its characteristic lor-dotic appearance. This form is given functional characteristics by actions of the lumbar spine muscles. Pope MH, DeVocht JW (1999) observed that these muscles are typically grouped into two differ-ent types: primary or secondary muscles. The primary lumbar muscles insert di-rec-tly into the bony elements of the spine, resulting in control of spinal motion. The secondary lumbar muscles aid in lumbar motion without a direct insertion into the spinal bony structures. They control mul-tisegmental gross movements and gener-ate the force necessary to perform many functional activities. Veeling A et al (1995) also studied global muscle system and described the integrated sling systems in low back which establishes the role of gluteus maximus in dynamic lumbar control. They observed the firing pattern of the lumber muscles during walking and other movements and concluded that gluteus maximus plays vital role during flexion and extension of lumbar spine, especially when the spine is moving from flexed position to extended position. Same kind of work was also done by Lewitt K (1995). He explained firing pattern of gluteus maximus, hamstrings and erector spinae during hip extention in his book manipulative therapy in rehabilitation of the motor system. It was observed that during the hip extension hamstring, gluteus maximus and erector spinae contract in the sequence. Joshua C (1999) also researched the relationship between low back pain and piriformis and gluteus maximus irritation. He observed that running or sitting lead to irritation of these two muscles and produce sciatica like symptoms. Nadler S F (2002) worked on athletes to correlate the incidence of LBP and the relationship with hip muscle imbalance. Hip strength of the athletes was measured during preparticipation, physical examinations. Occurrence of LBP was monitored throughout the year. Following the 1999-2000 preparticipation physicals, all athletes began participation in a structured core-strengthening program, which emphasized abdominal, paraspinal, and hip extensor strengthening. Incidence of LBP and the relationship with hip muscle imbalance were compared between consecutive academic years. The core program, however, seems to have had a role in modifying hip extensor strength balance.
Roger C (2007) recommended that patients who do not improve with self-care options, clinicians should consider the addition of nonpharmacologic therapy with proven benefits—for acute low back pain, spinal manipulation; for chronic or subacute low back pain, intensive interdisciplinary rehabilitation, exercise therapy, acupuncture, massage therapy, spinal manipulation, yoga, cognitive-behavioral therapy, or progressive relaxation. So it can be concluded that gluteus maximus has immense impact on the function of spine. Edmond L, (1995) in her book joint mobilization/manipulation has explained the technique of activation of gluteus maximus which also glides iliac crest over sacrum posteriorly by reversing the origin and insertion of the muscle. This technique is used for correcting anterior rotation of ilium over the sacrum. This technique is also explained in the book authored by Kamala S, and Marc O S, (1999) Exercise prescription, Foundation of therapeutic exercise classification and prescription. This technique is used in our research to activate the gluteus maximus and its effects are being evaluated.

**METHODOLOGY**

**Study design:** Experimental

**Study setting:** Gian Sagar Medical College and Hospital Patiala

**Study duration:** 2 months

**Sampling:** Random sampling technique

**Sample size:** 30 patients in group A which is control group and 30 patients in group B which is experimental group.

**INCLUSION CRITERIA**

1. Pain in low back (acute or sub acute).
2. Age group: 20–40 years
3. Pain should not be radiating to lower limb.
4. All the neurological tests should be negative.
5. Sensation of the patient should be normal.
6. All the reflexes should be normal.
7. There should not be any finding of structural changes in the spine.
8. Patient should be co-operative and well oriented to time, place and space.
9. Patient should not be having any neurological condition.

**EXCLUSION CRITERIA**

1. Patients those who were having clinical and radiological findings suggestive of disc prolapse were excluded from the study.
2. Any patients who had neurological tests (SLR, slump test) were excluded from the study.
3. Patients with radiating pain to lower limb were excluded from the study.
4. Those who had structural deformity in lower limb or spine were also excluded.
5. Patients having any neurological condition and who were not well oriented to time, place and space also excluded from the study.
6. Patients who experienced pain during the gluteal maximus isometric contraction maneuver were excluded.

**PROCEDURE**

Two groups of 30 patients each were taken. Group A was control group and was given routine physiotherapy which constituted SWD, TENS, spinal mobilization (grade 1 PA glide on hypomobile segment). Group B was the experimental group in which patients were given routine physiotherapy as in group A along with gluteal maximus isometric contractions in lengthened position. Patients were made to lie down in supine. Knee and hip joint were flexed to the maximum in a pain free range. Then patients were told to do hip extension against the resistance given by the therapist. Patient was told to hold the contraction for 10 seconds. This maneuver was repeated for 6 times (3 sets). Those patients who experienced pain during the maneuver were excluded from the study. Readings were noted on the visual analogue scale of pain (0 to 10). Readings were taken immediately after every session. Treatment was given till the reading on VAS scale was 0. Some patients were on NSAIDs and they continued the same treatment during the whole study period. Conventional physiotherapy treatment also continued during the whole study period.

**RESULT**

Data was statistically evaluated. This data shows that group 2 which was treated with gluteal maximus activation got relief earlier than group 1 although group 1 also got relief but took more number of days when compared with group 2.
DISCUSSION

The lumbar spine is an elegant structure with a complex local supporting system. Unlike the thoracic spine, it lacks the stabilizing strength provided by associated ribs. In acute LBP, a strain may occur in one or more of the supporting soft tissue structures. Local muscle spasms that occur secondarily are often the primary finding on physical examination. Patients presenting with LBP as their primary complaint can be divided into three broad groups. The smallest but most worrisome group has LBP as a consequence of a potentially serious and often occult condition, such as a neoplasm. In the absence of identified anatomic or physiologic abnormalities, terms such as nonspecific back pain or mechanical back pain may be used to describe the symptoms experienced by most patients. These are diagnoses of exclusion consistent with a presumptive soft tissue strain or sprain. This second group of patients often present with a history of an acute injury from an unsafe lifting practice or a history of repetitive overuse. They usually deny radiation of pain. The third group is the approximately 4% of patients with acute LBP who have radiating sensations to the lower extremities secondary to nerve impingement. Radiating sensations can include pain, numbness, weakness, or paresthesia.

Studies have been shown that unloaded inactivity induces atrophy and functional de-conditioning of skeletal muscle, especially in the lower extremities. As with most sedentary individuals, lower back pain is a common association with inactivity and prolonged sitting. Lower back pain that is categorized as mechanical pain will typically involve musculoskeletal factors that may be influenced by lifestyle, activity and body composition. Other types of low back pain are structurally specific to the spine and involve conditions such as arthritis, disc herniations, and degeneration. In mechanical low back pain, muscular length-tension relationships change over time in relation to the stress put on the body. For example, in the seated position, the hip flexors are in a constant shortened state and the knee flexors—primarily the gastrocnemius remains shortened. To exacerbate the effects of prolonged sitting, poor posture such as slouching, shoulder protraction, and cervical flexion, cause the erectors of the back to become overactive and fatigue causing the associated “creep”. The gluteals remain inactive in a seated position. Sitting for long periods can lead to the gluteal muscles atrophying through constant pressure and disuse. Movements that require the gluteal muscles become more difficult (such as climbing stairs or rising from a seated position); therefore, extra stress is put on the lumbar spine leading to low back pain. The average strength of the lumbar spine is approximately 200Nm depending on age. The lumbar spine muscles are not strong enough to overcome the flexion moment during a heavy lift and usually need the muscles of the posterior hip and thigh (gluteus maximus and hamstrings) for this function. Trained weight lifters lift heavy loads without a concomitant degree of acute low back injuries. They use the gluteus maximus during the early stage of the lift, perhaps contributing to earlier development of force. This process would stabilize the pelvis and permit the erector spinae to extend the trunk more efficiently.

Moreover as per the observations of Vleeming and Stoeckart (1995) with the single leg stance phase on right leg, the pelvis girdle translates anteriorly and adducts on the right femoral head. The right innominate starts to anteriorly rotate, whereas the left innominate rotates posteriorly both relative to the sacrum. During this movement biceps femoris relaxes while the gluteus maximus tightens along with latissimus dorsi. Both the muscles contracting at the same time stabilizes the pelvis during the gait. If there is relative weakness of gluteal maximus it can lead to the potential risk of sacro iliac dysfunction which in turn can put over strain on lumbopelvic junction which is the weak link of lumbo-pelvic-hip complex.

So patients complaining mechanical low back pain (sub acute or chronic) can respond to the gluteal maximus strengthening if done in lengthened position (muscles generate maximum force from lengthened position).

CONCLUSION

From the data analysis it is concluded that gluteus maximus activation helps the patients better in terms of pain relief although routine protocol also relieves pain but there is less number of days required for the physiotherapy treatment.

REFERENCES


INTRODUCTION

Cerebral palsy comprises a complex, multi-dimensional group of non-progressive movement disorders resulting from damage to the brain prenatally, perinatally, or early in childhood. It is one of the three most common lifelong developmental disabilities, the other two being autism and mental retardation causing considerable hardship to affected individuals and their families. The worldwide incidence of cerebral palsy is 2-2.5 per 1000 live births. Recent advances in the neonatal management in obstetric care have not shown the decline in incidence of cerebral palsy. On the contrary, with a decline in the infant mortality rate, there has actually been an increase in the incidence and severity of cerebral palsy. From the viewpoint of the International classification of Functioning, Disability and Health (ICF-6), cerebral palsy presents with “impairment” in the body function and structure such as muscle tone, strength, reflexes and range of motion. Significant “activity” limitations can also be present (e.g., dressing, feeding, functional mobility) as well as restricted “participation” (e.g. playing, participation in school) in social and community roles for the child. The long term disability and costs to the health care system and society associated with cerebral palsy are significant.

One of the important challenges in providing rehabilitation services to this group of children is to ascertain the dimension of disability in terms of prevalence, clinical spectrum etc. which help to formulate policy and to implement and monitor programs related to rehabilitation and prevention. Responding to this constant need of information the population based registers are maintained in the western countries which keeps a tab on the child birth and other related data (Pharoah, et al. 1998). However, obtaining epidemiological data in Indian situation...
poses far greater problems. The idea of cerebral palsy or childhood disability register is non existent in most of the hospitals of India. Therefore, the information on the prevalence and epidemiology of disability in children is not available from routine health service data systems. In addition, the absence of rehabilitation services in majority of geographical locations, non-reporting of cerebral palsy children in the Rehabilitation centers due to various factors etc. further complicates the task of obtaining reliable information on the prevalence of cerebral palsy. In this situation population surveys remains the only methods to obtain the epidemiological information.

In India camp approach is a very popular method to identify and to provide treatment advice to patients who are spread in a certain diversified geographical area. We have attempted to combine the elements of MICS methodology and Camp approach to obtain the epidemiological data related to the clinical profile of cerebral palsy, associated handicaps and the nature of management of children with cerebral palsy in and around Jalandhar town of Punjab.

METHODOLOGY

A database of children having cerebral palsy was prepared through one month advance advertisement for two days camp on TV and Radio. The information about the camp was also distributed in the community using pamphlets, and local contacts of social organizations in the Jalandhar and adjoining areas. Two days camp for children having cerebral palsy was organized in the month of February 2007 at Lyallpur Khalsa College, Jalandhar, Punjab. The content of advertisement was based on MICS module (Durkins et al. 1994) which is designed to identify children, in any cultural and social setting, who have congenital and developmental disabilities.

Procedure

Prior registration was done using a predeveloped evaluation format for each child which consisted of demographic profile, complaints, birth history, clinical profile i.e. motor assessment, gross motor function, deformity, gait and treatment history. At the time of registration each child’s demographical profile, birth history, treatment history and associated problems were recorded through interviewing the parents and from medical records available to them. Gross motor function was assessed using GMFM-88 (Russell et al. 1989, 1993) and score was converted into percentage using gross motor function measure estimator software.

Activities in the camp:

Each child was evaluated for tonal dysfunction, tone distribution, deformity, gait and any speech, learning problem by a team of Neurosurgeon, Physiatrist, Physiotherapist, Speech Therapist, Special Educator and an Orthotist. Tone assessment was done using Passive Motion Testing (O’Sullivan SB 2007) whereas deformity was evaluated by observation and measurement of active and passive joint range of motion (Levitt S 1995). Gait of each child was also assessed by observational method. After evaluation of each child parents were advised accordingly for the need of therapy, antispastic medication, orthosis or surgical intervention.

Statistical analysis: The data is presented as absolute number and percentage.

RESULT

A total number of 193 children having cerebral palsy reported to the camp, out of which 154 were identified as having cerebral palsy. 39 children had other afflictions such as PPRP, meningomyelocele, HSP, and muscle dystrophy. Table 1 presents the distribution of the cerebral palsy children as per the tone abnormalities.

<table>
<thead>
<tr>
<th>Tone abnormality</th>
<th>No. of children</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>spastic</td>
<td>127</td>
<td>65.8%</td>
</tr>
<tr>
<td>athetoid</td>
<td>5</td>
<td>2.5%</td>
</tr>
<tr>
<td>dystonic</td>
<td>9</td>
<td>4.7%</td>
</tr>
<tr>
<td>mixed</td>
<td>10</td>
<td>5.18%</td>
</tr>
<tr>
<td>flaccid</td>
<td>3</td>
<td>1.5%</td>
</tr>
<tr>
<td>Other (PPRP, meningomyelocele, HSP, muscle dystrophy)</td>
<td>39</td>
<td>20.2%</td>
</tr>
<tr>
<td>Total</td>
<td>193</td>
<td>100%</td>
</tr>
</tbody>
</table>

Spastic type of cerebral palsy constituted the predominant group (65.8%) followed by mixed type (5.18%), dystonic (4.7%), athetoid (2.5%) and flaccid (1.5%). The analysis of the associated problems recorded in the cerebral palsied children revealed that Convulsion disorder was reported in 34 children (17.61%) majority of them were spastic type.

<table>
<thead>
<tr>
<th>Associated problem</th>
<th>No of children</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seizure disorder</td>
<td>34</td>
<td>17.61%</td>
</tr>
<tr>
<td>Mental retardation</td>
<td>19</td>
<td>9.8%</td>
</tr>
<tr>
<td>Speech delay</td>
<td>12</td>
<td>6.21%</td>
</tr>
<tr>
<td>Dysarthria</td>
<td>14</td>
<td>7.25%</td>
</tr>
</tbody>
</table>
Subnormal intelligence was another common handicap (9.8%) among the children. 13.46% children among flaccid, mixed and spastic variety had speech defects. (Table 2).

Table 3. Distribution according to the etiology of cerebral palsy (n=139)

<table>
<thead>
<tr>
<th>Etiology</th>
<th>No. of patients</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prematurity (&lt;37 wks gest.)</td>
<td>56</td>
<td>29.01%</td>
</tr>
<tr>
<td>kernicterus</td>
<td>10</td>
<td>5.18%</td>
</tr>
<tr>
<td>Birth asphyxia</td>
<td>34</td>
<td>17.61%</td>
</tr>
<tr>
<td>IVH</td>
<td>2</td>
<td>1.03%</td>
</tr>
<tr>
<td>PVL</td>
<td>2</td>
<td>1.03%</td>
</tr>
<tr>
<td>RSD</td>
<td>2</td>
<td>1.03%</td>
</tr>
<tr>
<td>Unknown etiology</td>
<td>48</td>
<td>24.87%</td>
</tr>
<tr>
<td>Other</td>
<td>39</td>
<td>20.2%</td>
</tr>
</tbody>
</table>

The information on the etiologies summarized in table 3 Prenatal, natal and post natal factors were found in 56(29.01%), 34(17.61%), and 16 (8.27%) cases respectively. In 48 (24.87%) cases the prenatal, natal and post natal history was normal.

Table 4. Distribution according to topographical presentation (n=193)

<table>
<thead>
<tr>
<th>Tone abnormality</th>
<th>presentation</th>
<th>no</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spastic/athetoid/mixed/flaccid</td>
<td>quadriplegic</td>
<td>49</td>
<td>25.38%</td>
</tr>
<tr>
<td>Spastic diplegic</td>
<td></td>
<td>77</td>
<td>39.89%</td>
</tr>
<tr>
<td>Triplegic</td>
<td></td>
<td>9</td>
<td>4.6%</td>
</tr>
<tr>
<td>Hemiplegic</td>
<td></td>
<td>10</td>
<td>5.18%</td>
</tr>
<tr>
<td>Dystonic</td>
<td>focal</td>
<td>1</td>
<td>1.5%</td>
</tr>
<tr>
<td>Other etiology</td>
<td>general</td>
<td>6</td>
<td>3.1%</td>
</tr>
<tr>
<td>Other</td>
<td>general</td>
<td>39</td>
<td>20.2%</td>
</tr>
</tbody>
</table>

Among spastic type of cerebral palsy, spastic diplegia was the most common clinical presentation in 77 children (39.89%) followed by spastic hemiplegia (5.18%), quadriplegic presentation (25.38%) was common among mixed and athetoid variety. Generalized dystonia was observed in 3.1% cases only (table 4).

Table 5. Distribution according to milestone achieved (n=193)

<table>
<thead>
<tr>
<th>Milestones</th>
<th>No. of children</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head holding</td>
<td>3</td>
<td>1.5%</td>
</tr>
<tr>
<td>Rolling</td>
<td>10</td>
<td>5.18%</td>
</tr>
<tr>
<td>Creeping</td>
<td>20</td>
<td>10.36%</td>
</tr>
<tr>
<td>Sitting</td>
<td>70</td>
<td>36.26%</td>
</tr>
<tr>
<td>Crawling</td>
<td>14</td>
<td>7.25%</td>
</tr>
<tr>
<td>Kneel standing</td>
<td>27</td>
<td>13.98%</td>
</tr>
<tr>
<td>Kneel walking</td>
<td>5</td>
<td>2.5%</td>
</tr>
<tr>
<td>Half kneeling</td>
<td>3</td>
<td>1.5%</td>
</tr>
<tr>
<td>Squat to standing</td>
<td>9</td>
<td>4.6%</td>
</tr>
<tr>
<td>Standing</td>
<td>8</td>
<td>4.16%</td>
</tr>
<tr>
<td>Walking</td>
<td>24</td>
<td>12.43%</td>
</tr>
<tr>
<td>Total</td>
<td>193</td>
<td>100%</td>
</tr>
</tbody>
</table>

On GMFM scale only 12.43% cases achieved independent ambulation. However maximum children in this category belonged to different pathology group. Majority of the children (36.26%) were at sitting level. 6.68% among flaccid variety were at lower milestone level. (table 5)

Table 6. Percentage distribution of common deformities in upper/ lower limbs

<table>
<thead>
<tr>
<th>Lower limb deformity</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>foot</td>
<td>56%</td>
</tr>
<tr>
<td>Equinus</td>
<td>34%</td>
</tr>
<tr>
<td>Equinus+inversion</td>
<td>34%</td>
</tr>
<tr>
<td>Valgus</td>
<td>4%</td>
</tr>
<tr>
<td>Knee flexion</td>
<td>47%</td>
</tr>
<tr>
<td>Recurvatum</td>
<td>6%</td>
</tr>
<tr>
<td>Hip adduction</td>
<td>34%</td>
</tr>
<tr>
<td>Internal rotation</td>
<td>34%</td>
</tr>
<tr>
<td>Flexion</td>
<td>12%</td>
</tr>
<tr>
<td>Upper limb</td>
<td></td>
</tr>
<tr>
<td>Wrist</td>
<td></td>
</tr>
<tr>
<td>Elbow +Forearm</td>
<td>57%</td>
</tr>
<tr>
<td>Shoulder Adduction+internal rotation</td>
<td>29%</td>
</tr>
</tbody>
</table>

Equinus foot and knee flexion deformity were commonly observed among diplegics (39.89%) in lower limbs. Hip joint and knee joint deformity in lower extremity and elbow, wrist joint deformities were common in quadriplegic and hemiplegic group. (table 6)

Table 7. Distribution according to treatment measures taken (n=193)

<table>
<thead>
<tr>
<th>Treatment measures</th>
<th>No. of children</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical interventions</td>
<td>12</td>
<td>6.21%</td>
</tr>
<tr>
<td>Botox injections</td>
<td>24</td>
<td>12.43%</td>
</tr>
<tr>
<td>Medications only(antispastics)</td>
<td>34</td>
<td>17.61%</td>
</tr>
<tr>
<td>Therapies(PT,OT,aids)</td>
<td>70</td>
<td>36.26%</td>
</tr>
<tr>
<td>No treatment</td>
<td>14</td>
<td>7.25%</td>
</tr>
<tr>
<td>Other</td>
<td>39</td>
<td>20.2%</td>
</tr>
</tbody>
</table>

Out of 154 cases, only 14 (7.25%) cases had not taken any kind of treatment which belonged to very remote area. Majority of urban population were taking some kind of treatment regularly. 18.64% of cases had undergone for advanced form of surgical interventions and botox injections for the management of spasticity also.

DISCUSSION

In the present study, spastic type of cerebral palsy was the predominant group (65.8%) and spastic diplegia (39.89%) was the most common clinical presentation. Prematurity was the major factor involved in the causation of the cerebral palsy. A large number of subjects had convulsions and mental
retardation as associated handicaps. These observations are in agreement with the other Indian studies (Singhi et al., 1996; Sharma et al., 1991; Laisram et al., 1992).

Singhi et al' (1996) reviewed 1000 children with cerebral palsy to study their clinical profile, aetiological factors and associated problems. Spastic quadriplegia constituted the predominant group followed by spastic diplegia and dyskinetic cerebral palsy. Sharma et al' (1991) conducted a retrospective study involving 480 cases of cerebral palsy to examine their clinical profile and predisposing factors. In their series the spastics constituted predominant group (77.9%) followed by hypotonic (8.5%), ataxic (0.6%). History of perinatal asphyxia was found in 48.7% and in 6% cases postnatal infection was major cause among predisposing factors. Subnormal intelligence was common associated handicap in 74.2% cases followed by speech defects (53.8%) convulsions (25.6%) and ocular defects (35.8%). Laisram et al 9 (1992) studied 540 cases of cerebral palsy to find out the etiology. They found toxemia (1.29%) and microcephaly (1.84%) were the most common etiological factor in prenatal category. Among the natal causes (24.45%), birth anoxia was most common factor and infections constituted the common postnatal cause (17.1%). The present study also focussed on obtaining information on the level of motor function among cerebral palsied population, common deformities and mode of treatment taken.

We had combined the camp approach and childhood disability screening questionnaire to obtain information regarding the clinical profile and associated handicaps and found that majority of the subjects reported to the camp had symptoms mentioned in the questionnaire. Camp is the common practice in our country for creating awareness against any problem and for mass level treatment or advices. We observed that this approach can also be used as a tool of data collection for epidemiological studies. The only drawback in this approach is poor follow up or exactness of database. Studies conducted in other countries like by Liu et al10 (1999) and Robertson et al11 (1998)on the prevalence of cerebral palsy included surveys through the cerebral palsy registers maintained at government levels whereas in India provision of such registry do not exist . This acts as a major obstacle in obtaining accurate information on the prevalence and incidence of cerebral palsy. The epidemiological data is necessary for designing preventive and curative measures. The camp approach can be used successfully however with some planning to gather epidemiological data.

CONCLUSION

The present study revealed that spastic subtype constituted the major type of cerebral palsy and prematurity and birth asphyxia were found to be major predisposing factors in its development. Most of the children having cerebral palsy had convulsion disorder as an associated problem. Spastic diplegia was commonest clinical presentation of cerebral palsy. Equinus foot and crouch knee deformities were common. Most of the urban parents were aware about various treatment options available, whereas rural parents were ignorant about therapies and other treatment options.

ACKNOWLEDGMENT

We are thankful to the college management and all the BPT interns who helped us in organizing and managing the patient population during camp days.

REFERENCES

Modified Quadriceps Strengthening Maneuver for Patients Undergoing ACL Reconstruction-surface Electromyographic Analysis

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ABSTRACT

Introduction: Quadriceps femoris muscle setting is isometric quadriceps femoris exercise which can be widely used in early knee rehabilitation. However, this exercise cannot obtain enough co-contraction of the hamstrings. We succeeded in developing a simple training maneuver that is effective in obtaining co-contraction of the hamstrings—a modified maneuver for the quadriceps femoris (MQS) muscle setting.

Aim of Study: To analyze the effect of MQS muscle settings by Electromyographic (EMG) analysis.

Methodology: It is an experimental study including 50 normal healthy subjects (Age: 20-30, Sex: Male) from the K.K Sheth Physiotherapy College, Rajkot. Orthopaedic, Neurological, Cardiovascular and Un co-operative patients were not included in the study. The subjects underwent 2 Quadriceps settings. One was the normal quadriceps femoris muscle setting (NQS) and the other was MQS. Moreover, subjects had worn a sand bag of 2 or 5 kg on the ankle of the raised lower limb in MQS (MQS2, MQS5). EMG activity was recorded from surface electrodes on the vastus medialis, vastus lateralis, semitendinosus and biceps femoris. Statistical processing on four movements were conducted using repeated measures ANOVA. Significant differences were identified using the Fisher’s least significant difference test.

Results: The activities of the hamstrings were greater in MQS than in NQS, and co-contraction of the quadriceps femoris and hamstrings was obtained in the MQS maneuver.

Discussion: In MQS, the hamstrings work with quadriceps femoris. The activities of rectus femoris declined as the load to the raised lower limb progressed from NQS to MQS5. While in NQS induce contraction of the quadriceps femoris alone.

Conclusion: This study suggests that effective co-contraction of the hamstrings can be obtained in MQS.

Key words: NQS, MQS, EMG

INTRODUCTION

Quadriceps femoris muscle setting is isometric quadriceps femoris exercise which can be widely used in early knee rehabilitation. However, this exercise cannot obtain enough co-contraction of the Hamstrings. The co-contraction of the quadriceps and the Hamstrings that takes place during closed kinetic chain exercise (CKC) has made this exercise of choice for rehabilitation after anterior cruciate ligament (ACL) reconstruction. As this hamstring co-contraction during CKC exercise has been confirmed to reduce the tendency of the quadriceps to induce anterior tibial translation, it is useful for the stabilization of the tibia. But the application of CKC exercise is difficult in the early stage of knee rehabilitation with ACL injury.

Physical therapists use a combination of quadriceps femoris muscle setting (QS) and SLR to strengthen the quadriceps femoris muscle in the early stage of knee rehabilitation with ACL injury. These exercises are easy isometric quadriceps femoris contraction exercises and OKC exercises. As these exercises produce minimum co-contraction of the Hamstrings, the isolated contraction of the
quadriiceps femoris imposes maximum strain to the ACL.

We successfully developed a simple training maneuver that produced sufficient co-contraction of the hamstrings to strengthen the quadriceps femoris in the early stage of knee rehabilitation. This maneuver, quadriceps femoris muscle setting (MQS), is a conventional maneuver for quadriceps femoris performed with one leg raised while the other leg is exercised. In this paper, we present data on an EMG quantification of the effects of this maneuver.

MATERIALS AND METHODS
- **Study Design:** Observational Study
- **Study Setting:** This study was conducted in K.K Sheth Physiotherapy College.
- **Sample Selection:** 50
- **Study Duration:** One Session Study

**INCLUSION CRITERIA**
1. Normal Healthy Individuals BMI (18.6-24.9 KG/M²)
2. Age Group: Between 20-30 yrs
3. Only male participants
4. Participants willing to participate in the study.

**EXCLUSION CRITERIA**
1. Present or past history of hip, knee or ankle injury.
2. Positive findings on patella-femoral or tibio-femoral tests
3. Hyper-extension of knee.
4. Un co-operative patients

**Outcome Measures:**
- **ELECTROMYOGRAPHIC ANALYSIS**
- EMG instrument (RMS EMG)
- EP MK-II, Version 1.1), Measure tape, Weighing-machine,
- Height-scale, sketch-pen, spirit, pen, electrode gel.
- Cotton, Micropore tape, Universal Goniometer and Couch

**METHOD**

The subjects underwent two Quadriceps settings (QS). One was the normal quadriceps femoris muscle setting (NQS) that is performed in a supine position, leg extended. The other was a QS which maintained the opposite lower limb raising position at a hip flexion of 90° and knee flexion of 90° (MQS). Moreover, subjects wore a steel belt of 2 or 5 kg on the ankle of the raised lower limb in MQS (MQS2, MQS5). Surface electromyography was performed on the quadriceps femoris (vastus medialis, vastus lateralis), the semitendinosus and the biceps femoris (long head) of the leg on which quadriceps muscle setting was performed. Surface electromyography was performed. At the same time EMG Parameters were Filter-10khz,Sensitivity 200uV/D Sweep speed 10ms/D. Each movement was performed for 5 s and the derived electromyographic activity from each muscle was rectified, smoothed and integrated for 3 s between movements.

The value of % MVIC of each muscle in each movement was expressed by mean and standard deviation. Statistical processing on four movements was conducted using repeated measures ANOVA. Significant differences were identified using the Fisher’s least significant differences test. The level of significance was 5%.
RESULT

The activities of the hamstrings were greater in MQS than in NQS, and co-contraction of the quadriceps femoris and hamstrings was obtained in the MQS maneuver \((p<0.05)\). Both of these tendencies were enhanced in proportion to the increase of the weight load imposed on the raised lower limb (MQS2, MQS5).

The \% MVIC of the and hamstrings in MQS2 and MQS5 showed a greater increase than that in NQS when the load to the raised lower extremity was increased. The activities of the Vastus medialis and Vastus lateralis declined as the load to the raised lower limb progressed from NQS to MQS5, though not to a statistically significant extent.

DISCUSSION

Isolated quadriceps femoris contraction in knee extension imposes severe strain to ACL. Henning et al. recommended that patients in their first year after injury or reconstruction avoid quadriceps femoris exercise near full-extension angles. In MQS, the hamstrings with quadriceps femoris setting. In a radiographic study of 20 healthy subjects, Yasuda et al. calculated the shear force (anterior drawer force) during isometric knee extension at various knee angles and concluded that isometric knee extension at angles in the range of 0-45° should not be performed immediately after ACL injury because of the significant shear force generated by the quadriceps femoris contraction. Hirokawa et al. studied the load-elongation of the ACL and concluded that isolated contraction of the quadriceps femoris leads to significant anterior displacement of the tibia in the range of 0-80° knee flexion. Several previous studies on quadriceps femoris muscle setting and SLR have examined the positions and methods that produce effective quadriceps femoris activity, but none of these studies examined the activity of the hamstrings.

For early rehabilitation of knee disease, we have studied a simple quadriceps femoris muscle force augmentation training maneuver effective in obtaining co-contraction of the hamstrings. We confirmed that co-contraction of the hamstrings was achieved in the quadriceps femoris muscle setting position with the contra-lateral lower limb raised. The raised lower limb was positioned at a hip flexion of 90° and knee flexion of 90° to prevent excessive lordosis of the lumbar spine by means of the forward pelvis slant.

In MQS, the hamstrings work with quadriceps femoris setting. However, they also work without quadriceps femoris setting when the position of the contralateral lower limb is raised. The hamstring co-contraction obtained in MQS was achieved by a forward bending moment of the pelvis generated by the weight of the raised opposite lower limb (In Fig 4,Rt lower extremity). To counter this moment, the subject produces an opposing moment in the anti-rotatory direction on the pelvis by pushing his or her heel to the bed (In figure 4, left lower extremity). The hamstrings and gluteus maximus work at this point in the procedure.
Limitation: Small Sample Size.

CONCLUSION

Our study suggests that MQS exercise is a useful, safe, and simple maneuver for quadriceps femoris muscle augmentation that can be performed without producing severe strain to ACL in the early stages of knee rehabilitation with ACL injury.

ACKNOWLEDGEMENTS

I would like to thank Dr Vinit Modi (Assistant Physiotherapist) and I am grateful to all my patients for their kind cooperation and willingness to participate in this study, without whom this study would not have materialized.

Conflict of Interest Nil

REFERENCES

A Comparison Between Land-based and Water-based Balance Training Exercise Program in Improvement of Balance in Community Dwelling Elderly Population

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ABSTRACT

Background and Purpose: Specific balance training exercise program have been shown to play an important role in the improvement of balance and function. Water has been identified as a low risk, safe and supportive medium to perform these exercises. The purpose of this study was to investigate whether water acts as a better medium than land for training balance exercises in community dwelling elderly population.

Study Design: A pre-post experimental design was used in this study.

Subjects: 60 community dwelling elderly adults (≥60 years of age) participated in the study. These subjects were randomly allocated to one of the two groups: Group 1 (n=30) was administered with the balance exercises on land & Group 2 (n=30) was administered with the balance exercises in an indoor pool.

Methods: The balance performance of the subjects was evaluated on the Berg Balance Scale and Timed Up and Go Test. Each group performed a comparable program of balance training exercises which was divided into a warm-up period, a conditioning period and a cool-down period.

Results: Both the land-based and water-based exercise groups were benefited from the balance training exercise program with a significant improvement in post-intervention balance scores on Berg balance scale and Timed up and go test as compared to their pre-intervention scores. However, on comparison between the two groups, there was no statistically significant difference between post-intervention scores of Berg balance scale and Timed up and go test.

Conclusion and Discussion: Regardless of the exercise medium, significant improvement in the balance scores was achieved by the subjects in both the groups following the balance training exercise program. Thus, concluding that balance training exercise program in either medium may be equally effective in improving balance in the elderly population.

Key Words: Balance, Fall, Exercise.

INTRODUCTION

Biological functions decline with age. Deterioration of balance is a well-documented hallmark of the ageing process. The cause of age-related balance decline is related to a combination of decreased sensory input, slowing of motor responses, and musculoskeletal impairments.

Balance and mobility disorders are the single largest cause of chronic disability in individuals 60 years or older and is often manifested as falls and fall-related injuries. Approximately 30% of community-dwelling older adults fall each year. The incidence of falls rises exponentially with age in the elderly and is higher in women than in men. There is a greater than linear increase in the rate of falls between the ages of 60 to 65 and 80 to 85. Fall is the cause of increasing morbidity and mortality from limb bone fractures and their complications (especially fractured neck of femur and pulmonary embolism).

Participation in a regular exercise program is an effective intervention to reduce or prevent a number of functional declines associated with ageing thereby acting as an effective means to reduce falls in the
elderly. About 10 to 25% of falls are associated with poor balance and gait abnormalities. Thus, balance training exercise program have an important role to play in falls prevention. Meta analysis of seven of the FICSIT trials revealed that balance training had a beneficial effect on fall incidence. In another study, specific balance strategy training was found superior to traditional exercises for improving function and balance.

Though balance training on land may improve balance in elderly people, it may be risky or intimidating for those who are afraid of falling as fear of a further or more injurious fall tends to limit exercise gains. The goal of an effective intervention should always be to maximize functional independence within the margins of safety. Owing to the physiological properties of water such as buoyancy, viscosity and density water acts as a low risk and safe exercise environment for the elderly, particularly for those who have entered downward spiral of decreased activity.

It is suggested that exercise in water allows larger bandwidth of movement in which participants could error, receive the feedback and then correct for that error without an increase in their fear of fall and injury. Clinical evidence has supported benefit from aquatic therapy in function, joint mobility, strength, flexibility, balance, pain, self-efficacy and affect among older adults. Exercising in water has also shown significant improvement in cardio-respiratory fitness, body composition, blood lipids, and agility in older adults. Therefore, water-based exercise can be considered a safe and beneficial mode of exercise for older adults.

Although many studies have stated beneficial effects of water-based exercises, not many studies have been conducted to compare the effectiveness of land-based and water-based balance training exercise program in elderly adults. Keeping this in view this study was designed with the purpose to identify the most appropriate medium for balance training in community-dwelling elderly people with active lifestyle.

**METHODOS**

**Subjects:** 60 older adults took part in this study. The group receiving the balance exercise program on land (Group 1) consisted of 12 males and 18 females with a mean age of 64.97 ± 5.52 years while the Group 2 receiving balance exercise program in the aquatic therapy pool consisted of 10 males and 20 females with a mean age of 64.07 ± 4.29 years. The two groups were comparable with respect to age, height and weight.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group 1(n=30)</th>
<th>Group 2(n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr</td>
<td>64.97 ± 5.52</td>
<td>64.07 ± 4.29</td>
</tr>
<tr>
<td>Height, cm</td>
<td>161.25 ± 9.58</td>
<td>161.76 ± 10.12</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>67.32 ± 8.47</td>
<td>67.73 ± 8.49</td>
</tr>
<tr>
<td>Sex</td>
<td>Male = 12, Female = 18</td>
<td>Male = 10, Female = 20</td>
</tr>
</tbody>
</table>

Group 1: Land-based balance exercise program
Group 2: Water-based balance exercise program

The study was conducted in the year 2007-08 & the subjects were gathered through a Geriatric camp organized at Indian Spinal Injuries Center, Vasant Kunj. Residents of Vasant Kunj, New Delhi and relatives of in-patients of Indian Spinal Injuries Center volunteered for the study. Subjects who fulfilled the inclusion criteria and were ready to attend the exercise program regularly were selected. The inclusion criteria for the subjects included: Healthy asymptomatic elderly aged 60 yrs and above who were independent in ambulation and in activities of daily living and able to attain a score of more than 24 on Mini-Mental Status Examination (MMSE). Exclusion criteria for the subjects included: Receipt of physical therapy at the same time or enrollment in any other formal exercise program, any uncorrected hearing and visual impairment, Meniere’s disease, Benign Paroxysmal Positional Vertigo, any neurological or musculoskeletal impairment, any medical illness that may interfere with the participation in the exercise program and any obvious contraindication to aquatic therapy (Infections, incontinence, fever, wounds).

Procedure: The subjects were invited to participate in the study and were then randomly assigned to one of the two groups. A detailed explanation of the procedure was given after which the subjects signed the informed consent. Subjects were then assessed on two balance scales: Berg balance scale (BBS) and Timed up and go test (TUGT).

The balance exercise program given to both the groups was comparable and divided into a 10 minute warm-up period which consisted of stretching of major muscle groups, this was followed by a 40 minute conditioning period of various activities of balance performance such as weight transfer / reaching activities, fast walking, side-stepping, walking backwards, upper limb range of movement exercises,
resisted upper limb exercises, lower limb range of movement exercises, hopping and jumping in circle formation, team games like over ball relays and a 10 minute of cool-down period consisting of stretching, deep breathing and floating.

The subjects of Group 1 performed the exercises on land in the Rehabilitation department of Indian Spinal Injuries Center. These subjects performed the cool down period consisting of stretching and deep breathing in supine lying.

Group 2 performed the exercises in the indoor aquatic therapy pool of Indian Spinal Injuries Center with a water temperature of $35\pm 2^\circ C$, room temperature of $25\pm 2^\circ C$, and relative humidity of $55\%$ to $65\%$.

Subjects assigned to water exercise group were familiarized with the pool environment one day before the beginning of the exercise sessions. The subjects exercised at a water level between their waist and nipple line.

Each session comprised of 6-8 subjects in both the groups and a therapist’s assistance was taken. After an intervention of two weeks with five sessions per week, the subjects were again assessed on both the mentioned balance scales.

**RESULTS**

A student’s t-test was used to compare the performance of subjects of Group 1 and 2 on Berg balance scale (BBS) and Timed up and go test (TUGT) prior to the intervention program. The analysis of pre-intervention scores of Berg balance scale between Group 1 (Mean = 51.53, S.D. = 1.20) and Group 2 (Mean = 50.97, S.D = 3.09) did not show any significant difference (t-value = 0.94, p=0.353) indicating that both groups were matched in terms of Berg balance scale scores. The pre-intervention scores of Timed up and go test also showed no significant difference between both the groups (Group 1: Mean = 11.01, S.D. = 1.08; Group 2: Mean = 11.01, S.D = 1.21) with t-value = 0.03 and p=0.975.

The comparison of post-intervention scores of Berg balance scale between Group 1 (Mean = 55.07, S.D. =0.91) and Group 2 (Mean =55.10, S.D. =1.32) revealed no significant difference with t-value = 0.11 and p=0.910. Similar results were seen for post-intervention scores of Timed up and go test. (Group 1: Mean = 9.17, S.D. = 1.00; Group 2: Mean = 9.10, S.D. = 1.19) with t-value=0.25 and p=0.805.
Table 2. Comparison of Berg Balance Scale (BBS) and Timed Up and Go Test (TUGT) Post-intervention scores between Group 1 and 2.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group 1 (n=30)</th>
<th>Group 2 (n=30)</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBS</td>
<td>Mean ± S.D.</td>
<td>Mean ± S.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>55.07 ± 0.91</td>
<td>55.10 ± 1.32</td>
<td>0.11</td>
<td>0.910</td>
</tr>
<tr>
<td>TUGT</td>
<td>Mean ± S.D.</td>
<td>Mean ± S.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.17 ± 1.00</td>
<td>9.10 ± 1.19</td>
<td>0.25</td>
<td>0.805</td>
</tr>
</tbody>
</table>

N.S = Not significant

Group 1: Land-based balance exercise program
Group 2: Water-based balance exercise program

Within the group there was significant difference in the pre-intervention and post-intervention scores of Berg balance scale for Group 1 (t-value = 22.49 and p=0.000) and Group 2 (t-value = 11.55 and p=0.000). Pre-intervention and post-intervention scores of Timed up and go test scores also showed significant difference for both Group 1 (t-value = 10.82 and p=0.000) and Group 2 (t-value = 19.42 and p=0.000).

Thus, indicating that both the groups showed marked improvement in the balance scores following balance training exercise program in either of the medium.

Table 3. Intra-Group comparison of Berg balance scale (BBS) and Timed up and go Test (TUGT) Scores

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-intervention scores</th>
<th>Post-intervention scores</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± S.D.</td>
<td>Mean ± S.D.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BBS</td>
<td>Group 1 (n=30)</td>
<td>Group 1 (n=30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51.53 ± 1.20</td>
<td>55.07 ± 0.91</td>
<td>22.49</td>
<td>0.000</td>
</tr>
<tr>
<td>TUGT</td>
<td>Group 1 (n=30)</td>
<td>Group 1 (n=30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.01 ± 1.08</td>
<td>9.17 ± 1.00</td>
<td>10.82</td>
<td>0.000</td>
</tr>
<tr>
<td>BBS</td>
<td>Group 2 (n=30)</td>
<td>Group 2 (n=30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50.97 ± 3.09</td>
<td>55.10 ± 1.32</td>
<td>11.55</td>
<td>0.000</td>
</tr>
<tr>
<td>TUGT</td>
<td>Group 2 (n=30)</td>
<td>Group 2 (n=30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.01 ± 1.21</td>
<td>9.10 ± 1.19</td>
<td>19.42</td>
<td>0.000</td>
</tr>
</tbody>
</table>

* = Significant

Group 1, n=30: Land-based balance exercise program
Group 2, n=30: Water-based balance exercise program

DISCUSSION

This study was designed to compare the effectiveness of similar balance training exercise program in a land versus water environment. The results obtained reveal that subjects in both the groups: Land-based and Water-based exercise group were benefited from the balance training exercise program with a significant improvement in post-intervention balance scores on Berg balance scale and Timed up and go test as compared to their pre-intervention scores. This can be seen in figures 4, 5 and Table 3.

This improvement in balance function may be attributed to the presentation of repetitive motor tasks that produce an improvement in performance called adaptation, which is an important element of balance function. Thus, although the balance of older persons initially is poor, repetitive trials lead to a major improvement in performance.

Moreover, a balance specific exercise program was employed in this study, which might have resulted in improvement of balance scores of the elderly adults. In this study, the balance training exercise program for both Land-based and Water-based exercise group was carried out in ‘groups’. This would have led to improvement in the balance performance as belonging to a group seems to promote better adherence to an exercise program. Also, a supervised class seems to allow faster progression of training, greater individual feedback, a secure environment, peer support, an opportunity for social interaction, and a reduction in feelings of isolation.

On comparison between Land-based and Water-based exercise group, there was no statistically significant difference between post-intervention scores of Berg balance scale and Timed up and go test. Thus, indicating that regardless of the exercise medium, significant improvement in balance performance were achieved by the subjects in both the groups. These findings are consistent with the conclusions of Douris and colleagues. The main finding from their study...
was that balance ability in older adults can be improved through the use of either land-based or aquatic-based therapeutic exercise. Eleven subjects completed this study where both land and aquatic based exercise groups did a comparable set of lower body exercises twice a week for 6 weeks. Regardless of the treatment medium, significant improvements were evidenced on the Berg balance scale between pre-intervention and post-intervention scores.22

Similarly, Taunton et al concluded that the type of exercise venue (land vs. water) did not have a significant effect in improving cardio-respiratory fitness, body composition, forward trunk flexion and strength measurements of elderly women aged 65 to 75 years.36

The results of a recent study conducted on thirty-four patients aged 50 years and above with coronary artery disease also demonstrated that both the water exercise and land exercise programs were effective in increasing the exercise tolerance and muscular strength with similar favorable adaptations on lipid profile and body composition. Thus, indicating that water based exercise may be a useful alternative for low risk patients with coronary artery disease.37

Literature suggests that because of water’s low impact and reduced risk nature, water exercise provides a viable alternative for older persons who are unable to participate in land-based exercise programs because of limiting arthritis, significant mobility limitations, severe balance impairments or other disabilities.18,21,29,25 The buoyancy of water allows these elderly people to undertake exercises and movements that they could not perform on land thereby allowing people with various levels of ability and disability to participate at their own pace.38,34

Thus, the factor that might have contributed to the findings of the present study is that the population of elderly people participating in this study was leading an active lifestyle and was community-based and that was not frail and institutionalized.

Although a larger sample of 60 subjects was employed in the present study as compared to the above mentioned studies, the results obtained reveal no significant differences in either of the medium in improvement of balance performance in community dwelling elderly population.

Thus, water exercise is an evidence-based alternative method of balance training and postural re-education for the elderly population.19

**Clinical Implications:** These data suggest that balance training exercise program leads to improvement in balance performance in community dwelling elderly people. Regardless of the exercise medium (land or water), balance training exercise program can result in improvement of balance performance in community dwelling elderly population. Thus, balance ability in older adults could be improved through the use of either land-based or water-based balance training exercise program.

Considerations of availability, cost, and maintenance of the therapeutic pool will guide the clinician in the decision making process for balance re-training in the elderly.

**Limitations of the study:** Small sample size and shorter duration are the major limitations of the study. Increasing the sample size would have increased the statistical power of the study. Also, most of the participants belonged to the same community and were leading an active lifestyle. Thus, results obtained cannot be generalized for all population types including the frail and institutionalized.

**Future Research:** This study was conducted on a small sample of active and healthy community dwelling elderly population. However, had it been a frail, kyphotic and osteoporotic population it might have encountered difficulties in participating in the land-based balance training exercise program. Thus, water might be considered beneficial to those elderly adults who are frail, suffer from pain, or are severely kyphotic. Future researches can thus consider frail and institutionalized elderly population.

As mentioned earlier, this study used only a small sample of subjects and that too from the same community. The relevance of this study can be increased by taking a larger sample of subjects from different sectors of the society.

Re-assessment of the subjects at different intervals to determine the duration of the gains made during training, or when the significant gains were achieved, would be beneficial. Increasing the duration of the study can add further relevance to the results obtained.

**CONCLUSION**

Regardless of the exercise medium, significant improvements in balance scores were achieved by the subjects in both the groups after the balance training exercise program.
Thus, concluding that Balance training exercise program in either medium may be equally effective in improving balance in the elderly population.

ACKNOWLEDGEMENT

I wish to thank our Principal and all the faculty members of ISIC-Institute of Rehab Sciences.

Lastly, my thanks are due to all the participants of the study and my friends without whose cooperation this study would not have been successfully completed.

REFERENCES

Effect of Aerobic Exercise on Functional Capacity in Asymptomatic Coronary Artery Disease Risk Factors Subjects

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²Cardio, MPT-I/C Physiotherapist, Kaushal Hospital, Mohali- Punjab

ABSTRACT

Aim & Objective: Coronary Artery Disease (CAD) accounted for 43% in India in 2001 and the burden of this chronic non-communicable disease is going to increase day by day. Moreover, current prediction estimate that by the year 2020, CAD will become the leading global cause of total disease burden in the form of mortality and morbidity. Fortunately, Coronary Heart Disease can be prevented or controlled. This fact sheet gives an overview of Coronary Heart Disease and its prevention, diagnosis, and treatment. This study is a part of cardiovascular disease preventive rehabilitation program and is based on three time-honored classical coronary heart disease (CHD) risk factors: hypertension stage-1, overweight, and smoking.

Methods: Sample of 30 asymptomatic subjects with 30-40 years age group were allocated and assigned into three groups- Overweight Group (OWG), Smoking (SM) and Hypertensive Group (HTG). VO₂ Max, Heart rate, blood pressure were measured by treadmill test and pacer test to compare the effect of four weeks endurance exercise training period. Data was analyzed by using SPSS. T-test and ANOVA was used. The level of significance was set at $p > 0.05$.

Results: Results of our study suggested that four weeks of aerobic exercise training improve the aerobic capacity in all the three cardiac risk factor groups' subjects. The mean difference of all the three groups shows significant changes in aerobic capacity (VO₂ max & pacer test) in four week training of a proper schedule and protocol. The aerobic exercises show marked changes in overweight subjects followed by hypertension subject and the least in smokers.

Discussion: Present study results provide important clues in understanding the cause for low aerobic capacity (VO₂ max and pacer test) in smokers is due to not stopping smoking. Result of this study has proved the beneficial effects of aerobic exercise training to improve functional aerobic capacity in all risk factors groups. So aerobic exercise may be prescribed as regular therapy for long period of time to all risk factors for a better future health outcome. Results of our study have suggested that pacer test can be used to check the improvement in aerobic capacity.

Conclusion: Aerobic exercise is the basic tool of preventive cardiac rehabilitation to protect the heart against harmful cardiac events by improving the aerobic capacity and main emphasis must be given on smoking group rehabilitation.

Key words: CAD- Coronary artery disease, OWG- Overweight Group, SM-Smoking Group, HTG- Hypertensive Group. VO₂ max, Pacer Test.

INTRODUCTION

Prevention of Coronary Artery Disease (CAD) at early stage is recognized as one of the major health challenges in the twenty first century. So efforts need to be focused on early detection. It is recently added that inactivity has been accepted as an independent risk factor for coronary heart disease. People from Indian, Bangladeshi, Pakistani, or Sri Lankan background have a higher premature death rate from coronary heart disease compared to other countries due to the major prevalence of sub-clinical or symptomless CAD risk factors¹.
Risk factors are the pre-exposed condition that increases the chance for CAD. CAD risk factors include in this study are Overweight, Smoking and Stage-1 Hypertension.

Overweight is the most common prevalent conditions in India as compare to others countries and it is considered as major contributor to many health problems, including CAD.

The American Heart Association has been documented that approximately 66% (or two thirds) adults are overweight or obese. Reviewed studies concluded that 26% males and 40% females with overweight are responsible for coronary artery disease. Overweight on BMI scale is 25 to 29.9 Kg. /m2.

Smoking increases the risk of heart disease, peripheral vascular disease and lung cancer. Research has shown that smoking increases heart rate, tightens major arteries, raises blood pressure, and can create irregularities in the timing of heartbeats, all of which make heart proven for CAD. According to the, the risk of developing CAD drops 50% relatively soon after quitting of 1 year of not smoking.

Hypertension is the leading cardiovascular disease in industrialized nations of world. It commonly begins in young adulthood and occurs in 5% to 10% of people aged 20 to 30 years. The incidence of hypertension continues increasing with age and is found in 20% to 25% in middle-aged adults and 50% to 60% over 65 years of age. Hypertension, whether labile or fixed, mild or severe, or systolic/ diastolic in character & occurring at any age, is a powerful Independent contributor to CVD.

Suddenly increasing CAD in younger patients draws attention toward the risk factors earlier than before. In this study the aim is to screen, to treat and to make the subjects aware about CAD. Aerobic exercise protocol improves the health fitness at younger age so that the chances are reduced or decreased if the subjects continue the exercises without relying on medical treatment. There is a lack of data available about the studies related with asymptomatic young age individuals having CAD risk factors and making comparison among CAD risk factors subjects on the basis of aerobic capacity.

So the purpose of this study is to compare the aerobic capacity effect of endurance exercise asymptomatic coronary artery disease risk factors subjects. The main objective of this study is to evaluate the aerobic capacity after endurance exercise as an index of fitness in risk factor subjects.

CAD risk factors subjects face many physiological changes & these changes complicate their life. Therefore aim of our study is to design, assess and to provide a better aerobic exercise regime which is easy & effective for CAD risk factors adults’ so that CAD risk factors subjects can adopt & get benefits of it for better quality of life in future.

This study is a part of cardiovascular disease preventive rehabilitation program and is based on three time-honored classical coronary heart disease (CHD) risk factors: hypertension stage-1, overweight, and smoking. This study would be able to elaborate the significance of endurance exercise in daily life and play a important role in reducing the burden of coronary artery at early age by improving the aerobic capacity for healthy life.

**METHODOLOGY**

30 male subjects between 30-40 years were screened from 300 populations for this experimental Study. All subjects were allocated in three (10 subjects/ groups on the bases of their risk factors), group A (Hypertension) group B(Smokers) group C (Overweight).

All the subjects were screen for data collection before and after 4 weeks of aerobic exercise again Balke-Ware Protocol on Technogym Run Race 1400 HC treadmill and field PACER test or Beep test to get the baseline or the initial reading. The subjects were made to do the aerobic exercises with intensity 50 - 60% of maximal aerobic capacity (VO2 max), 30 minute, 4 times a week for 4 weeks.

Data were collected with variable of VO2Mx, BP / HR / Beep test completed stage by Polar heart rate monitor, Stethoscope, Sphygmomanometer, Audio Tape and Compact Disc. Initial reading were compared with the final reading for the improvement of aerobic capacity.

![Fig. 1. Subject for Pacer or Beep Test](image-url)
RESULTS

Thirty subjects have taken in three groups for aerobic exercise with Mean age 36 for group A (HTN), 35 for group B (SM), 34 for group C (Overweight).

Comparison of VO2max pre treatment, post 4 week for all the three Subjects group - A (HTN, Table 1, Fig. 3) , Group B (SM, Table 2, Fig. 4), of group C (OW, Table 3, Fig. 5).

Table 1. Comparison mean ±SD of the Group A (HTN) between pre treatment & after 4th week period

<table>
<thead>
<tr>
<th>VO2max</th>
<th>Mean ±SD</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>33.60±6.56</td>
<td>-9.49</td>
<td>0.001</td>
</tr>
<tr>
<td>4th week</td>
<td>45.20±6.59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Comparison mean ±SD of the Group B (SM) between pre treatment & after 4th week period

<table>
<thead>
<tr>
<th>VO2max</th>
<th>Mean ±SD</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>33.50±5.68</td>
<td>-12.81</td>
<td>0.001</td>
</tr>
<tr>
<td>4th week</td>
<td>38.20±5.51</td>
<td></td>
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</tbody>
</table>

Table 3. Comparison mean ±SD of the Group C (OW) between pre treatment & after 4th week period

<table>
<thead>
<tr>
<th>VO2max</th>
<th>Mean ±SD</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>36.10±5.02</td>
<td>-9.87</td>
<td>0.001</td>
</tr>
<tr>
<td>4th week</td>
<td>56.20±5.55</td>
<td></td>
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</table>

Table 4. Comparison mean ±SD of VO2max between pre treatment & post 4 week among all groups Subjects of-HTN, SM, OW by ANOVA & Post hoc Bonferroni (POB)

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>Mean ±SD</th>
<th>F Value</th>
<th>p-Value</th>
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</thead>
<tbody>
<tr>
<td>HTN</td>
<td>45±6.59</td>
<td>23.57</td>
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</tr>
<tr>
<td>SM</td>
<td>38±5.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OW</td>
<td>56±5.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POB</td>
<td>M±SD</td>
<td>29.70</td>
<td>0.001</td>
</tr>
<tr>
<td>HTN</td>
<td>11.6±1.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>4.7±1.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OW</td>
<td>19.1±6.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Comparison mean ±SD of the Group A (HTN) Between pre treatment & after 4th week period

<table>
<thead>
<tr>
<th>Beep test</th>
<th>Mean±SD</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>3.45±0.62</td>
<td>-5.39</td>
<td>0.001</td>
</tr>
<tr>
<td>4th week</td>
<td>4.80±0.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Comparison mean ±SD of the Group A (HTN) Between pre treatment & after 4th week period

<table>
<thead>
<tr>
<th>Beep test</th>
<th>Mean±SD</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>3.45±0.62</td>
<td>-5.39</td>
<td>0.001</td>
</tr>
<tr>
<td>4th week</td>
<td>4.80±0.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Comparison mean ±SD of Group B (SM) Between pre treatment and after 4th week period.

<table>
<thead>
<tr>
<th>Beep test</th>
<th>Mean±SD</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>3.38±0.57</td>
<td>-5.20</td>
<td>0.001</td>
</tr>
<tr>
<td>4th week</td>
<td>3.93±0.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level of significance p<0.05

Table 7. Comparison mean ±SD of Group C (OW) Between pre treatment and after 4th week period

<table>
<thead>
<tr>
<th>Beep test</th>
<th>Mean±SD</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>3.72±0.621</td>
<td>-8.53</td>
<td>0.001</td>
</tr>
<tr>
<td>4th week</td>
<td>6.96±0.98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level of significance p<0.05

Table 8. Comparison of Mean ±SD of Beep test between pre treatment & post 4 week period of all 3 group subjects - HTN, SM, OW. by ANOVA & post hoc Bonferroni (PHB)

<table>
<thead>
<tr>
<th></th>
<th>Mean ±SD</th>
<th>F Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTN</td>
<td>4.8±.46</td>
<td>51.96</td>
<td>0.001</td>
</tr>
<tr>
<td>SM</td>
<td>3.9±.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OW</td>
<td>6.9±.98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mean ±SD</th>
<th>F Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTN</td>
<td>1.35±.79</td>
<td>26.23</td>
<td>0.001</td>
</tr>
<tr>
<td>SM</td>
<td>0.55±.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OW</td>
<td>3.2±1.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level of significance p<0.05

Table 9. Comparison of mean differences data of VO2max (4th week) among all the 3 groups by Post Hoc test

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTN</td>
<td>7.0</td>
<td>.044</td>
</tr>
<tr>
<td>Smokers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>-11.0</td>
<td>.001</td>
</tr>
</tbody>
</table>

Level of significance p<0.05

Table 10. Comparison of mean differences data of Beep test (4th week) among all the 3 groups by Post Hoc test

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smokers</td>
<td>.87</td>
<td>.029</td>
</tr>
<tr>
<td>Overweight</td>
<td>-2.16</td>
<td>.000</td>
</tr>
</tbody>
</table>

Level of significance p<0.05
DISCUSSION

This study result have taken three CAD risk factors groups for analysis with mean age of 34 years and sample said to be homogenous in character.

Aerobic exercise protocol is design in this study with frequency four days/weeks/30 minutes for one week. Experts recommend engaging in moderate physical activity for at least 30 minutes five to seven days of the week to achieve benefits.

Overweight: When scheduled aerobic exercise protocol is followed in overweight subjects for 4 weeks for 4 times a week, then the result showed significant improvement in aerobic capacity in the form of VO2 max and pacer complete stages. The readings are significantly higher than the baseline readings taken initially on day 0.

Steven et al. have proved that endurance exercises improve aerobic capacity (VO2 max) and reduce 10-20% chances of CAD by improving vessel caliber with collaterals circulation formation. Thus the development of collateral helps in reducing, delaying and prevention of Coronary Artery Disease at an early stage. Klijn et al. have also showed that aerobic exercise effectively improved aerobic performance of adolescents with obesity and in addition, suggested that aerobic fitness is an important predictor of mortality.

Hypertension: Aerobic exercise protocol also shows significant improvement in aerobic capacity on treadmill exercise test, Beep test in the form of VO2 max and complete stages in pacer test. Emmanuel G. Ciolac has concluded in their study that sedentary people have a 35% greater risk of developing high blood pressure than physically active subjects. Schotte, J.A Raffo et al. have proved that aerobic exercise increase the VO2 max and helps in better controlling the blood pressure, obesity.

A. Ehsani et al. showed that the aerobic exercise training reduces SBP & DBP by 10 mm hg in individuals with mild hypertension. Regular exercise helps keep arteries elastic (flexible), increase in muscle capillaries, greater capacity venous system in the trained person. This, in turn, ensures good blood flow and maintaining heart-healthy levels of fitness.

Smoking: Aerobic exercise protocol in this group also shows significant improvement in aerobic capacity in the form of VO2 max and pacer complete stages. The readings are significantly higher than the baseline readings taken initially on day 0.

Ravin et al. have proved that the prevalence of CAD in smokers is 4 times more than the non smokers and the prevalence reduces when the smoker quits smoking. American college of sports medicine proved the beneficial effects of aerobic exercise training to improve functional aerobic capacity and reduces clinical symptoms in smoker risk factors.

Results of our study have proved that pacer test can be used to check the improvement in aerobic capacity. Similarly, it also provide to the physiotherapist and exercise physiologists personnel, a guide for exercise prescription and help evaluate the physical fitness status of an individual.

The mean difference of all the three groups shows significant changes in aerobic capacity (VO2 max & pacer test) in four week training of a proper schedule and protocol. The aerobic exercises show marked changes in overweight subjects followed by hypertension subject and the least in smokers. The cause for low aerobic capacity (VO2 max and pacer test) in smokers is due to not stopping smoking. Chronic nicotine exposure in smokers is the main responsible points to blame that smoker are worse condition as compare to others groups.

So result of the study suggested that smoking is the main factor responsible for suddenly increasing CAD in younger age as compare to other risk factors. Result of the study draws our attention toward its importance for rehabilitation by following a proper aerobic exercise protocol continuing for the long period more than four weeks.

Result of our study support the general view that physical activity is important, not only for the prevention but also in the management of cardiovascular disease. So from the results of our study it can be summarized that childhood participation in physical activity is appropriate for prevention of cardiovascular disease in future and complement
treatment of existing cardiovascular risk factor including hypertension, smoking and overweight.

CONCLUSION AND FUTURE RESEARCH

Physical activity should be a permanent lifestyle to enhance health and prevention of cardiovascular disease. An exercise prescription and the physio's advice to increase physical activity are very strong motivators and an important component of a successful exercise program for the subjects.

Whether the same findings apply to other ethnic groups of different age & other risk confirmed will be in future studies. Additional physiological based research is recommended for further studies to provide the scientific rationale supporting the importance of physical activity in asymptomatic young subjects. Such research should address the mechanisms by which exercise reduces CAD risk as well as explore other medical conditions effectively managed by exercise training.

REFERENCES

Clinical Outcome in Adult Ventilated Patients Using Multimodality Chest Physiotherapy as Treatment Approach: A Single Blinded Randomized Clinical Trial

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²Prof & HOD, Department of Pulmonary Medicine Jawaharlal Nehru Medical College Belgaum, Karnataka

ABSTRACT

Background & Aims: Mechanical ventilation is commonly required for critically ill patients. Evidence suggests that preventive measures reduce the high rates of morbidity and mortality in critically ill patients. However effect of multimodality chest physiotherapy on clinical outcome has been least studied. The present study aimed to investigate the effect of multimodality chest physiotherapy on clinical outcome in adult ventilated patients.

Methods and Materials: Trial was carried out in 150 bedded ICU of a teaching tertiary care hospital. 125 adult mechanically ventilated patients were included and randomly allocated to 2 groups. Manual hyperinflation (MH) and suctioning was given to the patients in control group (n= 63) and positioning and chest wall vibrations in addition to MH plus suctioning were given to the patients in study group (n= 62) till they were extubated. Both the groups were treated twice a day. Standard care in the form of routine nursing & pharmacological care as advised by intensivist was followed throughout the intervention period.

Results: Data was analyzed using Chi Square test, student t test and z tests. Mean GCS scores were higher in the study group (p=0.000). Rate of ventilator associated pneumonia increased in control group (p=0.032). The rate of successful outcome was higher in the study group (p= 0.000) with 66.1%.Conclusion: Twice daily multimodality chest physiotherapy may be used as a routine therapeutic option to improve outcome and prevent complications.

Key words: Multimodality Chest Physiotherapy, Mechanical Ventilation, Complications, Outcome, Mortality

INTRODUCTION

Mechanical ventilatory support is commonly required for critically ill patients. Although life saving, it is invasive, expensive and associated with a variety of serious complications. Reducing the time a patient spends receiving mechanically ventilator support is a worthy approach to both improving patient care and reducing its related costs.

Numerous reports pertaining to the outcome of mechanically ventilated patients have appeared in the scientific literature. Studies have been typically performed in relatively small populations comprising on or several units of a hospital, and occasional, a group of hospitals. There is much controversy regarding outcomes in mechanically ventilated patients and it is difficult to extrapolate conclusively from existing reports.

It has been observed that aggressive preventive measures reduce the high rates of morbidity and mortality in critically ill patients who are intubated and ventilated. There is evidence that various combinations of chest physiotherapy assist in the re-expansion of lung and confer short term improvement in lung compliance and flow rates. However, the effect of multimodality chest physiotherapy on clinical outcome in adult ventilated patients has been least studied. The present study was conducted to evaluate the effect of multimodality chest physiotherapy on clinical outcome in mechanically ventilated adult patients.

MATERIAL AND METHODS

A total of 125 patients who were mechanical ventilated for > 48 hrs from adult ICUs were recruited into the study using convenient sampling. Exclusion criteria included untreated pneumothorax, acute
myocardial infarction, cardiac arrhythmias, hypovolemia, haemodialysis, unstable cardio-vascular or neurological function or injury preventing positioning for chest physiotherapy, open heart surgeries, admission with tracheostomy and HIV patients. Random allocation of patients to either group was done using envelope method. Ethical approval was obtained from the Institutional Ethical Research Board of the University before the commencement of the study. All patients recruited to this study were ventilated by Servo Ventilator-900C and Servo Ventilator 300. After obtaining written consent from the patients or the patients’ relatives, baseline data including age, gender, admission diagnosis, ventilator mode, and Glasgow Coma score of all the patients were noted. Clinical Pulmonary Infection Score was used for diagnosis of Ventilator associated pneumonia.

Manual hyperinflation was administered as described by Suh-Hwa Ma. The MH procedure was given for a period of 20 min at each session twice a day (9.30 am and 3.30 pm) daily. After MH, immediately chest vibrations were employed. Suctioning was done as described by Jessica SP Choi & Alice YM Jones. Positioning was given to patients as described by Frownfelter D. At the end of treatment session, the head end was elevated to about 30-45 degrees. Change in position from supine to lateral was done by nursing staff by turning the patients every 2 hourly.

Standard care in the form of routine nursing care & pharmacological therapy was followed throughout the intervention period. Ventilator parameters were adjusted by the intensivist. Patients in both the groups were treated with chest physiotherapy by the investigator twice a day (9.30 am and 3.30 pm) till patients were weaned off from the ventilator. Patients were assessed at the end of 72 hrs, 7 days and at the end of extubation days. Primary outcome were oxygenation status, mortality rates and length of hospitalization. Secondary outcome were development of atelectasis and pneumonia. We considered < 10 cms of H2O as low PEEP and > 10cms of H2O as high PEEP. Standardized weaning criteria were used to wean the ventilated patients.

RESULTS

Data of 125 patients was analyzed using SPSS windows 0.9. Chi-square test, Student paired and unpaired ‘t’ test and ‘Z’ test was used compare the statistical significance. Both groups were well matched for age, duration of mechanical ventilation, length of ICU stay, GCS baseline scores, and the weaning modes. (Table 1). Majority of patients were started on volume control mode during the initiation of mechanical ventilation as compared to the other modes of ventilation. Mean GCS scores at the time of ventilation, mean GCS scores at the time of extubation/ at the end of the treatment were higher in the study group which was statistically significant (p=0.000). The rate of successful outcome was higher in the study group than the control group which was statistically significant. (p=0.000). Among the complications encountered by patients during ventilation, rate of ventilator associated pneumonia increased in control group which was statistically significant (p=0.032). Other complications included atelectasis, pleural effusion, pneumothorax, cardiac arrest and septicemia. (Table 3). Among the weaning characteristics, PaO2 was statistically significant in weaned group (p=0.00). Duration of mechanical ventilation was more in non weaned patients of study group as compared to control group which was statistically significant. (p=0.01) Length of duration in ICU of non weaned patients in study group was higher as compared to control group which was statistically significant. (p=0.04)

DISCUSSION

A total of 125 adult ventilated patients with 63 patients in the study group and 62 patients in the control group were treated with males to female ratio of 3.6:1 (Table 1) Previous studies have suggested that a patient’s sex may influence the provision and outcomes of critical care. In a retrospective cohort conducted by Fowler R A et al where 24, 778 critically ill adult patients were admitted and association between sex, age and admission to the ICU. Use of mechanical ventilation, length of ICU, and hospital and death were extensively studied. They concluded that among patients 50 years or older, women appeared less likely than men to be admitted to an ICU and to receive selected life supporting treatments and more likely than men to die after critical illness. Raine R et al studied influence of patient gender on admission to intensive care in 46,587 adult patients and found no gender differences on admission or in mortality. Age is clearly a relevant factor in outcome from serious illness. Hugo R et al observed that older women had higher mortality rate than men. Similar observations have been seen by Kollef et al. Scott and Van Vuong conducted a prospective observational study in 580 adult patients and found no differences in hospital mortality rates between mechanically ventilated men and women.

The ratio of partial pressure of oxygen in arterial blood (PaO2) to the inspired oxygen fraction (FiO2) (PaO2/FiO2) has been used to quantify the degree of abnormalities in pulmonary gas exchange before and after therapeutic intervention. The PaO2/FiO2 ratio has also been used in the clinical setting to classify patient's pulmonary gas exchange status, including the definitions ALI/ARDS. PaO2/FiO2 ratio depends on both FiO2 level and the arterial saturation level. Criteria for acute lung injury and ARDS, the FiO2
levels at which the PaO2/FiO2 ratio is measured should be defined when quantifying effects of therapeutic interventions or when specifying diagnostic criteria for ALI and ARDS.16-18

Table 1. Demographic characteristics at baseline in both groups

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Variables</th>
<th>Study group n=62</th>
<th>Control group n=63</th>
<th>p*</th>
<th>DF</th>
<th>p* value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Age (years)</td>
<td>49±15.86</td>
<td>55±16.62</td>
<td>0.042</td>
<td>123</td>
<td>0.067</td>
</tr>
<tr>
<td>2.</td>
<td>Male: Female</td>
<td>47:15</td>
<td>32:12</td>
<td>0.004</td>
<td>123</td>
<td>0.004</td>
</tr>
<tr>
<td>3.</td>
<td>Duration of intubation (days)</td>
<td>5±7.75</td>
<td>10±9.48</td>
<td>0.147</td>
<td>123</td>
<td>0.147</td>
</tr>
<tr>
<td>4.</td>
<td>Length of ICU stay (days)</td>
<td>11±11.43</td>
<td>9±6.45</td>
<td>0.288</td>
<td>123</td>
<td>0.288</td>
</tr>
<tr>
<td>5.</td>
<td>FiO2 (%)</td>
<td>0.66±0.19</td>
<td>0.60±0.18</td>
<td>0.003</td>
<td>123</td>
<td>0.003</td>
</tr>
<tr>
<td>6.</td>
<td>PaO2 (mm Hg)</td>
<td>80.48±5.74</td>
<td>79.35±5.78</td>
<td>0.274</td>
<td>123</td>
<td>0.274</td>
</tr>
<tr>
<td>7.</td>
<td>PEEP (cm of H2O)</td>
<td>7.41±2.35</td>
<td>8.75±2.14</td>
<td>0.011</td>
<td>123</td>
<td>0.011</td>
</tr>
<tr>
<td>8.</td>
<td>PaO2/FiO2 ratio</td>
<td>302.1±75.02</td>
<td>251.1±66.02</td>
<td>0.001</td>
<td>123</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 2. Indications for mechanical ventilation

<table>
<thead>
<tr>
<th>S. Baseline diseases for mechanical ventilation</th>
<th>Study group n=62</th>
<th>Control group n=63</th>
<th>p* value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Respiratory diseases</td>
<td>15 (24.19%)</td>
<td>08 (12.69%)</td>
<td>0.101</td>
</tr>
<tr>
<td>2. Neurological conditions / Neurosurgical conditions</td>
<td>19 (30.64%)</td>
<td>26 (41.62%)</td>
<td>0.218</td>
</tr>
<tr>
<td>3. Musculoskeletal conditions/ Trauma</td>
<td>00</td>
<td>06 (9.52%)</td>
<td>0.013</td>
</tr>
<tr>
<td>4. Post-surgical respiratory diseases</td>
<td>00</td>
<td>06 (9.52%)</td>
<td>0.749</td>
</tr>
<tr>
<td>5. Cardiac diseases</td>
<td>10 (16.12%)</td>
<td>05 (7.93%)</td>
<td>0.158</td>
</tr>
<tr>
<td>6. Other medical conditions</td>
<td>10 (16.12%)</td>
<td>12 (19.04%)</td>
<td>0.667</td>
</tr>
</tbody>
</table>

Table 3. Complications in ventilated patients in both the groups

<table>
<thead>
<tr>
<th>S. Complications after intubation and mechanical ventilation</th>
<th>Study group n=62</th>
<th>Control group n=63</th>
<th>p* value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ventilator associated pneumonia</td>
<td>18 (29.03%)</td>
<td>30 (47.61%)</td>
<td>0.032</td>
</tr>
<tr>
<td>2. Atelectasis</td>
<td>05 (8.1%)</td>
<td>02 (3.17%)</td>
<td>0.234</td>
</tr>
<tr>
<td>3. Pleural effusion</td>
<td>01 (1.61%)</td>
<td>01 (1.58%)</td>
<td>0.992</td>
</tr>
<tr>
<td>4. Pneumothorax</td>
<td>00</td>
<td>01 (1.61%)</td>
<td>0.312</td>
</tr>
<tr>
<td>5. Cardiac arrest</td>
<td>01 (1.61%)</td>
<td>01 (1.58%)</td>
<td>0.992</td>
</tr>
<tr>
<td>6. Septicemia</td>
<td>02 (3.22%)</td>
<td>01 (1.58%)</td>
<td>0.545</td>
</tr>
<tr>
<td>TOTAL</td>
<td>31 (50%)</td>
<td>39 (61.90%)</td>
<td>0.180</td>
</tr>
</tbody>
</table>

The administration of positive end expiratory pressure (PEEP) is aimed at preventing the end expiratory collapse of diseased pulmonary areas in order to reverse the severe hypoxemia resulting from pulmonary shunting, a hallmark of ARDS. There have been various randomized clinical trials to study the effects of high versus low PEEP in ARDS in suggesting further clinical trials to fully elucidate the role of higher than traditional PEEP levels in patients with ARDS. In the present study, it was observed that the mean levels of PEEP at the initiation of mechanical ventilation was slightly higher in the control group.

Traditionally, PEEP values of 5 cms to 12 cms of H2O have been used in the ventilation of patients with ARDS resulting in improved oxygenation. In the present study, higher levels of PEEP did not show any reduction in the mortality rate. Meade O M et al studied 983 patients with ALI/ARDS and observed that no significant harm or increase risk of barotrauma was noted despite use of higher PEEP. High PEEP or ‘open Lung’ strategy showed to improve oxygenation with fewer hypoxemia related deaths and a lower use rescue therapies by the treating clinicians. Hence suggesting that higher PEEP levels may be used as an alternative to the established low PEEP or low tidal volume strategy.

A variety of volume and pressure modes of ventilation are used to improve oxygenation, ventilation and acid-base status. In volume control modes, traditionally large volumes have been shown to cause “volume trauma.” Pressure modes of ventilation have characteristics that make them attractive for use in patients with non compliant lungs. However, the ARDS Network Group suggests the use of low volume targeted ventilation rather than pressure targeted ventilation which protects the lungs of the patients.

Physiotherapy intervention is regarded as an internal component in the management of patients in intensive care and has been demonstrated to be beneficial. Interventions like positioning, manual hyperinflation and suctioning have been suggested as safe.

To conclude, this trial had positive effect in terms of clinical outcome with success rate of 66.1% with multimodality chest physiotherapy in the study group. The study also suggested use of multimodality chest physiotherapy in reducing the incidence of VAP. This study suggests future trials with larger sample size, using APACHE scores.
REFERENCES


Efficacy of Low-Intensity Pulsed Ultrasound on Bone Mineral Density in Osteoporotic Postmenopausal Women

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²Assistant Professor of Physical Therapy, Faculty of Applied Medical Sciences, Umm Al- Qura University

ABSTRACT

Purpose of this current study was to investigate the effect of low intensity pulsed ultrasound on bone mineral density (BMD) of lumbar vertebrae in osteoporotic postmenopausal women. Thirty postmenopausal women suffer from lumbar vertebrae osteoporosis were selected from Umm El Masryeen General Hospital received ultrasound therapy three time / week for six weeks. DXA was used for assessment of BMD before and after treatment. The results of the study demonstrate significant increase in lumbar BMD. It was concluded that low intensity pulsed ultrasound is effective modalities in increasing bone mineral density (BMD) of lumbar vertebrae in osteoporotic postmenopausal women.

Key words: Postmenopausal, Bone Mineral Density, Low Intensity Pulsed Ultrasound, Osteoporosis

INTRODUCTION

Osteoporosis is a metabolic bone disease characterized by low bone mass, which increases the bone fragility and the risk of fracture¹. More cancellous than cortical bone is lost following the menopause due to bone trabeculae being more sensitive to estrogen deficiency than cortical bone, leading to a loss of connectivity and an increase in its porosity². Bones, such as proximal femur, distal radius and the vertebrae, are composed of a large amount of trabeculae bone. Thus, treatments to prevent or to stabilize the osteoporosis are important³. Alternative treatments are options for those people with an increased risk of osteoporosis development but with restrictions for the ordinary treatments already in existence¹.

Recently postmenopausal osteoporosis has become an area of interest in terms of medical, social and economic costs. It is a significant cause of women's morbidity and mortality leading to fractures of the hip, spine and wrist. Osteoporosis is a primary metabolic disease of bone and a major public health problem that mostly occurs in the elderly⁴.

There are two types of osteoporosis, type I due to a decrease in cumulating estrogens which affects trabecular bone (especially vertebral bone) and affects females more than males in a ratio of 1:6. Type II, senile osteoporosis, which is age related and occurs in cortical and trabecular bone, affects females and males in a ratio of 2:1⁵.

It is evident that low bone mass is the most potent factor leading to fracture. Estrogen deficiency is well established as a risk factor for osteoporosis. There are several risk factor reported in the literature which accelerate the development of osteopenic process includes negative calcium balance, sedentary life style, immobilization, menopause (surgical or natural), amenorrhea, family history of osteoporosis, high alcohol intake, smoking, high caffeine consumption and steroid therapy⁶.

Therapy should be directed primary toward increasing physical activity, reducing the risk of falling and secondarily toward stabilizing bone mass. Reversing the osteoporotic process require therapy in the form of hormonal replacement. Calcitonin which is peptide hormone mediator for estrogen action, produce inhibition of osteoclasts activity and therefore decrease the bone resorption⁷. Also maintaining a high dietary intake of calcium, vitamin D, reduction of excessive consumption of protein and phosphorous are indicated as therapeutic options². Calcium must be given with sodium fluoride to allow mineralization of the new osteoid. Problems with this modality include the questions of abnormal bone architecture and the high incidence of side effects⁸.

The impact of physical activity on BMD was established via reducing and/or preventing the volitional bone loss in both recently postmenopausal and very elderly women⁹. The role of electrotherapy in the management of menopausal osteoporosis is very limited in the literature. It was concluded that pulsed
electromagnetic field has an effect to slow down the bone mass loss in osteoporosis induced by ovariectomy in rats and clinical application of the same current in women’s osteoporosis was also reported.

The ultrasound is a form of mechanical energy which promotes local bone microdeformations, as the natural mechanical incentive, and which is crucial in stimulating the bone formation. Several studies have already shown that low-intensity ultrasound is capable of accelerating the healing of fresh fractures, delayed healing and nonunion. Furthermore; recent experimental studies have shown the ultrasound benefits on large bone defects and on spine fusion. However, there are no studies which relate the action of low-intensify ultrasound in cases of osteoporosis without fractures.

Ultrasound (US) represents a potential intervention for osteoporosis. US refer to a high-frequency no audible acoustic energy that travels in the form of mechanical waves. A mechanical wave is one in which energy is transmitted by the movement of particles within the medium through which the wave is traveling. As these waves travel as a relatively focused beam (typical effective radiating area = 5 cm²). US can be directed onto specific regions to exert a local mechanical stimulus.

METHODS

Subjects

Thirty postmenopausal women were selected from Umm El Masryeen General hospital. The criteria for inclusion were as follows: (a) DXA diagnosis of normal BMD and osteoporosis in lumbar vertebrae with no evidence of vertebral compression fractures, (b) age between 57 to 65 years (to avoid inclusion of older patients with multiple medical problems), (c) no history of cancer, renal disease, gastrectomy, metabolic bone disease or any condition (such as a neurogenic, myopathic or connective tissue disorder) that could cause secondary osteoporosis, (d) no intake of any medications associated with accelerated bone loss (steroids) or any medications affected bone metabolism (estrogen, calcium, vitamin D, ...etc), (e) body mass index not exceeding 30 Kg/m², non smoker, parity from 1-3 times and led sedentary life style without participation at any exercise training during this study, and, (f) had natural menopause at least 1 year before entry into the study with no history of ovariectomy.

Instrumentation

1. Dual x-ray Absorptiometry (DXA) (Model QDR-1000W, Hologic, Inc., Waltham, MA) was used for the qualitative assessment of BMD in the vertebral bodies of the lumbar spine for both groups. An imaging test that measures bone density (the amount of bone mineral contained in certain volume of bone) by passing x-rays with two different energy levels through the bone. It is used to diagnose osteoporosis.

2. Ultrasonic (US) device (Enraf Nonius - Sonoplus590): was used to deliver low -intensity pulsed ultrasound therapy. The apparatus provided the following options: 1 MHz frequency with transducer having an affective radiating area of 5.0 cm², intensity up to 1.5 W/cm² in continuous mode, 3W.cm² in pulsed mode. Gel was used as a coupling media.

PROCEDURES

A. Evaluation

Initially a screening test including careful history taking and gynecological examination were conducted for each subject before entry in this study. After that BMD of lumbar spine (L1-5) was measured by DXA densitometry. Evaluation of lumbar BMD was performed before and after the end of six weeks of treatment.

B. Treatment

All subjects in- this study underwent 5 minutes US application, three sessions per week for six successive weeks period of treatment. The treatment procedure was explained to all subjects. Skin was cleaned with alcohol to remove fat. During ultrasound application, the position of the subjects was the same for both groups (prone lying position with a pillow under her abdomen). Ultrasound therapy was applied to the lumbar vertebrae (L1-5) using 3 cm ultrasound head.

C. Statistical analysis

Data were collected and statistically analyzed using the arithmetic mean, standard deviation pre -post t test at level of significance of 0.05.

RESULTS

In the present study, the response of BMD to low intensity pulsed ultrasound was investigated. The data collected after six weeks of ultrasound treatment were compared with the pre treatment.

As revealed from table (1) and figure (1) there was a highly statistically significant increase (P>0.0001) in the mean value of lumbar T- Score between pre and post treatment.

As revealed from figure (2) While comparing pre treatment and post treatment, the improvement
percentage was 14.40% and statistically difference (P>0.0001) was highly significant.

Table 1. The comparison between pre & post mean values of the T-score

<table>
<thead>
<tr>
<th></th>
<th>Pre-ttt</th>
<th>Post-ttt</th>
<th>MD</th>
<th>Imp. %</th>
<th>t value</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.0167</td>
<td>-2.5833</td>
<td>5.60</td>
<td>14.4</td>
<td>-6.50</td>
<td>0.0001</td>
<td>Highly Significant</td>
</tr>
<tr>
<td>SD</td>
<td>9.129</td>
<td>0.3957</td>
<td></td>
<td></td>
<td></td>
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Fig. 1. The mean value of T-score of pre treatment relative to those of post treatment

Fig. 2. The improvement % of the mean values of T-score of post treatment

DISCUSSION

The primary problem in postmenopausal with osteoporosis is thought to be enhancement of bone resorption, with consequent net loss of bone mass as osteoblasts fail to repair the defect completely which increase the risk to fracture. The basic problem in the remodeling of bone is directly related to the stimulation, multiplication and proliferation of the extraperiosteal, periosteal and medullar connective tissue that form reparative blastemas leading to the consolidation of the bone.

Dual X-ray absorptiometry was used for assessment of bone density. The results of DEXA revealed a highly significant increase in lumbar BMD of postmenopausal osteoporotic women with low intensity pulsed ultrasound compared to pre treatment lumbar BMD.

Pulsed-wave US at low (<100 mW/cm²) spatial-averaged temporal-averaged in ten ultrasound is capable of producing changes within the cell membrane. This is illustrated by ultrasound’s capacity to alter cell membrane permeability to ions and to alter cell membrane electrophysiological properties. Ultrasound can cause an immediate decrease in intracellular potassium content in thymocytes a reversible increase in the intracellular level of calcium in chondrocytes), and an increase in calcium incorporation into differentiating cartilage and bone cell cultures7.

It is not clear if these changes are brought about by a direct mechanical deformation of the cell membrane, deformation of cell receptors, or indirectly as a consequence of cavitation, microstreaming, or a combination of these or other effects9.

It has been argued that the beneficial effect of ultrasound on bone healing is due to the piezo-electric phenomenon5. Bone is piezo-electric, which means that electric potentials are produced in bone when it is subjected to mechanical stress. Since Wolff’s law basically states that bone remodels according to functional demands, it is assumed that the stress-generated potentials in bone serve as a signal which controls bone remodeling10.

Ultrasound is a biophysical intervention that is capable of generating piezo-electric effects in bone and increasing electric potentials in bone Using 1.27-MHz ultrasound with a very low intensity of 0.00383 W/cm² on bone, measured an electric potential of 64 μV at the ultrasound frequency in vivo10.

Evidence that osteogenesis is stimulated by ultrasound can be found in vitro studies. Osteoblasts can be stimulated to increase collagen production20 and increase the production of prostaglandin E₂, an important bone-healing mediator that exert different effects on bone cells in the same microenvironments, such as inhibiting mature rat osteoclasts from resorbing bone and stimulating osteoblasts for bone formation11.

Elbialy et al.12, studied effects of ultrasound modes on mandibular osteodistraction and they found that earlier stages of bone healing were enhanced more by continuous, whereas late stages were enhanced more by pulsed ultrasound.

Warden et al.13, studied efficacy of low-intensity pulsed ultrasound in the prevention of osteoporosis following spinal cord injury and they found that alternate doses of US may have beneficial effects on intact bone. These effects are likely to be restricted to the outer bone cortex.

Sheng Sun et al., 14 studied in vitro effects of low-intensity ultrasound stimulation on bone cells and they found that low intensity ultrasound treatment may
have a stimulatory effect on bone healing processes as the concentration of PGE2 in the culture medium significantly increased after ultrasound stimulation which stimulate bone cell metabolism.

Chang et al., 15 who studied cytokine release from osteoblasts in response to ultrasound stimulation, they found that increase in osteoblasts growth due to mechanical stimulation of ultrasound and enhance osteoblasts population together. Monici et al., 16 who studied the effect of low intensity ultrasound stimulation on model of osteoclastic precursor, they found that ultrasound inducing enhancement of the osteoclastic function and impairment of osteoclastic one at the same time makes ultrasound a potential tool to counteract osteoporosis.

Ramas et al.,17 who studied stimulating bone growth using piezoelectric ultrasound transducers on the edentulous jaw and they found that ultrasound activating bone growth through the mechanical stress induced by the propagation of ultrasound into the bone.

Tsumaki et al., 18 who studied low-intensity pulsed ultrasound accelerates maturation of callus in patients treated with opening-wedge high tibial osteotomy by hemicallotasis and they found that low-intensity pulsed ultrasound applied during the consolidation phase of distraction osteogenesis accelerates callus maturation after opening-wedge high tibial osteotomy by hemicallotasis in elderly patients.

Eung et al.,19 studied the effects of low intensity ultrasound stimulation on the proliferation of alveolar bone marrow stem cells and they found that the alveolar bone marrow stem cell counts were significantly increased that indicate low-intensity ultrasound stimulation enhanced bone regeneration.

Rutten et al.,20 who studied low-intensity pulsed ultrasound increases bone volume, osteoid thickness and mineral apposition rate in the area of fracture healing in patients with a delayed union of the osteotomized fibula and found that increased osteoblast activity, at the front of new bony callus formation.

Stein and Lerner, 21 who studied How does pulsed low-intensity ultrasound enhance fracture healing and found that Pulsed low-energy ultrasound, a non-invasive therapeutic treatment modality, may improve callus formation and enhance fracture healing by initiating enhanced angiogenesis.Carvalho and Cliquet, 22 who studied the action of low-intensity pulsed ultrasound in bones of osteopenic rats and found that the low-intensity ultrasound can interfere in a positive way on osteoporosis.

CONCLUSION

Although osteoporosis is a primary metabolic disease of bone and a major public health problem that mostly occurs in postmenopausal period, there is no cure of it. Therapy should be directed primarily toward increasing physical activity, reducing the risk of falling and secondarily toward stabilizing bone mass. The results of this study demonstrated the superiority of low intensity pulsed ultrasound to increase BMD of lumbar vertebrae in postmenopausal women with osteoporosis.

Although the findings of this study are highly significant, but treatment of low bone mass might not be effective enough to guarantee that any gains in mass will be of sufficient magnitude to reduce fracture risk significantly, so further research is required to examine long term effectiveness of this treatment and combine it with physical activity that reported its effectiveness on bone repair in literatures.

ACKNOWLEDGEMENT

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Conflict of interest

The authors declare no conflict of interest.

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Cardiovascular Co-morbidity and role of exercise in Rheumatoid Arthritis: A Review

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ABSTRACT

Patients with rheumatoid arthritis have an increased risk of cardiovascular disease (CVD). Cardiovascular event rates are markedly increased in rheumatoid arthritis (RA). Data from population- and clinic-based epidemiologic studies of rheumatoid arthritis patients suggest that individuals with rheumatoid arthritis are at risk for developing clinically evident congestive heart failure (CHF). The vasculature plays a crucial role in inflammation, angiogenesis, and atherosclerosis associated with the pathogenesis of inflammatory rheumatic diseases. There is overwhelming evidence that, in the general population and several at risk subpopulations, exercise provides significant physical and psychosocial benefits, and facilitates management and improvements of outcome in Rheumatic disease. There is increased recognition of the need for structured preventive strategies to reduce the risk of CVD in patients with RA. In this review, the research agenda for understanding and preventing CVD co-morbidity in patients with rheumatoid arthritis is discussed.

Key words: Rheumatoid Arthritis, Cardiovascular Disease, Inflammation, Exercise

INTRODUCTION

Cardiovascular disease is an increasingly recognized contributor to excess morbidity and mortality in rheumatoid arthritis (RA)\(^1\)\(^-\)\(^3\). The most probable cause of cardiac death in rheumatoid arthritis, as in the general population, is atherosclerotic coronary artery disease leading to ischaemic heart disease\(^4\). Rheumatoid arthritis, which is characterized by inflammatory polyarthritis with progressive joint damage, occurs in about 0.5%-1% of adult population in most countries\(^5\). Several studies have shown a higher incidence or prevalence of ischaemic cardiac pathologies such as myocardial infarction, congestive heart failure, and coronary deaths in patients with rheumatoid arthritis than in the general population\(^1\).

Traditional cardiovascular risk factors do not adequately account for the extent of cardiovascular disease in RA\(^1\). Although hypertension and age are potential additional contributors to cardiovascular events in this disease, markers of current and cumulative inflammation (white cell counts and radiographic joint damage, respectively) are associated with ultrasonographically determined subclinical atherosclerosis - a predictor of cardiovascular events\(^6\).

The use of methotrexate is associated with a significantly lower risk for cardiovascular (CV) events in RA patients compared with patients who had never used disease-modifying antirheumatic drugs (DMARDs)\(^7\). Suissa and colleagues\(^8\) found a negative association between the rate of myocardial infarction and the current use of any DMARD in a case control study. A study from Sweden\(^9\) suggested that the risk for developing first CV events in RA was lower in patients who were treated with tumour necrosis factor-alpha (TNF-\(\alpha\)) blockers. In this review we examine the evidence of risk for CVD in patients with rheumatoid arthritis and the suggested underlying mechanism and discuss the role of exercise for the prevention and management of CVD in such patients.

EPIDEMIOLOGY OF CARDIOVASCULAR DISEASE IN PATIENTS WITH RHEUMATOID ARTHRITIS

Fewer statistics on incidence and prevalence rates for Congestive heart failure (CHF) in patients with RA...
are available and are derived from a handful of population-based\(^1\) and clinic-based RA cohorts\(^11\). In a follow-up retrospective review of the same cohort extended to 1995, now using the Framingham diagnostic criteria for CHF, Nicola et al.\(^10\) confirmed an increased risk of incident CHF in both rheumatoid factor (RF) negative and positive RA patients (hazards ratio 1.34 and 2.29, respectively) compared to non-RA controls adjusted for age, sex, and CV risk factors. Incident CHF risk remained elevated after further adjustment for comorbid ischemic heart disease (hazards ratio 1.28 and 2.59 for RF negative and positive RA patients, respectively), although the risk relationship was no longer statistically significant for RF negative patients in this model\(^10\).

In a combined cohort of RA patients from community-based practices and drug safety monitoring studies (n = 9093), Wolfe et al.\(^2\) estimated an adjusted lifetime relative risk of CHF in patients with RA of 1.43 (95% CI 1.24-1.63) compared to OA controls. The adjusted lifetime prevalence of CHF in the RA population was 2.34% compared to 1.64% in OA controls. Data were collected via patient survey of self reported, physician-diagnosed CHF, and confirmed by review of a random sample of medical records in 50% of patients reporting CVD events. In a subsequent analysis\(^11\), in which the drug safety cohort represented a third (n = 4307) of the total sample (n = 13,171), Wolfe et al. reported an adjusted frequency of CHF of 3.9% (95% CI 3.4-4.3%) in RA patients compared to 2.3% (95% CI 1.6-3.3%) in controls with knee or hip OA. Factors associated with prevalent and incident CHF were those typically associated with CHF in the non-RA population (e.g., age, male gender, hypertension, coronary artery disease, diabetes, and smoking) while RA-related measures (patient-reported disability, pain, and RA global severity) were also associated with prevalent and incident CHF.

Risk factors for cardiovascular events in patients with rheumatoid arthritis

Traditional risk factors for vascular disease such as, smoking, hypertension, diabetes and hyperlipidemia are important for the increased risk of CVD in subjects with RA\(^12\). However, traditional risk factors alone do not fully explain the excess CVD risk in RA. Other non-traditional factors are hypothesized to play a role, in particular the burden of inflammation as indicated by the C-reactive protein (CRP) and/or erythrocyte sedimentation rate (ESR)\(^13\). In a community-based cohort of patients with inflammatory polyarthritis, Goodson, et al also noted that excess CVD mortality was confined to patients who were rheumatoid factor positive\(^14\). These markers of inflammation and inflammatory burden confer additional risk of CVD death in those with RA after adjusting for traditional CVD risk factors and comorbidities\(^15\).

Severity of disease has consistently been associated with an increased risk of CVD events in RA. Patient with severe extra articular RA manifestations are at an increased risk of developing coronary artery disease\(^16\) as well as peripheral vascular disease\(^2\); and severe extra articular RA is a predictor of both overall mortality\(^18\) and cardiovascular mortality\(^19\), indicating that systemic inflammation is a major determinants of vascular comorbidity in RA. In contrast with the general population, a low body mass index (BMI), rather than obesity, has been associated with increased CVD in patients with RA\(^19\).

Role of exercise in Rheumatoid arthritis and Cardiovascular disease

Exercise is one of the most important behavioral interventions that can have a major beneficial impact on the likelihood to develop, suffer symptomatically or die from CVD. Any physical activity is better than no, or little, physical activity. There is overwhelming evidence that, in the general population and several at risk subpopulations, exercise provides significant physical and psychosocial benefits, and facilitates management and improvements of outcome in Rheumatic disease. It helps maintain a healthy lifestyle, reduce CVD risk factors including obesity\(^20\), dyslipidaemia\(^21\), hypertension\(^22\), diabetes mellitus\(^23\) and possibly even inflammation\(^24\); it is also effective for preventing acute coronary syndromes\(^25\). Moreover, exercise helps the management of established CVD: both aerobic exercise\(^26\) and resistance training\(^27\) improve myocardial contractility and quality of life in patients with chronic heart failure and produce significant functional benefits in people with intermittent claudication\(^28\). More importantly, cardiac exercise rehabilitation programmes are an important part in the management of patients after an acute coronary syndrome (ACS)\(^29\) and lead to significantly improved quality of life and reduced mortality rates\(^30\).

The overall physiological adaptations that occur as a result of exercise\(^31\) provide protection against CVD mortality, even in the presence of well-established CVD risk factors\(^32\). CVD mortality is lower in highly fit than in moderately fit individuals\(^33\), while physical inactivity is an independent risk factor for the development of CVD\(^34\). Even though cardiorespiratory
fitness may have a familial component, it can be increased significantly by exercise training, regardless of age, gender, race and initial fitness levels. The required activity levels can be accrued through formal training programmes or leisure-time physical activities. Moreover, supervised exercise programmes are more effective compared with non-supervised exercise, most likely due to greater adherence.

Great controversy still exists about the optimum amount of exercise for eliciting the greatest cardiovascular benefit. Different exercise intensity and duration, as well as various combinations of them, may have different impacts on the magnitude of cardiorespiratory fitness improvement. Most authors agree that there is a dose-response relation between the amount of exercise, all-cause and cardiovascular mortality. The greatest potential for reduced mortality is in sedentary individuals (such as many RA patients), in whom even slight increases in daily physical activity are beneficial; for more active individuals, higher levels of intensity should be pursued. Depending primarily on the starting levels of physical activity, cardiorespiratory fitness has been reported to increase by 8-51% following an exercise intervention.

Moderate-intensity exercise of long duration appears to elicit the most benefit on CVD risk and mortality. Current guidelines by the American College of Sports Medicine (ACSM) suggest that an individual should engage in exercise at least three times a week, at an intensity of 60-80% of maximum oxygen uptake (VO2max), for at least 20-30 min, in order to experience significant improvements in cardiorespiratory fitness and optimum cardiovascular benefits. In terms of caloric expenditure, this can be translated to 1000-2000 kcal/week. These calories can be expended in either continuous exercise or accumulated from several short bouts of exercise during a day. Aerobic exercise is the most appropriate, but this can be supplemented by low- to moderate-intensity resistance training. The exercise regimen should be reconsidered regularly, usually every 4-6 weeks, based on the principles of exercise periodization so that participants continue to improve their performance.

**SUMMARY**

There is strong evidence that persons with rheumatoid arthritis are at high risk for developing cardiovascular disease. Several studies have shown a higher incidence or prevalence of ischaemic cardiac pathologies such as myocardial infarction, congestive heart failure, and coronary deaths in patients with rheumatoid arthritis than in the general population. Severity of disease has consistently been associated with an increased risk of CVD events in RA. CVD mortality was more confined to patients who were rheumatoid factor positive. Role of exercise in the management and prevention of CVD in RA patients is very important yet neglected area of RA patients treatment programmes. As this review shows, there is accumulating evidence that in patients with RA, exercise therapy is effective in improving the prognostic risk factor profile. There is little has been investigated and published on the role of exercise as a means to control risk and manage CVD in individuals with RA. More research is required to identify the optimal regimens, timing and environment for exercise, as well as educational and behavioural intervention that will facilitate long term adherence to an active life style and/or structured exercise.

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Physiotherapy-supervised Mobilization and Exercise Following Total Knee Arthroplasty Surgery: a Questionnaire Survey

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ABSTRACT

Background: Limited published data are available on how patients are mobilized and exercised during the postoperative hospital stay following total knee arthroplasty. The aim of this survey was to determine current practice of physiotherapy-supervised mobilization and exercise following total knee arthroplasty.

Methods: A prospective survey was carried out among physiotherapists treating total knee arthroplasty patients. A total population sample was identified and postal questionnaires were sent to the 33 physiotherapists currently working at the departments of orthopedics. In total, 29 physiotherapists (response rate 88%) from eight hospitals completed the survey.

Results: The majority (90%) of the physiotherapists offered preoperative information. The main rationale of physiotherapy treatment after total knee arthroplasty was to prevent and treat postoperative complications, improve range of motion and promote physical activity. In general, one to three treatment sessions were given by a physiotherapist on postoperative day-1 and one to two treatment sessions were given during postoperative days 2 and 3. During weekends, physiotherapy was given to a lesser degree (59% on Saturdays and 31% on Sundays) to patients on postoperative day-1. The routine use of early mobilization and knee range of motion exercises was common during the first postoperative days, but the choice of exercises and duration of treatment varied. There were great variations of instructions to the patients concerning weight bearing and exercises involving the quadriceps. All respondents considered physiotherapy necessary after total knee arthroplasty, but only half of them considered the physiotherapy treatment offered as optimal.

Conclusions: The results of this survey show that there are small variations in physiotherapy-supervised mobilization and exercise following total knee arthroplasty. Comparison with surveys in other remaining centers in India is warranted to improve the physiotherapy management and postoperative recovery of the total knee arthroplasty patients.

Key words: Total Knee Arthroplasty, Mobilization, Questionnaire

INTRODUCTION

Total knee arthroplasty has become the standard of care for patients with end-stage knee OA and is the most frequently performed orthopedic procedure1,2. In a recent meta-analysis of largely osteoarthritic patients, TKA was found to be associated with substantial functional improvements and pain relief3. In patients with RA and avascular necrosis, TKA has also resulted in recovery of function compared to the pre-surgical state4.

Physiotherapy treatment is often prescribed to patients undergoing total knee arthroplasty, in order to prevent or diminish postoperative complications5. The physiotherapy treatment during the hospital stay generally consists of early mobilization, range of
motion exercises and breathing exercises. The value of postoperative physiotherapy has recently been established and accepted, but it is still unclear which treatment techniques are the most effective. In the literature a wide variety of treatments have been suggested. Many strategies and diverse therapies are applied postoperatively and these differ within and between centers. Early mobilization and physical activity is often the first choice of treatment, but evidence as to the optimal intensity, timing and choice of exercises is scarce.

There are only limited published data on how the total knee arthroplasty patient should be mobilized and exercised during the first postoperative period in hospital. However, we found no such study performed in India. This survey was carried out to establish current clinical practice of physiotherapy-supervised exercise and mobilization, during the hospital stay, for patients having undergone total knee arthroplasty. A postal questionnaire survey was sent to all physiotherapists in south India working with this patient group, to determine which methods and treatments are used.

METHODS

A cross-sectional, descriptive study was carried out to examine the physiotherapy management and mobilization routines of total knee arthroplasty in selected centers in south India. The study design was a postal questionnaire survey sent to all 36 physiotherapists working at total knee arthroplasty. The routine postoperative physiotherapy management of patients undergoing uncomplicated total knee arthroplasty was studied. Treatment of patients undergoing soft tissue repair with total knee arthroplasty or other types of associated knee surgical procedures was not studied. The care of patients developing neurological symptoms, circulatory instability, prolonged intubation, or other conditions requiring individualized programme was not considered. Physiotherapists who only treated patients undergoing total knee arthroplasty procedures were asked to return the questionnaire answered.

THE QUESTIONNAIRE

Questions were asked about pre- and postoperative physiotherapy-supervised mobilization and exercise for hospital patients following total knee arthroplasty. The routine pre- and postoperative care of a hypothetical, "everyday patient" undergoing total knee arthroplasty was considered to determine the standard clinical practice. The questionnaire was developed for this specific study and constructed following a detailed review of the literature concerning physiotherapy treatment after total knee arthroplasty and previously developed questionnaires. A range of both closed and open questions, about pre-operative and postoperative physiotherapy-supervised mobilization and exercise following total knee arthroplasty were included in the questionnaire. Respondents were also invited to make comments at the end of the survey.

The study was performed during January 2009 and April 2009. All physiotherapists working at a Department of orthopedics where knee arthroplasty procedures routinely done total were sent a postal questionnaire. The questionnaire was addressed personally to the physiotherapists identified. The letter included a cover letter and prepaid, self-addressed response envelope. After 3 weeks, reminder letters with a copy of the questionnaire were sent to those physiotherapists who had not yet returned the questionnaire.

PARTICIPANTS

Physiotherapists working at hospitals performing total knee arthroplasty surgery in south India were selected. The names and addresses of the physiotherapists had been identified and updated by the author. The names were double-checked via phone or mail at each hospital just before the start of the study.

STATISTICAL ANALYSIS

Descriptive statistics were used to analyze the results, and means, medians and ranges were calculated. SPSS 15.0 was used for the statistical analysis.

RESULTS

Of the 33 identified physiotherapists working at the departments of orthopedic surgery in December 2008. Responses were received from all hospitals to which the survey was sent. In total, 29 replies were received (giving an 88% response rate) out of the 33 questionnaires sent out. The physiotherapists were aged 35±8 years and the mean work experience as physiotherapist at a department of orthopedic surgery was 6±4 (range 1-16) years. Seventy-six per cent of respondents were men. Written physiotherapy guidelines or protocols for physiotherapy management of the orthopedic surgery patient were available for 21 (72%) of the respondents.
All physiotherapists declared that they considered physiotherapy necessary after orthopedic surgery and 55% considered the physiotherapy treatment offered at their department of orthopedic surgery optimal, while 31% found it not optimal and 14% said they did not know. Reasons for the treatment not being optimal were too many patients, lack of resources, shortness of care time, and increased care load.

PREOPERATIVE INFORMATION

The majority (90%) of the physiotherapists offered preoperative information to all patients undergoing total knee arthroplasty surgery. The following topics were most frequently covered in the preoperative information: early mobilization (90%), post-operative restrictions (90%), risk of postoperative pulmonary complications (40%), techniques for getting in and out of bed/the chair (80%), quadriceps exercise (80%) and information about exercising the lower extremities (69%). The preoperative information was usually given to a group of patients by the physiotherapists (76%).

POSTOPERATIVE PHYSIOTHERAPY TREATMENT

In total, 26 respondents answered that the physiotherapist automatically met all patients undergoing total knee arthroplasty while three said that they only met certain patients, with special needs, postoperatively. The physiotherapists reported that during weekdays they routinely treated patients on postoperative day 1 (90%), postoperative day 2 (93%), postoperative day 3 (69%) and postoperative days 4 and 5 (28%). The patients usually had between one and three treatment sessions with a physiotherapist on postoperative day 1, one to two treatment sessions on days 2 and 3, and typically one treatment on days 4 and 5. On Saturdays, physiotherapy treatment was reported to be routinely given to patients on their first postoperative day by 59%, and only if needed by 41%, of the physiotherapists. The corresponding figures were 31%, and 14%, respectively, for Sundays, while 55% of physiotherapists never gave treatment on Sundays. On the second postoperative day, physiotherapy treatment on Saturdays was generally provided routinely by 17%, and only if needed by 83%, of the physiotherapists. If the second postoperative day fell on a Sunday, 48% of the physiotherapists responded that they would give physiotherapy treatment to patients if needed or advised from physicians.

MOBILITY ASSESSMENT

The following mobilization and exercise abilities were routinely assessed or recorded during physiotherapy treatment: mobility, Quadriceps strength (100%), getting in and out of bed/the chair (100%), knee effusion (78%), circulation exercises for the lower extremities (62%); range of motion, knee and the lower extremities (72%); range of motion, hip and ankle (59%); functional activities of daily living scores (21%); and gait training used with walker/crutches (17%).

POSTOPERATIVE MOBILIZATION AND EXERCISES

Mobilization and exercises usually provided to the patients on the first postoperative days after surgery are presented in Tables 1-2. Instructions for range of motion exercises for the knee were provided to the patients on postoperative day 1 by six physiotherapists, on postoperative day 2 by 22, and on postoperative day 3 by 25 of physiotherapists. Postoperative group training for the patients during the hospital stay were provided by 62% of the physiotherapists. Physiotherapy - supervised standing/walking was practiced postoperatively, according to 79% of the physiotherapists.

Table 1. Physiotherapy-supervised mobilization usually provided to total knee arthroplasty patients during the first postoperative days

<table>
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<th>POD-1</th>
<th>POD-2</th>
<th>POD-3</th>
<th>POD-4</th>
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<tbody>
<tr>
<td>Mobilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quadriceps exercises</td>
<td>97%</td>
<td>52%</td>
<td>48%</td>
<td>34%</td>
</tr>
<tr>
<td>#CPM used</td>
<td>93%</td>
<td>55%</td>
<td>48%</td>
<td>34%</td>
</tr>
<tr>
<td>Knee range of motion</td>
<td>28%</td>
<td>69%</td>
<td>79%</td>
<td>34%</td>
</tr>
<tr>
<td>Cryo cuff used</td>
<td>66%</td>
<td>66%</td>
<td>28%</td>
<td>41%</td>
</tr>
<tr>
<td>Sitting on edge of bed</td>
<td>24%</td>
<td>28%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Standing/walking using</td>
<td>0%</td>
<td>0%</td>
<td>21%</td>
<td>38%</td>
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</table>

Data shown as % of respondents (n=29)

#CPM-Continuous Passive Motion apparatus

Instructions for moving in, and out of, bed were given to the patients using a “standard technique” by 90% of the physiotherapists. The most commonly described technique for getting out of bed was lying on the side, placing one or both hands in front of the body, leaning forward and pushing up to a sitting position.
POSTOPERATIVE INFORMATION

Before discharge from the department of orthopedic surgery all physiotherapists provided information to the patients about physical activity, exercises and rehabilitation. Instructions to the patients to continue range of motion exercises after discharge from the hospital were as well given by all physiotherapists. The time that patients were recommended to continue the exercise programme varied between 1 and 8 weeks.

Table 2. Precautions recommended for the healing period during the first postoperative weeks after total knee arthroplasty

<table>
<thead>
<tr>
<th>Precaution</th>
<th>n (%)</th>
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<tbody>
<tr>
<td>Use of biofeedback and neuromuscular electrical muscle stimulation</td>
<td>5 (17%)</td>
</tr>
<tr>
<td>Use of Knee immobilizer</td>
<td>28 (97%)</td>
</tr>
<tr>
<td>a rollator (rolling walker)</td>
<td>12 (41%)</td>
</tr>
<tr>
<td>a walker</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>crutches</td>
<td>19 (66%)</td>
</tr>
</tbody>
</table>

Data shown as number (n) and as % of respondents (n = 29).

DISCUSSION

Most of the physiotherapists, in total 90%, declared that they routinely met all patients undergoing total knee arthroplasty, while 10% responded that they only treated certain patients, with special indications or special needs. The physiotherapy treatment was most frequently given on the first seven postoperative days. On day 1 the patients usually received one to three treatment sessions by the physiotherapist, and on day 2, they were given one to two treatment sessions. The main purpose of physiotherapy after total knee arthroplasty was mostly seen as preventing and treating postoperative complications, improving pulmonary function and encouraging physical activity. Written local physiotherapy guidelines or protocols for physiotherapy management of total knee arthroplasty patients were available, according to 21 out of the 29 respondents.

The components of postoperative physiotherapy treatment, assessment of physiotherapy given to all patients (89%), and mobilization and breathing exercises. In total, 29 replies were received out of the 33 questionnaires sent out. Since the questionnaires were comprehensive the response rate of 88% can be considered high. A high response rate is important and various strategies were used to improve the response rate. Comprehensible instructions were given, the questionnaires were printed on colored paper; stamped, addressed envelopes were included with the questionnaires and reminders were sent out where the questionnaires had not been returned.

The study of a total population sample and the high response rate gives the study good external validity, even if some important questions may have been overlooked and the exact description of the actual clinical practice, in observational studies, is warranted in the future.

An intrinsic selection bias in questionnaire studies is a risk if only the most motivated physiotherapists respond. Since only four physiotherapists failed to answer, we found this risk of bias fairly low. To improve the content validity of the survey, information from earlier questionnaires used in similar studies as well as pilot testing was used to construct the questionnaire. Despite these limitations we believe that the result from this survey provides a good overview of the physiotherapy treatment given to total knee arthroplasty patients.

The majority (90%) of the physiotherapists offered preoperative information to all patients undergoing total knee arthroplasty surgery. Routine physiotherapy for patients on their first postoperative day was given more often on Saturdays (59%) than on Sundays (31%). This result indicates that there is a discrepancy in treatment of patients depending on which weekday they are operated. Today there is an agreement as to the value of early mobilization and functional activities after total knee arthroplasty, despite the risk of postoperative complications like knee effusion, wound infection, hematoma formation etc. Almost all physiotherapists in our study mobilized their patients with regard to sitting on postoperative day-1.

Of course, it is the individual strength and cardiovascular status of the patient that decides the level and intensity of mobilization. In this study the average mobilization routines performed by a physiotherapist of a hypothetical “everyday” patient was determined. The actual mobilization of individual patients has not been the focus of the present study. Despite the frequent use of early mobilization, the benefit of mobilization in preventing postoperative complications has not been studied.

Instructions in range of motion exercises for the knee and lower extremities were mostly started on postoperative days 2 and 3. Only six of the physiotherapists started these exercises on the first postoperative day. It is currently not known how these exercises should be performed. How many times the patients were instructed to perform the exercises
varied between one and three times a day. Knee range of motion exercises, to be continued after discharge, were given by all physiotherapists. Recommendations for continuing the exercise programme varied between 1 and 8 weeks.

A guideline for physiotherapy treatment for patients undergoing major surgery is currently under development, but was not available during the study period. In spite of this, the physiotherapy management given in the different departments, by different physiotherapists, was fairly similar. This survey provides information that may be useful in research as well as development and implementation of clinical practice guidelines in physiotherapy. It is also very important to widen this knowledge and formulate internationally accepted guidelines for total knee arthroplasty patients.

CONCLUSIONS

The results of the survey indicate that there are only small variations in physiotherapy-supervised exercise and mobilization following total knee arthroplasty in south India. Further research and development of high-quality clinical guidelines as well as comparison with routines in nationwide is needed to confidently promote the postoperative recovery of the total knee arthroplasty patient.

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The Effect of a Single Session of Static and Ballistic Stretching on Lower Limb Power in Sedentary Individuals

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ABSTRACT

Background: To date there is a lot of controversy regarding the optimal type of stretch to improve lower limb power. Furthermore, the majority of studies have been conducted in an athletic population. A large percentage of patients treated by physical therapists are sedentary and it is important to understand the impact of different types of stretches on this population.

Purpose of the study: The objective of this study was to determine the effect of a single session of static and ballistic stretching on lower limb power in young sedentary individuals.

Material and methods: A total of 44 sedentary university students participated in this study. Lower limb power was assessed with the vertical jump test. Baseline measurements for the vertical jump test were taken and subjects’ height and weight were recorded. Following this three repetitions of either ballistic or static stretching were done for the hip flexors, hamstrings and gastrocnemius muscles. Immediately after completing the stretches the vertical jump test was repeated. Subjects were allowed to rest for one day and the next day the same procedure was repeated but using the stretching technique that was not done previously.

Findings: Both ballistic and static stretching produced an increase in lower limb power but this was only statistically significant for the ballistic stretch. There was no significant difference in the change in power obtained by the two types of stretches when they were compared. Conclusion: Ballistic stretching produces slightly higher gains in lower limb power of sedentary individuals compared to static stretching, however the evidence is inadequate to support the use of one over the other.

Key words: Ballistic Stretching, Static Stretching, Lower Limb Power, Vertical Jump Test

INTRODUCTION

Power refers to the ability to produce the greatest amount of force in the shortest amount of time. It is believed to be predictive of performance in activities that requires stretch shortening properties of a muscle tendon unit, such as vertical jump or sprinting¹. Explosive power is thought to be generated by increased elastic energy stored in the muscle fibers². It is therefore believed that exercise or stretches that increases this elastic energy will result in increased explosive power for that group of target muscles³.

Research investing the effects of stretching on jump performance has been variable. Powers⁴ in 2004 reported that static stretching led to an immediate decrease in force output however vertical jump distance remained unchanged. Similar findings were observed in trained women, where neither static nor ballistic stretching resulted in any significant changes in jump performance during a series of counter movement and drop jumps⁵. Woolstenhume⁶ investigated the effects of six weeks of training consisting of different warm up protocols followed by basketball play on a variety of factors including vertical jump performance. It was noted that none of the groups had a significant change in vertical jump height immediately after the warm up period; however, after basketball play the group that used ballistic stretching for the warm up had a significant difference in jump
performance compared to the groups that used static stretching, sprinting or basketball shooting. Static stretching was reported by other authors to result in a decrease in lower limb power\textsuperscript{7-12}.

The majority of studies that have looked at the effect of stretching on power were conducted in different athletic populations. Experimental designs and outcome measures were quite varied therefore making it difficult to come to any conclusion regarding the benefit of any one type of stretching on power. In addition the athletic population is also exposed to many other factors that can influence their performance.

Most individuals in their daily lives require some degree of power for independent functioning. The ability to rise quickly from a chair, ascend a flight of stairs or cross the street at traffic lights requires power from the lower limbs. A larger proportion of the patients treated by physical therapists are sedentary and it is therefore important for studies to be conducted to determine the impact of various types of stretching techniques on these individuals. In an attempt to add to this body of literature this study looked at the immediate effects of a single session of static and ballistic stretching on peak anaerobic power of the lower limbs using the vertical jump test. It was hoped that the information would help to guide therapists regarding selection of stretching techniques prior to other rehabilitation activities requiring lower limb force generation in sedentary clients.

MATERIAL AND METHODS

A single group pretest posttest balanced cross over design was used to conduct this study with the target population being sedentary university students between the ages 18 to 33 years. Sedentary was defined as not being engaged in any form of exercise or sporting activity for the last two years. Students were excluded if they had any pathology of the lower extremities, upper extremities or spine that was a contraindication for performing the vertical jump test. Subjects were also excluded if they appeared to be at high risk for cardiovascular problems based on their responses on a brief screening questionnaire from the American College of Sports Medicine\textsuperscript{11}.

The vertical jump test was used to measure peak anaerobic power for the lower limbs. It is recommended for use by the American College of Sports Medicine and studies have been conducted to determine its validity in predicting peak power\textsuperscript{14,15}. Subjects were instructed to dip their middle finger in washable paint and stand with their dominant side against a wall. They were asked to reach up as high as possible keeping the feet flat on the ground and touch the board with the painted finger. After this they were asked to stand with the knees bent and then jump as high as possible upwards and touch the board with the painted finger. The distance between the initial mark and final position was recorded. This was repeated three times and the highest distance recorded was used for calculating peak anaerobic power using Sayers equation (\textit{PAPw (watts)} = 60.7 × \textit{jump height (cm)} + 45.3 × \textit{body mass (kg)} - 2055)\textsuperscript{14,15}.

Once ethical approval was obtained for the study students were recruited from the halls of residence and through presentations done in some of the classes. All who indicated an interest to participate were screened for the inclusion and exclusion criteria and were required to sign consent forms. Baseline measurements for height and weight were obtained after which the subjects did a five minute warm up consisting of brisk walking. After the warm up baseline measurements for the vertical jump test was obtained and subjects were exposed to one of two stretching protocols (static or ballistic). The order for the stretching protocols was randomly assigned using a computer programme. Immediately after completing the stretching protocol the vertical jump test was repeated. Subjects were allowed a one day rest period and the following day the testing protocol was repeated however this time they completed the stretching protocol that was not previously done. All subjects were tested in the afternoon period and all assessments were done by the same evaluator who was blinded to the stretching protocol that was being conducted.

The static and ballistic stretching was done bilaterally for the following muscle groups: hamstrings, hip flexors and gastrocnemius. For all stretches subjects were given practical demonstrations in addition to verbal instructions. Each stretch was performed three times with a 20 second rest period between stretches. For the static stretching the subjects were required to move into the required direction until they felt a stretching sensation or slight discomfort but not pain. The position was held for 15 seconds and then repeated for a total of three stretches. Ballistic stretching was done in the same positions as the static stretching, however once the subject reached the initial stretched position, they were asked to bounce up and down or back and forth at a pace of one bounce per second within the range in which they felt the stretching sensation.

For the seated bilateral hamstring stretch subjects began in a long sitting position on the plinth. They then reached forward to try and touch their toes. The spine was kept straight and they were asked to bend from the hips. The knees were kept straight by tensing the Quadriceps muscle. The subject was required to hold the end position for 15 seconds for the static
stretch or bounce for 15 seconds for the ballistic stretch.

For the calf stretch using a step subjects were asked to stand with the toes on the step and the heel of the leg to be stretched hanging off the step. It was ensured that they had something to hold on to for stability. They were then asked to lower the heel off the step until they felt a stretch and hold the position for 15 seconds. They were also instructed that if the intensity of the stretch decreased to lower the heel further until they felt the stretch once more. For the ballistic stretch they were instructed to bounce up and down for 15 seconds.

For the standing quadriceps stretch subjects were asked to assume a lunge position with one leg in front of the other and then bend the forward leg and while keeping the back leg extended. They were then told to lean their trunk forward until they felt a stretch at the front of the thigh of the back leg. They were instructed to hold the position for 15 seconds and the same was repeated on the other side. For the ballistic stretch they were instructed to bounce back and forth for 15 seconds.

A paired t-test was done to determine if the mean change in anaerobic power was significant immediately following a single session of static stretching and ballistic stretching. A student’s t-test was done to determine whether there was a difference in the mean change in power between the two techniques. All testing was done at an α level of 0.05.

FINDINGS

A total of 44 subjects participated in the study (5 males, 39 females). Subjects’ ages ranged from 19 to 33 years with a mean age of 21.75 ± 3.17 years. The mean height of the subjects was 170.06 ± 18.65 cm and mean weight was 64.53 ± 16.76 kg. Both ballistic and static stretching led to immediate improvements in peak anaerobic power of the lower limbs when compared to baseline values however, this change was only significant with the ballistic stretch (mean change in power with ballistic stretching = 922.20 ± 759.90 watts, p = 0.004, mean change with static stretching = 921.30 ± 759.34 watts, p = 0.24 ). A comparison of the two types of stretches showed no significant differences between the gains in power that was obtained with each technique.

The participants in this study were sedentary university students however the results of the study were similar to those that looked at recreational and competitive athletes where minimal or no difference were found between different types of stretching techniques and lower limb power24. In this study the subjects performed stretches for the calf, hamstring, and hip flexor muscles. It is possible that the slightly higher gains obtained with ballistic stretching may be due to the differences in the mechanisms by which different types of stretches are thought to affect muscle properties. Static stretching has been shown to affect both mechanical and neurophysiological properties of muscles. The changes in the viscoelastic properties could potentially reduce the effectiveness of the muscle with regards to force generation. Ballistic stretching on the other hand is believed to have an effect primarily through neurophysiological mechanisms20-22. It is possible that the bouncing that occurs with ballistic stretching enhances the proprioceptive response of the muscle tendon unit thus making it more responsive to the stretch that occurs just prior to the takeoff phase when performing a vertical jump. Sedentary individuals would potentially be more responsive to these small changes compared to a well trained athlete.

Young and Behm25 reported a decrease in explosive force following static stretching, whilst running and practice jumps led to significant increases in explosive force. This research appears to indicate that the specificity of the activity that is to be done should be considered when making decisions regarding which stretching technique to use. Ballistic stretching is a more dynamic stretch which trains the muscle in a manner that is more similar to the way the muscles function during activities requiring jumping. This may be an important factor for therapists to consider when planning their treatment approach. For example when working on a sit to stand transfer or ascending stairs patients are required to generate significant lower limb power in the extensors in order to create an upward propulsive force. In this case working on some ballistic stretches prior to these activities may actually improve performance. If the therapist is working on endurance and reaching activities however, static stretching of the relevant muscle groups prior to the activity training may improve performance. These are some areas that require further investigation.

The participants in this study were between the ages 19 to 33 and therefore the results of this study cannot be applied to the population outside of these age ranges. The largest percentage of the participants was females and one would want to exercise caution when applying the results to males. Studies should be conducted to investigate the effect of stretching in an older sedentary group since they form a large proportion of the patients that are seen by physical therapists. It may also be useful to focus on the outcomes related to performance of specific functional activities such as time to cross a traffic light or to ascend a set number of stairs.
CONCLUSION

The results of this study showed that there is no difference between the effects of a single session of static and ballistic stretching on jump performance in sedentary individuals, however further research is required in this area.

Conflict of interest

There was no conflict of interest in the conduct of this study.

REFERENCES

Autonomic Adaptation and Functional Capacity Outcomes after Hospital-Based Cardiac Rehabilitation Post Coronary Artery by Pass Graft

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ABSTRACT

Background and purpose: secondary prevention of coronary heart disease and increased exercise tolerance in patients who received coronary artery by pass graft (CABG) are the main goals of cardiac rehabilitation.

The aims of the present study were to evaluate the effect of in-patient cardiac rehabilitation program on autonomic recovery after CABG and on functional capacity.

Subjects and methodology: fifty male patients with coronary artery disease who had been operated upon CABG were involved in the present study. They were randomly divided into two groups; group A (training group) who participated in ten steps cardiac rehabilitation program with adjusted intensity about 85% of maximal heart rate. Group B (control group) continued to perform mild walking, calisthenics, breathing exercises without adjustment for exercise intensity. Heart rate recovery and resting, mean six minute walking distance and estimated peak VO2 were measured preoperative, 4th day after operation and after the end of the rehabilitation program.

Results: there was a statistical significant effect of time and the interaction of time by group. Also there was a statistical significant difference between both groups except for resting heart rate.

Conclusion: In patient cardiac rehabilitation for patients who had been operated for CABG is beneficitation for improving autonomic balance and functional capacity.

Key words: Autonomic Adaptation; Functional Capacity; Coronary Artery Bypass

INTRODUCTION

Inherent factors to myocardial revascularization surgery, such as anesthesia, hypothermia, cardioplegia and peri-aortic sympathetic lesion, potentially lead to cardiovascular dysfunction in the postoperative period. Specifically, modulation of the autonomic nervous system, producing an abnormal increase in heart rate, myocardial oxygen consumption, may augment the sensation of exertion during physical activities performed during the early phase of recovery. Because of the strong association between HRR and mortality, and the link between HRR and exercise capacity or physical activity patterns, HRR has the potential to be an additional marker of training efficacy and risk stratification in patients undergoing cardiac rehabilitation. Although 6 MWT is commonly used to assess the functional status of patients with severe cardiopulmonary disease; few studies have tested its value in cardiac rehabilitation. Despite the growing number of older patients undergoing cardiac surgery, there is little evidence of the use of 6 MWT in this group of cardiac patients. Therefore, the aims of the present study were to evaluate the effect of inpatient cardiac rehabilitation program on heart rate recovery as a marker of autonomic recovery after CABG, resting heart rate, and functional capacity.
measured by using distance walked in 6 MWT and the estimated peak oxygen consumption (Peak VO₂).

METHODS

Study population

The study population consisted of fifty male patients with coronary artery disease, their age ranged from 45 to 60 years old. All of them had been operated upon CABG. Criteria for eligibility were as follows; male patients with sinus rhythm and ejection fraction > 50% as determined at preoperative cardiac catheterization and by Echocardiograph examination postoperatively before the enrollment in the rehabilitation program. Exclusion criteria were as follow: unstable angina, valve disorders, peripheral vascular diseases, arterial blood pressure > 180/100 mmHg, peripheral neuropathy, insulin-dependent diabetes, periperal anterior myocardial infarction, and any orthopedic or neurological limitation that interfere with the rehabilitation program. The patients were admitted to the rehabilitation center at the Coronary Care Unit (C.C.U) and Inpatient Cardiology Department in El-Hussin University Hospital during the preoperative period (one or two days before the operation), and 4th day postoperative. They were randomly assigned to either training group or control group by arrangement into numerical numbers from 1 to 50, then odd numbers were allocated as a training group and the even numbers were allocated as a control group. Patients assigned an informed consent and the study was approved by Ethical Committee of El-Hussin University Hospital.

Initial evaluation procedures

On admission to rehabilitation center, one or two days, the referred reports, all previous preoperative documents and investigations were revised in addition to recording their personal and anthropometric data then the procedure of the operation that was be done had been explained. Then the role of cardiac rehabilitation in preventing postoperative complications was explained.

Preoperative assessment

Six minute walking test according to ATS statement 2002, and Wu et al., 2003.

The test was symptom-limited, so patients who became symptomatic were told to stop walking and restart when possible. The hallway length was marked every three meters. The peak heart rate and the distance walked during the test were recorded. Before the test, the patient’s resting heart rate and blood pressure was monitored. Immediately after completion of the 6 MWT, the heart rate in the first minute of recovery was recorded from sitting position. The test was repeated for three times with rest interval in between about half an hour, and then the mean 6-minute walking test was calculated.

Heart rate recovery (HRR)

Heart rate recovery was defined as the decrease in the heart rate from the end of peak walking test to the first minute of recovery. As the test was repeated three times, the mean recovery heart rate was calculated by pulse oximeter.

Mean peak VO₂

The following equation was used to accurately estimate mean peak VO₂ from mean 6-minute walking distance (6 MWD); Mean peak VO₂ (ml/kg/min) = 4.948 + 0.023 x mean 6 MWD.

Training procedures

All patients in the training group underwent training program, at 4th day postoperative after assessment was done. The program consisted of two daily sessions of 30-minute for two weeks (24 sessions). The training program was conducted into steps according to Paul et al. (2001).

Step 1: (1.0: 1.5 Metabolic Equivalents) (MET) (sitting).

A.M.: Active assisted to active range of motion to all extremities; active ankle; active scapular; repetition 3:5 times; deep breathing.

P.M.: monitored ambulation 30:60 meters (assisted).

Step 2: (1.0: 1.5 MET) (sitting): repetition 3:5 times; deep breathing; ambulation 60 meters with assistance (stress correct posture).

Step 3 (1.5: 2.0 MET) (standing): active upper limb exercise and trunk bilateral (circumduction-backwards); knee extension 5:10 repetition; ambulation 90 meters.

Step 4 (1.5: 2 MET): increase repetition 5:10; monitored ambulation 130 meters.

Step 5 (2: 2.5MET): increase to 15 repetition; ambulation 130: 260 meters, for 5: 10 min; Exercise center: walk to inpatient center; strengthen exercise 15 repetition; treadmill 5:10 min; leg stretching exercise (hamstring, calf); increase ambulation to 3 laps (130 m.).
Step 6 (2: 2.5MET): active range of motion to each upper limb with one pound (= 0.450 kg) 15 repetitions; ambulation up to 5 laps (600 meters) for 10:15 min; treadmill 10:15 min; up stairs 6:12 with assistance.

Step 7 (2: 3 MET): active R.O.M. to each upper limb with one pound weight 15 repetition; ambulation 10:15 min; treadmill 20:30 min; up stairs 14 with assistance.

Step 8 (2: 3 MET): resisted with two pounds weight; up stairs 16; ambulation 9 laps (1150 meters)

Step 9 (2: 3 MET): continue; ambulation 12 laps (1550 meters); up stairs 18.

Step 10 (2: 3 MET): continue with 3 pounds; up stairs up to 24; up to 14 laps (1675 meters)

The training intensity was adjusted according to 85% of maximal heart rate reached during the 6-minute walking test, the heart rate was monitored by pulse oximeter. Patients in the control group continued to perform mild walking, calisthenics, and breathing exercises with coughing technique without adjustment for the exercise intensity for about 24 sessions (2 sessions daily for 2 weeks).

Data collection and statistical procedure

Two ways mixed ANOVA was conducted to evaluate the effect of time and grouping and their interaction. A level of P < 0.05 was considered indicative of statistical significance.

RESULTS

Table 1. The demographics and clinical characteristics of the sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Training group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of Patients:</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>2. Age</td>
<td>50.6±8.6</td>
<td>50±7.5</td>
</tr>
<tr>
<td>3. BMI (kg/m²)</td>
<td>24±3</td>
<td>25±2</td>
</tr>
<tr>
<td>4. EF %</td>
<td>50 - 59%</td>
<td>61 - 56%</td>
</tr>
<tr>
<td>5. Tobacco use</td>
<td>23(92 %)</td>
<td>22 (88%)</td>
</tr>
<tr>
<td>6. Hypertension</td>
<td>23(92 %)</td>
<td>22 (88%)</td>
</tr>
<tr>
<td>7. Cholesterol mg/dl</td>
<td>195±30</td>
<td>195±25</td>
</tr>
<tr>
<td>8. medicated infarction (MI) number</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>9. Time after MI in months</td>
<td>8.5 (4-31)</td>
<td>6.5 (3-24)</td>
</tr>
</tbody>
</table>

Considering the resting heart rate, the main effect of time was significant; p value was (0.0001). The time by group interaction was significant; p value was (0.0001). The main effect of group was significant, p value was (0.0001); see Table 2, 3. Considering distance walked, the main effect of time was significant, p value was (0.0001). The time by group interaction was significant, p value was (0.0001). The main effect of group was significant, p value was (0.04); see Table 2, 3. Regarding peak oxygen consumption, the main effect of time was significant, p value was (0.0001). The time by group interaction was significant, p value was (0.0001). The main effect of group was significant, p value was (0.04); see Table 2, 3.

Table 2. The main effect of time for different studied variables within patients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>Pre operative day</th>
<th>4th day</th>
<th>At the end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting heart rate (b/min)</td>
<td>Training Mean ± SD</td>
<td>99.857 ± 5.729</td>
<td>85.809 ± 5.124</td>
<td>85.904 ± 5.584</td>
</tr>
<tr>
<td></td>
<td>Control Mean ± SD</td>
<td>98.952 ± 5.132</td>
<td>91.809 ± 4.588</td>
<td>91.809 ± 4.589</td>
</tr>
<tr>
<td>Recovery heart rate (b/min)</td>
<td>Training Mean ± SD</td>
<td>114.952 ± 2.085</td>
<td>91.857 ± 4.028</td>
<td>91.809 ± 4.589</td>
</tr>
<tr>
<td></td>
<td>Control Mean ± SD</td>
<td>116.000 ± 1.843</td>
<td>107.476 ± 2.088</td>
<td>107.476 ± 2.088</td>
</tr>
<tr>
<td>Distance walked (meters)</td>
<td>Training Mean ± SD</td>
<td>284.523 ± 27.069</td>
<td>301.142 ± 4.253</td>
<td>325.142 ± 6.253</td>
</tr>
<tr>
<td></td>
<td>Control Mean ± SD</td>
<td>297.142 ± 1.843</td>
<td>301.142 ± 4.253</td>
<td>301.142 ± 4.253</td>
</tr>
<tr>
<td>Peak VO2 ml/ kg/ minute</td>
<td>Training Mean ± SD</td>
<td>11.124 ± 0.622</td>
<td>11.874 ± 0.650</td>
<td>11.874 ± 0.650</td>
</tr>
<tr>
<td></td>
<td>Control Mean ± SD</td>
<td>10.917 ± 0.837</td>
<td>11.782 ± 0.610</td>
<td>11.782 ± 0.610</td>
</tr>
</tbody>
</table>

Table 3. Statistical comparison between groups and the time by group interaction

<table>
<thead>
<tr>
<th>Variable</th>
<th>Between both groups</th>
<th>Interaction of time by group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting heart rate (b/min)</td>
<td>0.683</td>
<td>0.413</td>
</tr>
<tr>
<td>Recovery heart rate (b/min)</td>
<td>95.582</td>
<td>0.0001</td>
</tr>
<tr>
<td>Distance walked (meters)</td>
<td>4.458</td>
<td>0.041</td>
</tr>
<tr>
<td>Peak VO2 (ml/kg/min)</td>
<td>4.458</td>
<td>0.041</td>
</tr>
</tbody>
</table>

DISCUSSION

Mechanical injury to the autonomic nerve fibers during surgery might interfere with vagal cardiac reflex. Moreover, bed-rest reconditioning may lower the parasympathetic tone in the early phase of cardiac rehabilitation, but the mechanism by which vagally mediated heart rate recovery is blunted in post-CABG remains unclear.

The results of the present study, concerning the effect of cardiac rehabilitation program on heart rate recovery were in accordance with Sato et al. (2005) who conducted a supervised cardiac rehabilitation program on male patients at two weeks after CABG. The patients were divided into active group walking
> 5,434 steps / day and less active group. The training program lasted for two weeks and patients who used β-blockers were excluded.

It’s generally accepted that structured exercise training enhances the vagal contribution to the cardiac autonomic control in patients with coronary artery disease15,16.

The significant decrease in heart rate recovery in the first minute may be attributed to the release of inhibitory central command or afferent stimulation from baroreflex or chemoreflex functions 17.

The results of this study also go a head with Soleimani (2008)4 who supported an increase in HRR over one minute in patients who completed 24 sessions of cardiac rehabilitation (phase2). The study indicated that precutaneous coronary intervention patients achieved greater improvement in HRR by comparison with CABG patients.

Wu et al. (2006)18 also showed that the mean value of HRR decline improved from 9.2±4.5 to 6.2 beats per minute after cardiac rehabilitation among CABG patient.

The results of the present study also were confirmed by the results gained by Soleimani. (2008)4 who investigated out patient cardiac rehabilitation program impact on HRR after precutaneous transluminal angioplasty, the results showed a reduction in HRR post training.

The reduction of resting heart rate in the present study conceded with Wu et al. (2005)19 designed a cardiac rehabilitation program according to 60-85% of peak heart rate achieved in cardiopulmonary exercise test conducted at discharge and 3 months later for CABG patients.

According to the reference values for distance walked in the 6-minute test soon after cardiac surgery in male patients with ejection fraction more than 50% and having no operatively 2 comorbidies, the patients included in the present study, had a lower functional capacity post.

The significant increase observed in the functional capacity in the present study conceded with Fiorina et al. (2007)20 showed an increase the walked distance measured after in-hospital cardiac rehabilitation program for 15 days. The rehabilitation program included training with treadmill, and/or bicycle ergometer, walking, jogging, stair climbing and step aerobic. The intensity was established according to the clinical condition and the results of symptom-limited exercise testing. The improvement seen in the control group of the present study was lower than that observed in the study of Hirschhorn et al. (2008)21 who showed a change to about 444±84 meters and 431±98 meters in walking and walking breathing exercise groups who were trained in the inpatient phase after CABG without adjustment for exercise intensity. This discrepancy may be related to the time of measurement as Hirschhorn et al.21 measured 6 MW distance preoperative, at discharge and four weeks following discharge.

The significant improvement observed in mean six-minute walking distance and mean peak VO2, may be related to reduction of resting and recovery heart rate along with improvement of autonomic nervous system balance 22, other mechanisms potentially involved in functional capacity improvement may be related to correction of anemia, the reduction of chest pain and of respiratory limitation usually appearing early after surgery 19.

REFERENCES

Analysis of the Influence of Fear of Fall on the Score of Berg Balance Scale among the Elderly Population

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ABSTRACT

Background: Fear of fall felt by the elderly population even in the absence of incidence of fall can affect their mobility. It can also expected to affect the scoring of Berg Balance Scale. This study is done to analyse this impact of fear of fall on score of Berg Balance Scale.

Method: 50 elderly individual in the age range of 65 to 74 years were recruited. Tinetti Fall Efficacy scale was administered to quantify the fear of fall in them. Berg Balance Scale was administered. Confidence to do the Berg Balance Scale was measured with Visual Analogue Scale. Counseling and placebo exercise training was given to improve their ability to perform ADL and Berg Balance Scale. Pre and Post counseling with training data was analysed. Correlation between scores of Tinetti Fall Efficacy scale and Berg Balance Scale was identified.

Results: Higher level of correlation was found between Tinetti Fall Efficacy and Berg Balance Scale. There was a significant change found the in the scores of both the scales with counseling and placebo training.

Conclusion: Fear of fall has to be considered while measuring balance with Berg Balance Scale and counseling prior to evaluation will improve the quality of the measurement.

Key words: Tinetti Fall Efficacy Scale, Fear of fall, Berg Balance Scale.

INTRODUCTION

WHO defines elderly population as individual in the age group above 65 years. Increase in age may lead to increasing probability of degenerative changes in biological systems, which may lead to functional and structural changes in the body mechanism. These changes may be extremely profound and may result in total disability. Advancing age is related with decrease in lower extremity strength¹⁻⁵. This results in decrease in mobility and increase risk of fall among elderly. Lord et al⁶ states that quadriceps muscle strength was poorer in multiple fallers when compared to non fallers. Individuals who experience fall, reduces their mobility. Fear of falling induced avoidance of activities among elderly individuals. Tinetti et al⁷ reports that, out of 1,103 individuals studied 19% avoided activities due to fear of falling. Avoidance of activities will result in further decrease in lower extremity muscle strength. Women are more likely to report fear of falling than man⁸. Fear of falling is considered to be an important factor which restricts the activities of daily living⁹⁻¹¹. Chandler et al¹² states that with advancing age, a psychological symptom called fear of falling develop in elderly. This happens even without an experience of fall. Chandler et al¹² found that 38% of 306 community dwelling male aged 70 and above, experienced fear of fall without a history of fall. Van Haastregt JC et al¹³ found that depression was associated with severe fear of falling. This depression can further decrease the mobility and result in further weakness. As fear of fall reported to have negative impact on mobility of an individual, it may also have influence on any mobility related tests performed on the individual. The score of the test may get altered because of the fear of fall impeding the movement, not due to presence of motor deficit.
Berg Balance scale is one such measure, which is commonly used to predicting falls. Muir SW and Berg K\textsuperscript{16} did a prospective study to find out the use of Berg Balance Scale among community dwelling older people, and concluded that Berg Balance Scale has a good discriminative ability to predict multiple falls among older people. This scale consist of fourteen functional task commonly performed in everyday life it is reported to be highly reliable and sensitive measure for balance. As fear of fall can affect motor performance of an individual, it may also have impact on scores of Berg Balance scale. But the impact of fear of falling on the scores of Berg Balance Scale has not been documented. This study was intended to analyze whether fear of fall will have an impact on the scores of Berg Balance Scale among elderly population.

Tinetti et al\textsuperscript{17} have referred fear of falling as low perceived self efficacy at avoiding falls during essential, non hazardous activities of daily living. Fear of falling can be measured by Tinnetti Fall Efficacy scale. This scale consists of 10 items of activities of daily living. Individuals are instructed to score their confidence in doing the activity without falling on a scale of 1 to 10, with 1 being very confident and 10 being not confident at all. This scale has good test retest reliability and is useful in evaluating the independent contribution of fear of falling to functional decline among elderly. A total score of 70 and greater than 70 indicates that the person has a fear of falling.

In this study influence of fear of falling on scores of Berg Balance scale was studied. The fear of fall was quantified with Tinetti Fall Efficacy scale.

**METHODOLOGY**

Elderly women population in the age range of 65 to 74 years, in old age home was screened for the inclusion and exclusion criteria. Those who ambulate without any assistive devices were included for screening. Cognitive function was screened with Mini Mental State Examination. One hundred and Two individuals were screened. All of them briefed about the need for the screening process. Three were excluded as they scored 23 in their Mini Mental State Examination and 15 had orthopaedic and neurological impairments which can compromise balance and one didn’t agree for further screening. Finally 83 were selected for further screening with Tinetti Fall Efficacy scale to grade their "Fear of Fall" or otherwise their confidence in doing their Activities of Daily living independently. Fall Efficacy Scale consists of 10 components with a total score of 100. The original Falls Efficacy Scale consists of 10 items with a 10-degree scale (1-10), where 1 indicates 'very confident, no fear of falling' and 10 'not confident at all, very afraid of falling'. Subjects who had a score of 70 and greater than 70 were concluded to have Fear of falling. Eighty-three individuals were screened and 50 who scored 70 and greater than 70 in Tinetti Fall Efficacy Scale were selected for the study. The selected individuals were explained about the study and written informed consent was obtained. Subjects were explained about the Berg Balance Scale. As it was felt that measuring the confidence of the individuals to score maximum in Berg Balance Scale, will add clarity to the study, it was marked on Visual Analogue Scale. In Visual Analogue scale 1 indicated minimal confidence to score maximum in Berg Balance Scale and 10 indicated maximal confidence to score maximum in Berg Balance Scale. Berg Balance Scale was administered and scored. As it was assumed that existence of a relationship between presence of fear of fall and decrease in score of Berg Balance Scale may even be a coincidence, it was decided to decrease the fear of fall by an intervention and analyse the relationship again with scores of Berg Balance Scale. All the individuals were given a counseling to improve their confidence to do their daily activities and reduce the fear fall. The researcher who did counseling was blinded from the scores of Fall Efficacy Scale and Berg Balance Scale to avoid bias during counseling. All the subjects were given a set of exercises to improve their confidence. Exercises were structured in such a way they that they will not improve their performance in Berg Balance Scale, but will give them only psychological well being. The Exercise program consisted of four exercises, and subjects were advised to repeat for 10 times per session. The exercises were given for 5 days consecutively. All the subjects received one session of exercises per day, under the supervision of the researcher. Subjects were insisted not to perform them in the absence of the researcher. This instruction was repeated regularly to avoid any influence of exercises on physical performance in Berg Balance Score. The four exercises given were quadriceps contraction in high sitting, in supine lying static quadriceps contraction, hip & knee flexion and hip abduction & adduction to neutral. Counseling was along with the exercise session on a daily basis. On the fifth day the same examiner who administered Visual Analogue Scale and Berg Balance Scale during initial evaluation did the evaluation.

**RESULTS**

This study was done on 50 subjects and the result was analysed. The subjects comprise of only females.
Table I shows the correlation between Tinetti Fall Efficacy Scale (TFES) and Berg Balance Scale (BBS) for pre counselling values was calculated and table shows the correlation between Tinetti Fall Efficacy and Berg Balance Scale pre counselling values and the correlation was significant.

**Table 1. Pre counseling correlation between TFES and BBS**

<table>
<thead>
<tr>
<th>No of subject</th>
<th>r value</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinetti Fall Efficacy Scale Score</td>
<td>50</td>
<td>-.783</td>
</tr>
<tr>
<td>Berg Balance Scale Score</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Table II shows the correlation between Tinetti Fall Efficacy (TFES) and Berg Balance Scale (BBS) post counselling values and the correlation was significant.

**Table 2. Post counseling correlation between TFES and BBS**

<table>
<thead>
<tr>
<th>N</th>
<th>r value</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinetti Fall Efficacy Scale Score</td>
<td>50</td>
<td>-.825</td>
</tr>
<tr>
<td>Berg Balance Scale Score</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

Table I and II shows that the relationship between the fear of fall and scores of Berg Balance scale was not due to coincidence.

The change in the fear of fall due to counseling was also measured and found that there was a significant decrease. Table III shows analysis for pre counseling and post-counseling score of Tinetti Fall Efficacy Scale (TFES) using Student’s T test. The result is highly significant.

**Table 3. Comparison of Pre and post counseling values of TFES**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>t test</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>TFES Pre counseling values</td>
<td>74.84</td>
<td>4.8</td>
<td>11.1</td>
<td>Significant</td>
</tr>
<tr>
<td>TFES Post counseling values</td>
<td>70.26</td>
<td>5.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The change in values of Visual Analogue scale was also analysed for changes in the confidence to perform the Berg Balance Scale. The change was highly significant with t’ value 10.0.

**DISCUSSION**

The aim of this study was to select Elderly subjects with fear of fall without any previous history of fall and analyse the influence of fear of fall on their ability to perform Berg Balance Scale. The subjects were given a set of placebo exercises under supervision for a period of five days to decrease their fear of fall. It was hypothesized that by the influence of supervised placebo exercise the fear of fall might decrease and their functional abilities would improve.

Subjects with the score of 70 and greater than 70 in Tinetti Fall Efficacy Scale were taken for the study. In this study fifty subjects with the score greater than 70 were included. Anne Shumway Cook in motor control 2007, states that fear of fall increases with age. It was noted that 32 out of 50 subjects were greater than 70 years of age.

Analysis of pre and post counseling values of Tinetti Fall Efficacy Scale showed that there is a statistically significant difference between the values. There was a decrease in values in post counseling period, denoting that there was a decrease in the fear of fall or increase in the confidence in doing the Activities of daily living. Correlating the pre-counseling score of Tinetti Fall Efficacy Scale and Berg Balance Scale showed that they are negatively related with r-value -.783. The relationship between Tinetti Fall Efficacy Scale and Berg Balance Scale post counseling session also shows higher value of r .825. These data suggests that there exist a relationship between the fear of fall and performance of Berg Balance Scale.

Individual subject level analysis revealed more interesting findings. In this study 42 individuals as whole had decrease in scores of Tinetti Fall Efficacy Scale after counseling. This group forms 64% of the population studied. In this 42 only 33 have shown increase in the score of Berg Balance Scale. All these individuals had their Visual Analogue Scale score increased displaying their increase in the level of confidence to perform Berg Balance Scale. Seven Subjects with decrease in Tinetti Fall Efficacy Scale score didn’t show any changes in Berg Balance Score, even though their Visual Analogue Scale score recorded an increase in their confidence in six subjects. This controversy between the scores may be due to the subjects’ visualisation of functional activities stated in Tinetti Fall Efficacy Scale and activities performed in Berg Balance Scale as different with respect to the requirement of Balance. Hence even though they thought they could perform the activities noted in the Tinetti Fall Efficacy Scale with ease with their counseling, they did not feel the same level of confidence with the Berg Balance Scale performance. Seven subjects did not show any changes in Tinetti Fall Efficacy Scale, Visual Analogue Scale and Berg
Balance Scale. This could be assumed as a result of insufficient counseling to those individuals.

The fear of falling among the elderly has an influence on the mobility of the individual that in turn reduces the functional ability. As components in Berg Balance Scale replicates or mimics few postures and movements commonly noted in daily living, fear of fall may influence Berg Balance Scale scores. The results of this study suggest that there is a negative correlation between fear of fall and Berg Balance Scale. It can be suggested that Berg Balance Scale scores may vary even if the individual has fear of fall during movements or posture control without having any physical impairment affecting the balance. This has to be considered when the Berg Balance Scale is used to evaluate balance especially in elderly population. Prior counseling about the testing, precautions provided or environment that makes them feel safe against fall and risk of injury may alter the Berg Balance Scale scores.

CONCLUSION

The results suggest that there is a negative correlation between fear of fall that was present among elderly and Berg Balance Scale, when fear reduces among elderly it may alter the scores of Berg Balance Scale.

Proper counseling and instruction regarding the Berg Balance Scale can positively influence the scores of Berg Balance.

REFERENCES

Impairment of Spinal Proprioception Following Stroke

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ABSTRACT

Objective: To objectively determine any impairment in Spinal Proprioception in individuals with chronic stroke.

Methods: A two group, observational study was performed on 30 individuals with chronic stroke (Age 48.9±2.5 years, post stroke interval in years 1.4±0.6), and 30 healthy controls. Spinal Proprioception impairments, as determined by Trunk Reposition Error (TRE) was assessed by the Spinal Reposition Sense Device

Results: The individuals with chronic stroke had a significantly higher trunk reposition error, more than twice that of the healthy controls.

Conclusion: This is the first Indian study to report significant impairments in Spinal Proprioception in individuals with chronic stroke. This finding can be used to expand interventional strategies post-stroke, by considering the state of a client’s proprioceptive system when developing a plan of care.

Key words: Proprioception, Spinal Reposition Sense, Trunk Reposition Error, Stroke

INTRODUCTION

Brain stroke is the third largest cause of death and disability in India after heart attack and cancer, affecting 130 per 1,00,000 people every year.1 Stroke leads to a lot of impairments, such as motor and sensory paralysis, cognitive, perceptual, speech disorders, and many other systemic dysfunctions. It is also a major cause of postural imbalance in terms of static and dynamic control2. Individuals with strokes have been shown to exhibit problems with balance and postural control, which can hamper their movements. Stroke individuals with balance impairments take longer time than those without balance impairments to reach the same level of functional gain1. Disuse of the trunk musculature, due to weakness, as seen in stroke, can impair tracking the position and velocity of the spine, as the muscle spindles present in the trunk muscles function as kinesthetic sensors for spine motion1. While trunk musculature provides some stabilization to the spine, without adequate position sense, the trunk cannot be stable. Trunk reposition accuracy is found to be impaired in various musculoskeletal and neurological conditions, and also in geriatric individuals2,5,11. It has also been identified in people in the chronic phase of recovery post-stroke2, but more evidence is needed to backup this result, as there is only one study that has objectively documented errors of trunk position sense in individuals poststroke. There is association of the loss of selective control in the trunk with problems of breathing, speech, balance, gait, arm and hand function2, but as most literature concerning motor evaluation in stroke focuses on the upper and lower extremity, there are many lacunae, leaving many areas less explored. One of such area is Trunk proprioception in stroke. Thus in this study, which is the first Indian study of its kind, we have attempted to fill the lacuna by exploring proprioceptive sense impairments in individuals with chronic stroke.

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Proprioception describes those sensations generated within the body which contribute to an awareness of the relative orientation of the body parts, both at rest and at motion. Better spine proprioception leads to better spine control, which in turn reduces effort level. Position sense is one of the dimensions of proprioception that is classically assessed by the ability to reproduce a preselected target position. Position sense testing of the spine, or components of the spine, is less common and in some circumstances more difficult because of the multiple joints involved and the inability to match a contralateral limb, thus relying heavily on memorizing the target position. Impairments in trunk position sense is measured by Trunk Reposition Error (TRE), which is defined as the difficulty to sense trunk position. Researchers have emphasized on the importance of a sensitive method for quantitative assessment of proprioception deficits, which would help clinicians identify patients in need of such treatment, and would facilitate monitoring of treatment efficiency in terms of increased accuracy and reduced performance instability.

Using a device which could be easily incorporated into the community setting is needed, in order to meet out the socioeconomic status of the Indian population. Due to the inability to use most of the methods citing greater cost, increased time and less ease of use, a purpose effective clinical measurement tool for proprioception, the Spine Reposition Sense Device for measurements within the sagittal plane which was developed by Clive Pai et al was considered. Trunk Reposition sense in non-neurologically involved healthy individuals was evaluated by various researchers, by the use of different methods, albeit the disagreement in literature about the ranges of the Reposition Errors obtained, and it was found that the Spine Reposition Sense Device was a cost effective clinical technique for sagittal trunk reposition sense measurement.

Proprioception is highly emphasized in sports and musculoskeletal injuries, but conversely there is lack of sufficient number of studies targeting spinal reposition sense in stroke. Trunk proprioception receives only little attention, if at all measured, the objective values and their clinical implications are not mentioned, thus lacking sufficient literature backup. This lack of emphasis on trunk stability and objective evaluation of reposition sense in stroke forms the need for this study, whereby the primary objective of this study is to objectively determine any impairment in Spinal proprioception in individuals with chronic stroke.

**DESIGN & METHODOLOGY**

A two group, observational design was used. Samples were selected as per the selection criteria based on convenient sampling method. 30 individuals in the chronic phase of stroke were taken for the study. 30 age-matched non-neurologically impaired individuals used as controls.

Medically stable male individuals between the age group of 45 and 60 years were selected for the study. As per the selection criteria, individuals with either right or left hemiplegia, with post stroke interval >6 months <2 years; with NIHs Scale Score either 0 or 1 in the selected 3 domains; and with the ability to sit independently on a bench, reach forward and down to the floor, and return to an upright sitting position with arms in front the body, hands clasped and eyes closed were included. As screened by the neurologist, individuals with strokes involving the parietal lobe, posterior limb of internal capsule and thalamus; history of Balance Disorders prior to stroke; any co morbid neurological diseases, any clinical evidence of shoulder subluxation, chronic uncontrolled Diabetes Mellitus, low back pain and any degenerative spinal disorders were excluded from both groups. Female individuals could not be considered for the study, owing to privacy reasons.

The study was performed in Physical Medicine and Rehabilitation Centre, Govt. of Puducherry, a Tertiary Care Centre, following the Ethical guidelines.

**OUTCOME MEASURES**

To measure the Proprioception of the trunk by TRE, the Spinal Reposition Sense Device (SRSD) developed by Clive Pai et al, an objective outcome measure was chosen.

**Spinal Reposition Sense Device (SRSD):**

This device is a cost effective clinical technique for sagittal trunk reposition sense measurement. It consists of two meter sticks and a sliding mechanism. One meter stick is positioned vertically and the second meter stick extends horizontally, perpendicular to the vertical meter stick. Leveling the entire device ensures 90° angles, enabling the use of a trigonometric equation in measuring trunk orientation and reposition error. The Interclass correlation coefficient of this device was 0.82.

**RESEARCH PROCEDURE**

The procedure of the study was thoroughly explained to the individuals selected for the study and
an informed written consent was obtained in the individuals’ vernacular language. For the assessment of Spinal Proprioception, the procedure followed by Clive Pai et al was used, with their permission. All the individuals were tested by the same evaluator.

Individuals of both groups were instructed before testing not to perform any unaccustomed strenuous physical activity for 24 hours before testing and not to eat or drink two hours prior to testing, and the cutaneous, visual and auditory inputs were minimized.

During testing, the individuals were seated on the Spinal Reposition Sense Device, adjusted to standardize individual sitting positions, hips at 90 degrees, and feet flat on the floor. The individuals were then palpated in sitting by the examiner and a line was marked with a pen on the top of the T1 spinous process. The initial test position of the individuals was upright sitting with arms either in front the body with hands clasped, or with arms folded across the chest. The measurement procedure was standardized and completed by the examiner. The X and Y coordinates were recorded for the estimated 50% flexion, and used in a trigonometric calculation \( \theta = \tan^{-1} \frac{X}{Y} \) to determine the starting angle. This procedure was performed once, as the initial trial, and was repeated for 7 trials. Reposition error was calculated as the difference between each trial’s 50% angle position and the initial trial. Mean absolute reposition error for each individual was calculated as the average of the sum of the reposition angle errors across trials. The individuals were allowed to rest 10 seconds between each trial.

The data obtained were documented and analyzed.

**DATA ANALYSIS & RESULTS**

The outcome values obtained were tabulated in GraphPad Prism 5 for Windows Version 5.03 for statistical analysis. The level of impairment of Spinal Proprioception was analyzed using the Independent sample “t” test.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group A (Healthy controls)</th>
<th>Group B (Stroke group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Participants</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Age (yrs.)</td>
<td>48.9±2.5</td>
<td>50.3±3.2</td>
</tr>
<tr>
<td>Post-Stroke Interval (yr.)</td>
<td>1.4±0.6</td>
<td>–</td>
</tr>
<tr>
<td>Side of Hemiparesis (Right : Left)</td>
<td>14:16</td>
<td>v</td>
</tr>
<tr>
<td>NIHSS Score* (0-6)</td>
<td>3.87±0.94</td>
<td>1.52±0.63</td>
</tr>
</tbody>
</table>

* The items of this scale that have been used in this study have been limited to Level of Consciousness (Commands and Questions) and Extinction and Inattention.

**RESULTS**

Referring the baseline characteristics of the study participants (Table 1), and the breakdown of the TRE values of individuals of both groups (Figure 1a,b), the outcome TRE’s were compared using independent t-test. The means (3.87±0.94, 1.52±0.63) and median quartiles (3.9, 1.5) of the TRE’s of both the groups differed significantly, with “t”- value 11.35 at P < 0.05. Thus, in analysis of the Impairment of Spinal proprioception, the individuals with chronic stroke of Group A had an increased difference in TRE (more than twice the value) when compared to the healthy control Group B. (Figure 2)

**DISCUSSION**

This is the first Indian study on objective assessment of spinal proprioception, performed on individuals with chronic stroke. It was found that the
individuals with chronic stroke had a significant increased TRE when compared to the healthy controls. The obtained mean values of TRE in individuals with chronic stroke (3.87±0.94) were lower than with the TRE’s reported in study performed by Susan Ryerson et al. (6.19±3.1) The TRE’s obtained in the normal controls (1.52±0.63), also were lower than the corresponding values reported by Susan Ryerson et al, (3.2±1.8) Peterson et al, (2.26±0.84) Goldberg et al, (3.8±0.7) and Åssel et al. (6.15±2.3) These variations could be attributed to the morphological differences in the individuals, as the studies were conducted in different geographical locations. The TRE’s of the individuals with right sided hemiplegia (3.65±1.5) did not significantly differ from that of the individuals with left sided hemiplegia, (4.09±0.9) thus implying no influence of the side of the hemiplegia on the trunk proprioception. However, further studies are needed to confirm this observation. Also, the influence of gender on spinal proprioception could not be considered, owing to privacy reasons females could not be assessed.

In this study individuals with chronic motor stroke devoid of any lesions directly affecting the sensory pathways were included, as diagnosed by the neurologist. This was done so to eliminate the influence of central sensory disruption on spinal reposition sense, as there is evidence that ascending sensory information can have a powerful influence on cortical motor circuits and their descending pathways. Trunk proprioception in all individuals in the study group was supposedly impaired due to impairment in processing of the trunk position sense input and the detection of position sense from spinal muscles and joints during the active target movement. Disturbances in somatic sensation, especially in position sense or proprioception may have detrimental functional implications, consequent upon poorly controlled posture and balance. Such disturbances may arise following damage to the sensory pathways anywhere between the peripheral nerve endings and the somatosensory association cortex of the parietal lobe. Decreased input from position sense receptors as a result of trunk muscle weakness could be a contributing factor. Formation of accurate neural models of the spine system, which then use sensory signals to predict the state of the system, is aided by trunk muscles and their embedded sensory receptors. This generates feedback control signals to activate the trunk muscles to stabilize the spine, delays of which can impair spine control, particularly when the spine is in motion. Further studies can be performed to evaluate the impairment of Spinal proprioception on central disruption of proprioception.

The measurement of spinal reposition sense using the Spinal Reposition Sense Device was in the sagittal plane, since there is presence of double TRE in the sagittal plane, when compared to other planes, as observed by Susan Ryerson et al (2008) and Goldberg et al (2005). Further research is needed to address the question whether regional assessment of spinal position sense in one plane can functionally imply in other planes. Also, correlating the obtained values of TRE with clinical measures of balance can find out the critical value of the error which causes functional implications. Researching in this regard can also help formulate an age and gender wise reference value range for the TRE.

CONCLUSION

From this study it can be concluded that individuals with chronic stroke had a significantly higher TRE, more than twice that of the healthy controls. Hence, proprioceptive assessment of the trunk must be made an integral part of evaluating stroke, in order to improve functional gain.

REFERENCES

A Cost-effective Patient Designed Hand Splint for Rehabilitation after Two-stage Flexor Tendon Reconstruction

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ABSTRACT

Background : A number of splints have been described to aid in the rehabilitation after two-stage flexor tendon reconstruction. We present an innovative splint design by a motivated patient to assist in his own functional recovery in a cost-effective manner.

Case: A 45 year old male engineer underwent a traumatic motor bike injury to the volar aspect of his left middle finger at the level of the distal interphalangeal (DIP) joint. He was found to have a segmental loss of the distal segment of the flexor digitorum profundus (FDP) that prevented a primary repair. He was planned for a two stage repair with physiotherapy. After consulting with the therapist, the patient designed a device to aid himself with the flexion of the DIP, PIP and MCP joints of his affected digit which he used during this period. His post operative recovery was remarkable with excellent functional recovery scoring 95% of normal movement on the Strickland’s Adjusted system.

Conclusion: In combination with a hand therapy regime, we recommend this innovative patient designed splint as a simple and inexpensive alternative to existing splints for rehabilitation for two-stage flexor tendon reconstructions.

Key words: Occupational Therapy; Flexor Tendon Reconstruction; Splint; FDP (flexor digitorum profundus); FDS (flexor digitorum superficialis); PIP (proximal interphalangeal) Joint; DIP (distal interphalangeal) joint.

INTRODUCTION

A number of splints have been described to aid in the rehabilitation after two-stage flexor tendon reconstruction. We present an innovative splint design by a motivated patient. The novel aspect is that in this case the well informed patient came up with the idea which was recognized by the clinical team and hand therapist who allowed the patient to assist in his own functional recovery in a cost-effective manner.

CASE REPORT

A 45 year old male engineer underwent a traumatic motor bike injury to the volar aspect of his left middle finger at the level of the distal interphalangeal (DIP) joint and underwent a primary debridement of a surgically contaminated wound. He was found to have a segmental loss of the distal segment of the flexor digitorum profundus (FDP) that prevented a primary repair. After consulting with the therapist, the patient designed a device to aid himself with the flexion of the DIP, PIP and MCP joints of his affected digit. He also underwent a standard protocol of digital exercises supervised by hand therapists in the three months leading to his first stage flexor reconstruction with a silicone rod. Postoperatively he remained compliant with physiotherapy and continued wearing his splint. Three months later at the time of his second stage reconstruction, he was observed to have 90 degrees of flexion at the DIPJ and PIPJ of the affected digit.

After the second stage reconstruction he was again assessed by the hand therapist and a week later started wearing his designed splint again for another four weeks. His post operative recovery was remarkable.

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with excellent functional recovery scoring 95% of normal movement on the Strickland's Adjusted system 
[(PIP + DIP) flexion extension deficit × 100/175 degrees].

THE SPLINT - DESIGN AND APPLICATION

The splint designed by the patient consisted of a Velcro hood constructed by stitching together two Velcro straps (wire securing Velcro bought from an electrical store). This hood covered the tip of the digit and was secured to the wrist with elastic bands that passed as adjustable straps through a slit on each side of the hood. The elastic straps were secured distally with knots allowing the elastic band length to be adjusted (if it became loose secondary to overstrecthing) by simply pulling the band distally through the slits and securing the newly adjusted length with a new knot. The distal segment of the band could then be cut off enabling this design to be used successfully in digits of all lengths with easy adjustment.

The elastic straps chosen by the patient were soft and the splint design allowed the fulcrum to rest of the dorsum of the hand (just distal to the wrist joint) (Figure 1) enabling passive assisted flexion of the digit at both the DIP and PIP after each active extension (Figure 2). Despite allowing full extension of the finger against the elastic, there was still enough tension remaining to provide sufficient traction when flexed. There was no restriction imposed on the the volar surface of the hand by the device. The elastic straps despite not having a base did not dig into the wrist or the finger webs and hence did not pose a risk for neuropaxia or pressure. The splint was worn fulltime by the patient prior to first stage reconstruction and in the interim period between the first and second stages (when it kept the PIP, DIP and MCP joints in flexion), and also after a few days of the second stage of reconstruction (when it allowed both passive flexion as well as extension against some resistance).

It could also be easily removed and washed for hygiene purposes and the total cost price of the Velcro and elastic bands was described by the patient to be 0.40 pounds sterling (approximately US $ 0.65).

DISCUSSION

Prior to a two stage flexor reconstruction, it is wise to start the patient on a range-of motion and scar softening therapy program to attain maximum preoperative passive range of motion1-3. After stage one of flexor reconstruction, passive motion exercises are started 2 - 3 days after surgery4. In the postoperative therapy after stage two of flexor reconstruction, there has been a steady trend toward early active mobilization1,5,6.

Fig. 1. Dorsal view of the worn splint

Fig. 2. Lateral view of splint with flexed PIP, DIP and MCP joints
There are several splint designs and splinting protocols including the Duran and the Kleinart rubber traction, the Brooke Army palmer-bar modification, the Mayo clinic synergistic wrist splint, Evan’s short arc motion, and the Strickland hinged wrist splint and active tenodesis. The splints can vary in design from simple elastic straps around PIP and DIP joints, elastic straps of various designs around the palm and distal phalanx, flexion gloves with elastic traction or with an extra strap around the distal phalanx and palm. Other alternatives include palm based dynamic finger flexion splints or sticking hook-Velcro to the nail plate and attaching a loop or elastic from the palm to the wrist.

Most of these alternatives are complex in design and have to be custom made by occupational therapists and can have a substantial cost and time factor involved in the manufacturing process. Full details of the treatment protocol, the rationale for why splints are used and how the different existing designs address specific treatment objectives such as early protected mobilization are beyond the scope of this manuscript.

The patient designed splint acted as a flexion strap which allowed him to regain flexion at the DIP and PIP joints. The fact that the patient had an excellent outcome may not be enough evidence that this splint is generally effective, but the splint designed by the patient proved to be innovative, simple, inexpensive and fulfilled the requirements of therapy. The design has since been used to help other patients with good outcome.

**CONCLUSION**

In combination with a hand therapy regime, we recommend this innovative patient designed splint as a simple and inexpensive alternative to existing splints for rehabilitation for two-stage flexor tendon reconstructions.

**ACKNOWLEDGEMENTS**

The patient has given consent to them being presented as a case and we would like accredit Mr. Ian Tomkins for the splint he has designed.

**REFERENCES**

Comparative Study Between Auditory, Visual and Combined EMG Biofeedback in Management of Patients with Tension type Headache

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ABSTRACT
Background: Tension-type headache (TTH) is the commonest primary headache. Electromyography (EMG) biofeedback (BF) is considered an effective therapy for tension-type headaches. Comparative effects of auditory and visual EMG biofeedback have not been systematically studied in TTH. The objective of the present study was to compare the effects of EMG BF with audio, visual and integrated BF on headache and quality-of-life in subjects with TTH.

Methods: Subjects with TTH fulfilling the International Headache Society criteria were selected by random sampling and allocated into EMG audio feedback (EMG-a), visual feedback (EMG-v) and integrated audiovisual feedback (EMG-av) groups. They underwent EMG BF therapy for fifteen sessions of thirty minutes each. The headache (pain) variables and SF-36 (Quality of life) scores were documented at baseline, one month and three months after commencement of EMG BF therapy.

Results: All groups showed significant improvements in all pain variables. Improvements were also seen in the total, physical and mental scores of SF-36 scores in first and third month follow-up (p<0.05). Inter-group analysis revealed significant differences between the three groups (p<0.05) with EMG audio-visual BF showing more significant improvement in the pain variables. EMG-av BF group also showed highest improvement in SF-36 scores at first and third month follow-up. EMG audio group showed significant improvement in the intensity parameter of pain variable at the third month follow-up.

Conclusion: Auditory, visual and integrated auditory-visual EMG biofeedbacks are effective in treatment of TTH with most benefit seen with combined feedback.

Key words: Tension Type Headache, EMG Biofeedback, Audio Biofeedback, Visual Biofeedback, SF-36.

INTRODUCTION
Tension type headache (TTH) is the most common type of primary headaches¹. Biofeedback (BF), a process whereby information about usually unconscious biological activities is made available to consciousness is an established treatment modality for TTH². BF treatments for pain emphasize the patients’ active role in managing these conditions, thereby establishing improved coping with the psychological and psychosocial consequences of pain. BF is virtually free of untoward side effects and if effective for preventive and abortive treatment of headaches would obviously be preferable to the use of medication³. Though various forms of BF have been used in migraine, tension type headaches and combined headaches, electromyographic (EMG) BF has shown maximum benefits⁴.

Muscle hardness has been found to be increased in the pericranial muscles of the patients with TTH⁵. It has been widely accepted that increased pericranial muscle activity is of important for the development of TTH as reflected in the formerly used term muscle contraction headache⁶. EMG BF is directed at reducing pericranial muscle activity and is the most frequently used behavioral treatment option for TTH⁷. McCrory et al reported medium-to-large average effects for EMG-BF in adults with TTH⁸. EMG BF units provide visual, auditory or both feedbacks. To our knowledge no study has been done so far to find out the effectiveness of auditory, visual or integrated (audio-visual) EMG feedback in TTH patients.
In a study, auditory EMG BF was used in TTH patients and it was found that the subjects were not only able to maintain low frontalis EMG levels but also managed to remain headache free during follow-up.

Similar studies utilizing only auditory BF have been performed in both TTH and migraine patients. Visual EMG BF has been used less compared to auditory feedback. In another study, TTH patients received both visual and audio EMG feedback and found significant decrease in headache.

Though there is evidence pointing out the efficacy of BF in tension headache patients, it is not advocated very frequently in India which could due to the cost of the equipment involved and hence the added cost to the patient as well. Most BF equipment provide both visual and audio feedback, hence if the equipment could be designed to provide only the form of feedback which is the most effective, it could automatically reduce the equipment cost as well as the cost to the patient making it more economical for both practitioner as well as patient.

No controlled trials have been done so far to compare the efficacy of visual EMG feedback or auditory EMG BF separately in tension type headache. This study therefore was conducted to find out relative efficacy of visual and auditory BF in isolation or combination in TTH subjects.

**MATERIAL AND METHODS**

Subjects fulfilling the International Headache Society (IHS) criteria for TTH were recruited in the study after obtaining informed voluntary consent. Both males and females were included in the study. Subjects were recruited from various neurology clinics and subjects referred by neurologists to our physiotherapy department for biofeedback therapy. Ethical clearance was obtained from the institutional ethical committee. A total of 30 TTH subjects were recruited by simple random sampling method and were allocated to various groups using the lottery method. Demographic data on pain variables namely average duration, frequency and intensity of headache per week were obtained. Quality-of-life score was obtained using the licensed SF-36 questionnaire at baseline, after one and three months of EMG BF therapy.

**PROCEDURE**

The subjects were explained the treatment procedure in detail. The subjects were made to lie with head end slightly higher to visualize the visual display in the EMG-v group. The same position was maintained for all groups to avoid any bias due to positioning. After preparing the forehead skin, surface EMG electrodes were applied 2.5 cm above the centre of each eyebrow. All subjects received BF for duration of 30 minutes per session for 15 sessions with eyes open. The EMG BF was performed using EMG-IR Retrainer, Chattanooga group Inc, U.S.A.

The EMG-a group (n=10) received auditory BF with headphones. The pitch of the sound was directly proportional to the relative muscle tension displayed on the screen. The subjects were instructed to reduce the pitch and intensity of the sound.

The EMG-v group (n=10) received visual feedback in form of glowing bars and numerical display, which increased or decreased depending on the muscle tension in bilateral frontalis (right and left separately). The auditory feedback was switched off for this group. The subjects were instructed to reduce the number of glowing bars or the numerical score.

The EMG-av group (n=10) received combined auditory and visual feedback.

After the end of 15 sessions the patients were instructed to relax similarly off sessions, whenever the headache started. They were also instructed to avoid taking any medication unless the headache was unbearable. Complete data on medication usage before and after therapy could not be obtained hence that data was not analyzed in this study.

All subjects were given diaries in which they had to note the pain variables at the end of every week. They were instructed to calculate frequency of headache as number of headache episodes per week, average duration as total hours of all episodes of headache that week divided by the number of episodes experienced in that week and intensity of headache as average of the visual analogue score (VAS) on a standard 10 point scale scored per headache that week. The average scores of the pain variables were recorded at baseline, one month and three months after receiving BF.

Statistical analysis was performed using the SPSS-16 version.

**RESULTS**

Thirty subjects were recruited in the study (females-18, males-12). Of the thirty subjects, seven subjects dropped out of the study. Three subjects failed to report for the first month follow up [EMG-a(1), EMG-av(2)] and four for the third month follow up [EMG-a(2),
EMG-v(1), EMG-av(1)]. All subjects however completed the 15 sessions of therapy. Therefore at the end of one month the sample size was: EMG-a: n=9, EMG-v: n=10 and EMG-av: n=8 and at the end of three months, it was: EMG-a: n=7, EMG-v: n=9 and EMG-av: n=7. No analysis was carried out for the missed data since it accounted for less than 20% of the sample size.

The three groups were matched relative to age and pain variables and SF-36 total scores (Table 1). The intergroup analysis revealed non-significant differences between the groups in all variables, therefore the groups could be treated as homogeneous groups.

Kruskall Wallis test was used to compare the groups for age and baseline parameters.

Table 1. Baseline data of the subjects

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Demographic variables</th>
<th>EMG-a</th>
<th>EMG-v</th>
<th>EMG-av</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age</td>
<td>42.3 ± 9.8</td>
<td>39.7 ± 15.1</td>
<td>43.5 ± 11</td>
<td>0.07</td>
</tr>
<tr>
<td>2</td>
<td>Average duration of headache/week</td>
<td>11.3 ± 5</td>
<td>10.8 ± 6</td>
<td>10.7 ± 6</td>
<td>0.14</td>
</tr>
<tr>
<td>3</td>
<td>Average frequency of headache/week</td>
<td>5.4 ± 2.1</td>
<td>5.2 ± 1.5</td>
<td>4 ± 1.3</td>
<td>0.15</td>
</tr>
<tr>
<td>4</td>
<td>Average intensity of headache/week</td>
<td>42.1 ± 10.5</td>
<td>45.1 ± 10</td>
<td>43.1 ± 11</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Mean of SF-36 scores and pain variables in all groups, at all end points in the study namely baseline, after one month and after months are depicted in the figures 1 and 2.

Wilcoxon matched pairs test was used for analysis of data obtained (pain variables and SF-36) for comparison within the groups. A non-parametric test was considered since the sample size per group was small. The analysis showed a highly significant reduction in all pain variables and SF-36 scores (p<0.05) after one and three months (Table 2), except in the groups which received only audio and visual feedback showing insignificant differences in average duration and frequency in the first month follow up. All groups showed significant improvement in all variables at six months follow-up.

Table 2. Intra-group analysis (p-value) using Wilcoxon matched pairs test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Groups</th>
<th>Baseline vs 1 month</th>
<th>Baseline vs 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average duration of headache/week (hr)</td>
<td>EMG-a</td>
<td>0.006*</td>
<td>0.007*</td>
</tr>
<tr>
<td></td>
<td>EMG-v</td>
<td>0.02*</td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>EMG-av</td>
<td>0.005*</td>
<td>0.005*</td>
</tr>
<tr>
<td>Average frequency of headache/week</td>
<td>EMG-a</td>
<td>0.003*</td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>EMG-v</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td></td>
<td>EMG-av</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td>Average intensity of headache/week (VAS)</td>
<td>EMG-a</td>
<td>0.01*</td>
<td>0.005*</td>
</tr>
<tr>
<td></td>
<td>EMG-v</td>
<td>0.05*</td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>EMG-av</td>
<td>0.005*</td>
<td>0.005*</td>
</tr>
<tr>
<td>SF-36 Total score</td>
<td>EMG-a</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td></td>
<td>EMG-v</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td></td>
<td>EMG-av</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td>SF-36 Physical score</td>
<td>EMG-a</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td></td>
<td>EMG-v</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td></td>
<td>EMG-av</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td>SF-36 Mental score</td>
<td>EMG-a</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td></td>
<td>EMG-v</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
<tr>
<td></td>
<td>EMG-av</td>
<td>0.008*</td>
<td>0.008*</td>
</tr>
</tbody>
</table>

*significant

Inter-group comparison was done using the Kruskall Wallis test (Table 3). All parameters showed significant differences in the intra group analysis.

Table 3. Inter-group analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>EMG-a</th>
<th>EMG-v</th>
<th>EMG-av</th>
<th>Kruskall Wallis test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache Duration</td>
<td>Baseline</td>
<td>11.3 ± 5.5</td>
<td>10.8 ± 6.6</td>
<td>10.7 ± 6.7</td>
</tr>
<tr>
<td></td>
<td>1 month</td>
<td>6.5 ± 4.3</td>
<td>6.5 ± 4.7</td>
<td>6 ± 3.7</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>2.6 ± 1.6</td>
<td>2.9 ± 3.0</td>
<td>2.1 ± 2.4</td>
</tr>
<tr>
<td>Headache Frequency</td>
<td>Baseline</td>
<td>5.4 ± 2.1</td>
<td>5.2 ± 1.5</td>
<td>4 ± 1.3</td>
</tr>
<tr>
<td></td>
<td>1 month</td>
<td>3.3 ± 1.9</td>
<td>3.6 ± 2.1</td>
<td>1.7 ± 1.4</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>2 ± 1.0</td>
<td>1.9 ± 2.2</td>
<td>1.1 ± 0.8</td>
</tr>
<tr>
<td>Headache Intensity</td>
<td>Baseline</td>
<td>5.7 ± 2.1</td>
<td>5.2 ± 1.5</td>
<td>4.3 ± 1.3</td>
</tr>
<tr>
<td></td>
<td>1 month</td>
<td>3.8 ± 1.9</td>
<td>3.6 ± 2.1</td>
<td>1.7 ± 1.4</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>3.6 ± 1.5</td>
<td>2.3 ± 1.6</td>
<td>1.4 ± 1.0</td>
</tr>
<tr>
<td>SF-36 Total</td>
<td>Baseline</td>
<td>42 ± 10</td>
<td>45 ± 10</td>
<td>43 ± 11</td>
</tr>
<tr>
<td></td>
<td>1 month</td>
<td>64 ± 9</td>
<td>60 ± 10</td>
<td>78 ± 7</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>71 ± 9</td>
<td>71 ± 10</td>
<td>82 ± 7</td>
</tr>
<tr>
<td>SF-36 Physical</td>
<td>Baseline</td>
<td>41 ± 10</td>
<td>43 ± 7</td>
<td>44 ± 10</td>
</tr>
<tr>
<td></td>
<td>1 month</td>
<td>61 ± 8</td>
<td>53 ± 11</td>
<td>77 ± 9</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>69 ± 9</td>
<td>68 ± 8</td>
<td>82 ± 8</td>
</tr>
<tr>
<td>SF-36 Mental</td>
<td>Baseline</td>
<td>44 ± 8</td>
<td>45 ± 8</td>
<td>44 ± 9</td>
</tr>
<tr>
<td></td>
<td>1 month</td>
<td>66 ± 11</td>
<td>63 ± 9</td>
<td>78 ± 9</td>
</tr>
<tr>
<td></td>
<td>3 months</td>
<td>69 ± 15</td>
<td>71 ± 11</td>
<td>80 ± 6</td>
</tr>
</tbody>
</table>

All pain variables showed a highly significant difference between the groups after one month (p<0.005). Analysis of average intensity of headache per week showed that EMG-av had the lowest mean rank (EMG-a: 19, EMG-v: 18, EMG-av: 9.5) indicating...
that group EMG-av showed maximum benefit in the first month as compared to other two groups, however at three month follow up EMG-a group had the lowest mean rank as compared to other groups.

The variable average frequency of headache per week had EMG-av scoring the lowest mean rank at the first and third month follow up.

Average duration of headache per week too showed EMG-av with the lowest rank as compared to the other groups at the first month and third month.

SF-36 total, physical and mental scores too showed the best improvement in EMG-av group at one month and three month follow up with highest mean ranking compared to the audio or visual BF group.

**DISCUSSION**

Learning is facilitated when auditory and visual information is provided simultaneously, which explains why audio-visual aids are an integral part of learning.Likewise BF too is a learning process which therefore can be assumed to be facilitated by providing audio and visual cues to the patients.In our study there was significant improvement of headache variables and SF-36 sum and sub-scores in EMG-av group indicating that integrated feedback is more effective than isolated feedback.

In a similar non-therapeutic study,audio,visual and integrated (auditory plus visual) BF was given to participants and task performance like putting peg in a hole and electronic box assembly task was assessed for task completion time, performance errors and subjective opinions. The results showed that integrated feedback offered better assembly task performance than either feedback used in isolation.16

This study indicates that adequate learning and retention (memory) requires input from both auditory as well as visual sources.

Another study similar to ours in terms of methodology, in which EMG BF was used for relaxation training.In this study the subjects were randomly assigned to four groups:1) group receiving EMG audio BF with eyes closed, 2) group receiving EMG audio BF with eyes open, 3) group receiving EMG visual BF and 4) control group which received no feedback. It was reported that group which received EMG audio BF with eyes closed showed better decrease in frontalis muscle activity as compared to other groups. Pain variables were difficult to compute in our study especially intensity, since it was variable throughout the duration of headache. Hence to minimize the bias the patients were instructed to note the intensity at the peak of headache irrespective of intervention in the form of relaxation or medication. Number of headaches during the therapy was not analyzed, but there was a general trend of decrease in the frequency of headaches during the BF sessions in all groups irrespective of whether they received audio, visual or integrated EMG BF. One confounder we noticed in the study was the fluctuations in the auditory tone and visual bars on the display of the EMG equipment whenever the patient blinked causing a transient increase in the audio tone and increase in number of bars which may have caused confusion and distraction to the patient and therefore could have affected learning. The regional language (Kannada) version of SF-36 QOL questionnaire was used for all subjects who knew the language. The English version was used for subjects who could not understand the regional language to omit the bias created by translation of Kannada into English.

The inter-group analysis showed that EMG-av group had better benefits as compared to other groups and intra-group analysis too showed that EMG-av group had significant improvement over three months indicating that retention of improvement is good too. It was noted at several instances that inspite of specific instructions, some patients found it difficult in the initial sessions to concentrate on audio feedback in the EMG-a group. They used to either scan the room or looked distracted. This distraction may have affected our parameters too, since it would have affected the learning/training which is provided by BF. On the contrary EMG-av group had better concentration as compared to other groups. Our brain processes visual and associated audio information as a natural habit in everyday life which is very essential for cognition, hence providing both feedbacks could have made information processing and modifying the biological processes (reducing frontalis activity) easier for the subjects. Moreover integrated feedback obviously gives additional information as compared to isolated feedback therefore understanding of the information is better and hence its modification too, which is the main aim of BF therapy.

The sample size in each group was small, hence studies with larger sample sizes should be considered in future. Though the groups were matched relative to age, pain variables and SF-36 scores (p<0.05), a better homogeneity could have been achieved if the subjects
were matched according to their baseline frontalis quantitative EMG activity. Another limitation of the study was the study duration. The duration of study too was small, considering the time factor involved in our study, hence longer duration longitudinal studies should be considered to study the efficacy of individual or integrated EMG BF and its retention of improvement with time. Since this is the first study of this nature, similar studies would definitely be required to confirm the efficacy of individual and integrated BF procedures in TTH as well as other psycho-somatic disorders where BF has proven effective.

**CONCLUSION**

All forms of EMG biofeedback are effective in treatment of TTH. Integrated EMG biofeedback is most beneficial in reduction of headache and improving quality of life in subjects with TTH.

**REFERENCES**

Effect of Manual Therapy Techniques on Knee Proprioception in Patients with Osteo-arthritis of Knee

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³Professor and Head, P.T School and Centre, Seth Dhurmal Bajaj Orthopaedic Centre, Seth G.S.Medical College and KEM Hospital, Parel, Mumbai

ABSTRACT

A prospective clinical trial of 90 patients with osteoarthritis knee was carried out. Outcome measures assessed were full weight bearing knee joint proprioception (mean proprioception error), pain on visual analogue scale and physical function on WOMAC scale. Subjects were divided into 3 groups; Group A received Maitland's mobilization technique and exercise program, Group B received Mulligan's mobilization technique and exercise program and Group C received only exercise program. The duration of treatment was 5 days which included 3 sessions on day 1, day 3 and day 5. Outcome measures were assessed pre and post treatment at the end of day 1 and day 5. The data obtained was analyzed statistically and results were displayed graphically. The within group results showed statistically significant reduction in mean proprioception error, pain on VAS and WOMAC score post treatment of day 5. However, when between groups comparison was done no statistically significant difference was noted.

Thus it was concluded that exercises alone are effective in improving full weight bearing knee joint proprioception in patients with osteoarthritis knee. Manual therapy techniques did not have any added benefits to those of exercise alone.

Key words: Knee Osteoarthritis, Manual Therapy, Proprioception.

INTRODUCTION

Osteoarthritis is defined as a degenerative joint disease characterized by breakdown of articular cartilage. Osteoarthritis affects mainly the weight bearing joints of the body such as lumbar spine, cervical spine, hip and knee joint.

Functional impairments associated with knee OA are pain, restricted range of motion (ROM), reduced muscle strength and endurance, altered gait and altered knee proprioception.

The rehabilitation for patients with knee OA generally is focused on pain relief, restoration of ROM, muscle strength and joint flexibility. However, little attention is given to the role of altered knee proprioception in these patients.

Pai and Sharma in their study in patients with knee osteoarthritis concluded that proprioception declines with age and is further impaired in elderly patients with knee OA. Poor proprioception contributes to functional impairments in knee OA. Barrett noted that the patient's satisfaction was more closely correlated with their proprioception than with their clinical scores. He has demonstrated that limb function depends more on proprioceptive information than on strength.

Hence, there is a need to address this important impairment when treating patients with OA knees.

Ufuk Sekir and Hasan Gur have show that using a proprioceptive exercise program it is possible to improve postural control, functional capacity, decrease perceived knee pain and improve both passive, active and weight bearing joint position sense in patients with bilateral knee osteoarthritis.
Wyke et al in 1973 showed that manual therapy techniques improve joint proprioceptive inputs.

Thus there is literature describing how ageing and osteoarthritis reduces knee proprioception. Studies indicate that this knee proprioception is of utmost importance for lower limb function. Exercises alone have been shown to improve knee proprioception and thus the functional capacity in patients with knee OA. Maitland’s and Mulligan’s mobilization techniques have been shown to be effective in reducing patient’s pain, improve range of motion and thus finally the quality of life. However, there is paucity of literature assessing the effects of these manual therapy techniques on knee proprioception in patients with osteoarthritis knee.

This study therefore aims to study the effect of manual therapy techniques - Maitland’s and Mulligan’s mobilization techniques, on knee proprioception in patients with osteoarthritis knee and then to compare these with effects of exercise alone.

MATERIAL AND METHODS

The study was prospective clinical trial. Ethics committee approval was obtained from the institution’s ethical committee before commencement of the study. There were ninety participants with diagnosis of knee osteoarthritis who were referred to Physical Therapy OPD of KEM hospital, Mumbai between the period from March 2008 to May 2009 and were willing to participate in this study.

Inclusion criteria:

According to American college of Rheumatology, Inclusion criteria for OA knees:

• Crepitus on active joint motion
• Morning stiffness<30 mins
• Bony enlargement of knee on examination
• No palpable warmth
• Age > 40 years

Any 3 of above mentioned criteria should be present along with knee pain.

Patients with pain on VAS < 5 on weight bearing were taken for the study.

Patients with any history of trauma to knees, ligament injuries or neurological impairments were excluded from the study.

Materials used:

• Standard Universal Goniometer
• Velcro straps
• Visual Analogue Scale(VAS)
• WOMAC scale

Procedure:

1. Proprioception was tested as follows:
Weight bearing position sense: The protocol for testing knee joint position sense in full weight bearing position is a modification of that reported by Bullock and Saxton (12). The test was performed at 30 degrees of knee flexion. Rotation axis of a standard Goniometer was placed on lateral surface of the affected knee joint when subjects remained standing. The knee was fully extended i.e. 0 degrees at the starting position and was moved randomly to the allocated target angles of 30 degrees of knee flexion. This was maintained for 5 sec. Subjects then returned the knee to the start position and after a 5sec. rest attempted to reproduce the previously attained target angles. The outcome measure used for the reposition test is an error score calculated as the absolute difference between the target and the replicated angle (in degrees).

Starting position End position
(at allocated target angle of 30 deg.)

Fig. 1. Testing of full weight bearing knee proprioception

2. Pain assessment:

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>(No pain)</td>
<td>(Worst pain)</td>
</tr>
</tbody>
</table>

A 0 to 10 visual analogue scale (VAS 10 cm) was used to find the intensity of pain.

3. WOMAC scale was used to assess functional status of the patient.

90 subjects were then divided into 3 groups.

INTERVENTIONS

Group A: 30 patients of this group received Maitland’s mobilization techniques for the affected knee joint in addition to exercise program.

Tibio-femoral anterior and posterior glides and patellofemoral superior-inferior and medio-lateral glides were given.
Grade of mobilization: Grade 2 and 3.

2a) Tibiofemoral posterior glide

2b) Tibiofemoral anterior glide

2c) Patellofemoral mobilzation

Fig. 2. Maitland’s mobilization

Group B: 30 patients of this group received Mulligan’s mobilization techniques for the affected knee joint in addition to exercise program.

**Technique:** The therapist flexed up the knee just short of the painful limitation. Now the therapist grasped the lower leg and internally rotated the tibia on femur. Maintaining this patient was asked to flex further and overpressure was applied. Dosage: 3 sets of 3 repetitions each.

Starting position  |  End position (with tibia in internal rotation)

Fig. 3. Mulligan’s Mobilization with movement

Group C: This group received only the exercise program. Exercise program consisted of the following:
1. Multiple angle isometrics
2. Terminal arc knee extension (Fig 4)
3. Mini squats (Fig 5)
4. Partial lunges (Fig 6)
5. One-leg balances (Fig 7)
6. Cross-body leg swings (Fig 8)

Repetitions: 10 repetitions per session
3 sessions per day.

Fig. 4. Terminal arc knee extension

Fig. 5. Mini squats

Fig. 6. Partial lunges

Fig. 7. One leg balance
FINDINGS

Age of the subjects in this study was between 40-70 years with mean age of 54.67 years among Group A, 51.67 years among Group B and 51.90 years in Group C which were comparable and difference was not statistically significant. 50.0 - 53.3 % of total cases were males in all three groups.

Mean proprioception error at baseline was 7.79 among Group A, 6.36 among Group B and 6.67 in Group C which were same and difference was not statistically significant. Post test score after treatment on Day 1 showed that mean proprioception error had a significant fall in all groups i.e. 2.93 (37.6%) in Group A, 1.90 (29.9%) among Group B and 2.12 (31.8%) in Group C. Post test scores after treatment on Day 5 showed that mean proprioception error had a significant fall of 3.51(45.1%) in Group A, 3.35 (52.7%) among Group B and 3.26 (48.9%) in Group C. Between group comparison showed that the reduction was more in Group A and Group B, but the difference between the three groups was not found to be statistically significant. Post test scores after treatment on Day 5 showed that pain on VAS had a significant fall of 3.00 (76.2%) in Group A, 3.07 (81.4%) in Group B and 2.47 (59.2%) in Group C. Between group comparison showed that the fall was less in Group C, but the difference between the three groups was not found to be statistically significant.

The mean WOMAC score was 25.33 among Group A, 23.43 among Group B and 27.03 in Group C; which were same and difference was not statistically significant. Post test scores after treatment on Day 5 showed that mean WOMAC score had a significant fall in all groups i.e. 11.87 (46.9%) in Group A, 11.97 (51.1%) among Group B and 14.37 (53.2%) in Group C respectively from basal. Difference between the three groups was not found to be statistically significant.

The result of this study showed that the mean proprioception error showed a significant fall in all the groups. These changes in mean proprioception error were considered statistically not significant when compared between groups. This implies both groups A and B showed similar improvements to Group C. This is in accordance with study of Ufuk Sekir and Hasan Gur (10) who showed that exercise program...
alone was able to improve knee joint proprioception in patients with knee OA.

Improvements seen with respect to proprioception in all the 3 groups could be attributed to common therapeutic effects of exercises. 4 of this set of exercises which were primarily closed chain kinematic exercise had certain common therapeutic effects namely:

1. Muscular contraction
3. Neural adaptation: Using functional Closed chain kinetic activities enhanced nervous system’s ability to recruit groups of muscles to work together. Neural pathways are created that closely replicate functional demand.
4. Stimulation of muscle spindles and GTOs thus contributing to proprioception.

With respect to pain on Visual Analogue Scale, all the 3 groups showed statistically significant reduction after 5 days of treatment with no statistically significant difference when compared between the groups. However, here both the manual therapy groups Maitland’s and Mulligan’s showed better results (76.2% and 81.4% reduction in pain on VAS) compared to only exercise group (59.2% reduction).

Maitland’s mobilization techniques stimulated a diphasic response from mechanoreceptors in joint capsule that was stretched. This consists of an initial brief burst of impulses from type II receptors that melted into a prolonged type I receptor activity. These transmissions modulated transmissions from type IV nociceptors through the "gateway" synapses in the basal spinal nucleus up into the brain.

The improvement in Mulligan’s group could be attributed to the rationale behind Mulligan’s techniques which is that mobilization with movement sedates an agitated, facilitated nervous system, particularly the dorsal horn by bombarding it with painless normality it has been patterned to receive.

Physical function improved as indicated by reduction in WOMAC scores. The reduction was 46.9, 51.1 and 53.2 % in Maitland’s, Mulligan’s and exercise only group. The difference between the groups was not significant. Improvement in physical function can be attributed to a combination of reduced pain and improved knee joint proprioception.

Clinical application: A well designed exercise program inclusive of close chain kinematic exercises is effective in improving knee proprioception as indicated by a reduction in mean proprioception error in full weight bearing position in patients with knee osteoarthritis. This in turn would lead to improvement in lower limb functions.

CONCLUSION

Exercises alone are effective in improving full weight bearing knee joint proprioception in patients with osteoarthritis knee. Manual therapy techniques do not have any added benefits to those of exercises alone.

Conflict of Interest

We, Singh Y, Mhatre B and Mehta A state that there is no conflict of interests with other people or organizations about our work.

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