

ORIGINAL ARTICLE

IJPHY

MULLIGAN SELF MOBILIZATION VERSUS MULLIGAN SNAGs ON CERVICAL POSITION SENSE

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ABSTRACT

Background: Neck pain is very common. It can negatively affect the patient's life and may result in disability. This study conducted to compare the effect of different Mulligan techniques which is more effective (Mulligan self-mobilization or Mulligan SNAGs) on cervical position sense, pain and function.

Methods: 87 subjects with chronic mechanical neck pain, three groups were randomly assigned to Group (1) 29 subjects received Mulligan self-mobilization and traditional treatment. Group (2) 29 subjects received Mulligan SNAGs and traditional treatment. Group (3) 29 subjects received traditional treatment only. Position sense measured by Joint reposition error, pain measured by visual analog scale and function by Functional Neck disability index. Measurements were taken pre and post the intervention period.

Results: MANOVA test revealed that there was significant improvement in values of the post-treatment in all Group compared with pre-treatment of JPE (pre: $P=0.725$, post: $P<0.001$), VAS (pre= 0.984 , post: $P<0.001$) and NDI (pre= 0.903 , post: $P<0.001$).

Conclusion: It can be reasoned that both Mulligan self-mobilization and Mulligan SNAG techniques have a similar effect in JPE, VAS and NDI favoring traditional in chronic mechanical neck pain patients.

Keywords: Mulligan Self Mobilization, Mulligan SNAG, Joint Reposition Error, Neck Disability Index, Visual Analogue Scale.

Received 10th January 2017, revised 09th March 2017, accepted 07th April 2017



www.ijphy.org

10.15621/ijphy/2017/v4i2/141947

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INTRODUCTION

Neck pain causes disability and hardly costs alot. Its prognosis is poor, and the disability persistent than low back pain [1]. Mechanical neck pain as reported as a disabling condition with a course marked by periods of remission and exacerbation [2]. Neck pain much affects women, and it increases gradually with age [3]. Cervical movements like turning and bending results in severe pain, along with clicking sounds and stiffness. Also, decrease in range of motion [4], and change in position sense [5] are of certain symptoms.

Mulligan pioneered specific manual approach called mobilization with movement (MWM).The advance of this approach was aimed for application on the spinal joints. He claimed that his technique could improve the spinal range of motion (ROM) and decrease pain through the correction of a positional fault occurring between the surfaces of the involved facet joints [6].

The most commonly used Mulligan technique is called “sustained natural apophyseal glides” or SNAGs, this technique has introduced in 1999 by Mulligan and is performed by applying an accessory glide along the axis of the facet joint of the affected level while the patient is doing an active movement from weight-bearing position [6,7]. The pressure applied by the therapist in a cephalad direction over the spinous process (centrally) or the transverse process (unilaterally) or to the articular pillar of the affected vertebra [8].

Disabilities were identified in patients with neck pain. These disabilities were presented in cervical ROM [9] muscle function [10] and postural control system. According to the postural control system, people with neck pain manifest changes in proprioception (tested by cervical joint position error) [11]disturbed balance, eye movement uncontrolled [12] and altered postural activity of cervical muscles [13]Abnormality in joint position error (JPE) has been detected in patients with neck pain using either tests of ability to relocate the natural head posture after an active movement or to actively relocate a position within a movement plane [11].These disturbances to postural control have been attributed to disturbed input from cervical afferents.Multiple receptors in the cervical muscles [14]with central and reflex connections to the vestibular, visual, and postural control systems. Especially, the deep portions of the suboccipital muscles have the highest cervical receptor numbers [14],and they have a specific role in these reflex and central connections.

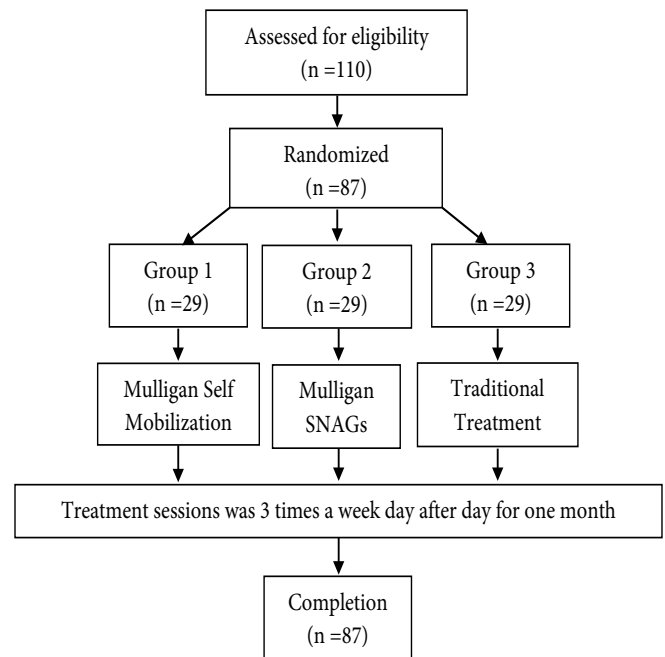
Up till now, the available literature shows a gap in knowledge and lack of well-designed studies concerning the clinical and physiological effects of MWM generally and “SNAGs” technique specifically and its relation to proprioception in mechanical neck pain.So,the aim of this study is to compare the effect of different Mulligan techniques which is more effective (Mulligan self-mobilization or Mulligan SNAGs) on cervical position sense,pain and function.

METHODOLOGY

The current study was conducted in Faculty of Physical Therapy, Cairo University, Since July 2015 to September 2016.This study conducted to compare the effect of different Mulligan techniques which is more effective Mulligan self-mobilization or Mulligan SNAGs on cervical position sense.

Design of the Study

A Randomized Controlled Trial(RCT) compared different effects of Mulligan techniques (Mulligan self-mobilization or Mulligan SNAGs) on cervical position sense, function and pain in chronic mechanical neck pain as shown in the diagram:



Flow Chart 1: Diagram of the Study Design

Subjects

A sample of eighty-seven participants with CMNP was assigned randomly using a random sequence generator to one of the three study groups, concealed allocation by opaque sealed envelopes. Subjects were referred by a physician or an orthopedist. The study was validated by the faculty of physical therapy ethical committee, Cairo University with number P.T.R EC/012/00943 and registered with Pan African Clinical Trial Registry database with a number (PACTR 201601001395264) all subjects provided written informed consent. Subjects were included if their age ranged from 20-35years.

Instrumentation

To measure cervical joint reposition error:

To measure the joint position error (JPE), subjects adopt exact positions twice of 30° left Lateral flexion (LLF), 30° right lateral flexion(RLF), with passive cervical movements in a neutral position under the measurer’s instructions. Afterward, the subjects had to adopt these positions actively without the measurer’s instructions. All subjects were instructed to close their eyes, the difference between each position’s measured, and correct values were recorded. The

joint position error was measured three times before and after the intervention, and the averages were used for the evaluation [15].

PROCEDURES

Current study consists of three stages: Pretest measurements, treatment period, Posttest measurements:

Pretest measurements:

Clinometer application:

This Phone application to measure JPE using Android HTC smart phone (HTC 816 Desire) has been valid and reliable method suggested by [16]. The smart phone is stabilized by a cover containing a strap fixed to it, this strap used to make phone stable on the patient head to minimize error compared to the phone being held by hand on the participant's head in the previous study [17]. Afterward, subjects adopt the positions actively without instructions. All subjects were instructed to close their eyes, during the test, the difference between each position's measured, and correct values were recorded this is known as absolute error. The error was measured three times, and the averages were taken [15].

Lateral bending:

Lateral bending is to place the ear upon the sideways shoulder movement of the head and neck only (the shoulders remain immobile). ROM of lateral bending was measured while the subject is sitting and the phone placement: the strap is placed around the head at the level of the forehead. The phone is placed on the forehead so that the indicator reads zero when the head is in mid position; the indicator is in line with the nose tip. Not to passively move the head and neck. Lateral bending to the right and left was repeated actively three times to angle 30° with eyes closed on each side and the average of the three readings was recorded.

Vigil Analogue Scale:

Although the pain VAS measures only one dimension of pain [18] VAS validity and reliability for assessing pain of different origins was investigated in several studies [19]. VAS is a horizontal continuous (HVAS) scale, 10 cm in length, ended with two verbal pain descriptor on either end one is "no pain" (score of 0) and "pain as bad as it could be" or "worst imaginable pain" (score of 10 / 10m scale) on other end [18].

Neck Disability Index (NDI):

It consists of ten sections; seven sections evaluate activities of daily living, two sections for pain, and one section evaluate concentration. Scores from 0 to 5, where 0 is the highest level of function and 5 are lowest level of function. Scores are expressed as a percentage. A high score corresponds to a higher degree of disability. NDI is highly valid and reliable [20]. Patients completed the NDI (score out of 50) impairments were recorded by the patient caused by their neck pain [20].

Posttest measurements

The outcome measure for comparing the effect of differ-

ent Mulligan techniques on mechanical neck pain was JPE, VAS and NDI were significant in all groups.

Treatment

Group 1: Mulligan Self Mobilization + Traditional Treatment (Infra red and TENS) (n=29)

Subjects in the study group(1) were treated with a self-SNAG using a self-SNAG towel (Manual Concepts, Booragoon, Australia). The technique is defined by [6]. The towel was positioned on the posterior arch of C5 and drawn horizontally forward across the face. The purpose of the towel is to enhance side bending to left and right at C5-C6. The subject applied pressure on the towel and turned the head toward the restricted side, sustaining end range for 3 seconds. The treating patient assisted with the positioning of the towel and applied end range overpressure in bending. It is essential that the technique is performed in the pain-free range and no symptoms, other than stretching, are provoked. Subjects were given three trials to familiarize themselves with the treatment. Subjects were then asked each session to perform three sets of 6 to 10 repetitions. It should describe to the patient that they should continue to exercise through the period of the study and to ensure that the exercise was carried out effectively, as demonstrated, without pain. While it is recognized that in normal clinical practice prescribed exercise should be checked at a short interval to ensure correct application [21].

Group 2: Mulligan Cervical SNAGs Group + Traditional Treatment (Infrared and TENS) (n=29)

The program of treatment adapted from [22-25]. Patient in a sitting position, supported back, the therapist behind him. The therapist applies an anterosuperior accessory glide through the superior spinous process of the involved motion segment used the medial border of thumb's distal phalanx reinforced by the pad of another thumb too. Thumb nail slope at 45°. The therapist's other fingers are placed lateral to each side of the neck to give some lift and prevent the neck from flexing. The spinous process moves upwards by the therapist (toward the ears). The therapist asked the patient to do the active movement in the form of side bending with instructions from the starting position. Repeat the procedure three sets of 6 to 10 repetitions in each session.

Group 3: Traditional Treatment only (infrared and TENS) (n=29)

Application of Infrared:

The IR luminous source consisted of an electrically heated filament made of tungsten filament within a glass bulb which contains an inert gas at low pressure [26]. The patient will relax in prone position and neck free from clothes. The infrared lamp was above the patient, the distance adjusted according to the patient comfort, for 15 minutes [27].

Application of TENS:

Using a TENS device present in the out patient clinic, faculty of physical therapy was ASTAR ABR 43-382 Biels-

ko-Biala, Poland.

Two adhesive electrodes were used, attached to the device by two cords, attached directly to the skin. The adhesive pad conducts the TENS current once turned on the device, without using tape or jelly it can be fixed easily.

Patient Position: sitting position with back erected and supported with electrodes placed at the maximum tender area the patient pointed himself [28]. After placing electrodes correctly, current ready to be conducted, the intensity must be according to patient tolerance and should feel comfortable, not painful with the application. The output frequency set at 4 - 8 Hz and current intensity according to the subject.

Duration of treatment: For 20 min. session [29], for 12 sessions day after day.

Statistical Analysis

Data were screened for normality assumption, homogeneity of variance, and the presence of extreme scores before final analysis. This exploration was required for parametric calculations of the analysis of difference, using histograms with the normal distribution curve and box and whiskers plots showed that the data were normally distributed and not violates the parametric assumption for each of the measured dependent variables.

The current test involved two independent variables. The first one was the (group); between subject factor which had three levels (Group 1 has received IR, TENS and Mulligan self-mobilization, group 2 has received IR, TENS and Mulligan SNAG and group 3 which has received IR, TENS only. The second one was the (treatment time); within subject factor which had two levels (pre and post). Accordingly, 2x2 mixed design MANOVA was used to compare the tested variables of interest and to compare between groups in the "pre" and "post" tests. Also, it was intended to compare between "pre" and "post" tests for each variable at each tested group and finally test the interaction between the two independent variables (tested group & time $P \leq 0.05$).

Sample size

For sample size estimation of the study using VAS as primary outcome with ANOVA test, 80% power, the effect size of 0.40, 0.05 type one error (2 tailed), 24 subjects will be recruited in each group and to account for dropout of 20 % total number recruited was 87. This calculation using IBM Sample Power 3

RESULTS

There was no difference between groups regarding physical characteristics concerning age, weight, height and body mass index (BMI), As $P > 0.05$.

MANOVA revealed no significant differences in general characteristics of the participants in the mean ages ($p = 0.282$), heights ($p = 0.483$), weights ($p = 0.241$), and BMI ($p = 0.190$) between three groups ($p > 0.05$) table (1).

Statistical analysis using 2x2 Mixed Design MANOVA indicated that there was significant effects of the tested group (the first independent variable) on the dependent variables;

($F = 8.191$, $P = 0.001$). As well as, there were significant effects of the treatment periods (the second independent variable) on dependent variables; ($F = 764.369$, $P = 0.001$). So, the interaction between the two independent variables was significant, which indicates that the effect of the tested group (first independent variable) on the dependent variables was influenced by the treatment periods (second independent variable) ($F = 15.844$, $P = 0.001$) as shown in the table (2). There was a difference between the three groups post-treatment as $p < 0.001$ for all variables JPE, VAS and NDI as shown in the table (3). Post hoc analyses using the Bonferroni correction revealed significant decrease in JPE values of pre and post treatment for Group 1 ($p < 0.001$, CI: 2.557-3.343), Group 2 ($p < 0.001$, CI: 2.207-2.993) and Group 3 ($p < 0.002$, CI: 0.257-1.043) as shown in table (4). On another regard, the 2x2 mixed design MANOVA indicated that the mean values for the VAS decreased significantly after treatment compared with pre-treatment in Group 1 ($p < 0.001$, CI: 2.87-3.529), Group 2 ($p < 0.001$, CI: 2.77-3.429) and Group 3 ($p < 0.001$, CI: 0.921-1.579) as shown in table (5). Also, the 2x2 mixed design MANOVA indicated that the mean values for the NDI decreased significantly after treatment compared with pre-treatment in Group 1 ($p < 0.001$, CI: 40.78-50.216), Group 2 ($p < 0.001$, CI: 40.58-50.01) over Group 3 ($p = 0.16$, CI: 1.366-8.06). There was no significant difference in mean values of group (3) pre and post treatment as shown in Table (6).

Table 1: Descriptive Statistics on Age, Weight, Height and BMI

Variable	Group 1 (N=29) Mean±SD	Group 2 (N=29) Mean±SD	Group 3 (N=29) Mean±SD
Age (years) $p = 0.282$	26.25±3.07	27.45± 2.03	27.95 ± 4.66
Weight (Kg) $P = 0.241$	74.8 ± 8.73	78.9± 8.08	77.55± 6.18
Height (cm) $P = 0.483$	172 ± 5.52	175.30± 8.1	175.2± 6.9
BMI(Kg/cm ²) $P = 0.190$	25.75±3.07	27.25±2.65	26.8±2.06

SD: Standard Deviation; BMI: Body Mass Index; Group I: Mulligan Self-mobilization; Group II: Mulligan SNAG; Group III: Traditional: p-value(probability value)

Table 2: Interaction Time

Source of variation	F-value	P-value
Group	8.191	0.001
Time	764.369	0.001
Group*Time Interaction	15.844	0.001

Significant alpha level at ≤ 0.05

Table 3: Results of comparisons between joint position sense, VAS, and NDI among three groups

variables	Time	Group 1 Mean± SD	Group 2 Mean± SD	Group 3 Mean± SD	P-value
JPE (°)	Pre	5.25 ± 0.71	5.15 ± 0.74	5.05 ± 0.88	0.725
	Post	2.30 ± 1.12 ^a	2.55 ± 0.686 ^a	4.40 ± 0.86 ^b	<0.001*
VAS(cm)	Pre	7.45 ± 1.14	7.40 ± 0.99	7.45 ± 9.44	0.984
	Post	4.30 ± 1.12 ^a	4.30 ± 1.12 ^a	6.20 ± 0.833 ^b	<0.001*
NDI	Pre	66.30 ± 1.39	67.30 ± 12.91	65.45 ± 13.01	0.903
	Post	20.80 ± 1.39 ^a	22 ± 1.48 ^a	62.1 ± 12.85 ^b	<0.001*

*: Significant at $P \leq 0.05$, SD: standard deviation, p-value: significance level, Different superscripts in the same row are statistically significantly different.

Table 4: Results of comparisons between pre and post treatment in JPE in each group

Groups	Pre Mean± SD	Post Mean± SD	% of change	MD(95% CI)	P-value
Group 1	5.25 ± 0.71	2.30 ± 1.12	56.19%	2.95(2.557-3.343)	<0.001*
Group 2	5.15 ± 0.74	2.55 ± 0.686	50.48%	2.6(2.207-2.993)	<0.001*
Group 3	5.05 ± 0.88	4.40 ± 0.86	12.87%	0.650(0.257-1.043)	0.002*

*: Significant at $P \leq 0.05$, SD: standard deviation, %: percentage, MD: mean difference, CI: confidence interval, p-value: significance level.

Table 5: Results of comparisons between pre and post treatment in visual analogue scale in each group

Groups	Pre Mean± SD	Post Mean± SD	% of change	MD (95% CI)	P-value
Group 1	7.45 ± 1.14	4.30 ± 1.12	32.88%	3.2(2.87-3.529)	<0.001*
Group 2	7.40 ± 0.99	4.30 ± 1.12	41.89%	3.1(2.77-3.429)	<0.001*
Group 3	7.45 ± 9.44	6.20 ± 0.833	16.77%	1.25(0.921-1.579)	<0.001*

*: Significant at $P \leq 0.05$, SD: standard deviation, %: percentage, MD: mean difference, CI: confidence interval, p-value: significance level.

Table 6: Results of comparisons between pre and post treatment of neck disability index in each group

Groups	Pre Mean± SD	Post Mean± SD	% of change	MD(95% CI)	P-value
Group 1	66.30 ± 1.39	20.80 ± 1.39	68.62%	45.5(40.78-50.216)	<0.001*
Group 2	7.30 ± 12.91	22 ± 1.48	67.31%	45.3(40.58-50.01)	<0.001*
Group 3	5.45 ± 13.01	62.1 ± 12.85	5.11%	3.350(1.366-8.06)	0.16

*: Significant at $P \leq 0.05$, SD: standard deviation, %: percentage, MD: mean difference, CI: confidence interval, p-value: significance level.

DISCUSSION

This study was conducted to compare the effect of different Mulligan techniques which is more effective (Mulligan self-mobilization or Mulligan SNAGs) regarding proprioception, function, and pain on CMNP.

There was a marked and significant improvement where adding Mulligan mobilizations to traditional program in group 1 and 2 rather than group 3 traditional group only. The percent of improvement in proprioception for group 1 was 56.19%, for group 2 was 50.48% and for group 3 was 12.87%. For function, the percent of improvement was 68.62% for group 1, 67.31% for group 2 and 5.11% for group 3. For pain, the percent of improvement was 32.88% for group 1, 41.89% for group 2 and 16.77% for group 3, i.e.; there were significant effects of Mulligan self-mobilization and Mulligan SNAGs techniques on proprioception, function and pain $P \leq 0.05$.

Gliding mobilization that occurs during Mulligan technique might lead to pain reduction, [30] this reduction could be attributed to sympathoexcitatory effect [31]. The activation of afferent nerve endings through manual contact influences the spinal cord neurons, inhibiting nociception and motor neuron pool [24]. This also can be a reason that marks the reduction of pain in a neutral position. Also, mechanoreceptors might be playing a role in pain modulation as it stimulated as a consequence of stretch of the capsule brought about by spinal mobilization. Passive joint mobilization might give another explanation for pain modulation through gate control mechanism [32] as passive mobilization affect the afferent impulses as it sent to higher centers through the large diameter myelinated neurons, which modulates and inhibits the incoming nociceptive information [24]. (spinal gate control mechanism) [32].

Furthermore, mobilization had an effect on pain through Descending pain-inhibitory systems and release of certain chemicals like serotonin and noradrenaline [33], which decrease muscle spasm, facilitate movement and improve neck function.

Accessory movement (glide) gives more explanation for patient improvement as it applied to the spinous process of cervical vertebra, enhances the circulation and nutrition to the joint, leading to washing out of nociceptive metabolites and better heals of minor injuries of the soft tissue, thus bringing out smooth and pain free physiological movements [30]. Jasmita reported that there was a greater improvement in the NDI scores of participants in Mulligan groups, This can be attributed to the reduction in the level of pain and disability, Jasmita et al. 2017 [34].

Trying to explain the effect of Mulligan technique on proprioception, Accessory gliding by SNAGS mobilization cause Stimulation of mechanoreceptors, also, increase the sensitivity of muscle spindle within the muscle gamma motor neurons, lead to proprioceptive facilitation [35].

Further explanation considers the human fascia, which had mechanoreceptor nerve endings. As active ROM increases movement from near mid-ROM to end-ROM, it is likely that more mechanoreceptors are stimulated due to an increase in tissue stretch surrounding the cervical spine. This increase in afferent information near end-ROM may ultimately result in higher precision in position sense than near mid-ROM [36].

The Mulligan's SNAGs technique involves passive accessory joint play combines simultaneously with active physiological neck movement in loaded position, repeated multiple times, that may cause further sedation and nociceptive pain receptors inhibition also, can stretch and stimulate the mechanoreceptors present in the facet joint capsule and also end range overpressure done with SNAGS technique can stimulate the mechanoreceptors which present in the ligaments and muscles. This might be a probable advantage of SNAGS group performing better over the control group [37]. Also, the obvious increase in cervical ROM and facet joint mobility were attributed in part to a greater decrease in neck pain.

This study clarified using TENS treatment and found it was effective in pain relief. TENS is a popular modality for treating pain. TENS stimulate the large-diameter afferent fibers, blocking the transmission of pain signals through the small afferent fibers, thereby inhibiting pain perception and transmission, this is the gate control theory [28].

Results of the current study clarified that Mulligan SNAGs and self-mobilization had more pronounced effect on pain reduction and improvement of proprioception, this came in accordance with [38] who reported that the predominant explanation provided for these effects is naturally mechanical and based on the bony positional faults and the ability of mobilization with movement to correct these positional faults.

Findings of present study come in agreement with those which compared mobilization and manipulation in the management of chronic neck pain, and their conclusions were the same; techniques of both mobilization and manipulation produced similar effects on pain and disability [39]. Moreover, both had a significant effect on increasing pain threshold when compared to a control group. It appeared that SNAGs mobilization was more effective in pain reduction, pressure tenderness, producing a greater improvement immediately [40].

Sudarshan, 2015 [41] agreed with our results as he applied a simultaneous combination of SNAGs and neurodynamic mobilization. Immediate improvements were seen in VAS, cervical ROM, and NDI. The patient was discharged from physical therapy by the second week after four treatment sessions with complete pain resolution maintained at a four-month follow-up period.

The present finding was in agreement with Rovi Tachii, 2014 [37] who reported an advantage of SNAGs group performing over the control group for VAS, JPE, and functional NDI.

A study found that there were improvements in cervical spine ROM immediately after treatment with SNAGs and that the improvements were maintained for 12 weeks when the participant was instructed to perform self-SNAG home exercises once daily for people with cervicogenic dizziness, when the two manual therapy groups were compared, the SNAGs therapy group had greater ROM improvement than the passive joint mobilization (PJM) group in 2 directions

post treatment; This indicates that this Mulligan approach is clinically beneficial in treating reduced cervical spine ROM in patients with cervicogenic dizziness [42].

A study by [29] supported the findings of TENS when they measured pain and functional disability suggested that adding TENS to physical therapy program has decreased the pain level and has a disability reduction in cases of cervical myofascial pain syndrome and TENS is beneficial in acute and chronic pains.

On the other hand [43] Perez et al., 2014 compared the effectiveness of three manual therapy techniques. Manipulation, SNAGs, and mobilization in patients with CNP. Outcome measures were the VAS, Neck Disability Index, Global Rating of Change and Cervical ROM. There were no significant differences between manipulation, SNAG, and mobilization at the end of treatment and during the follow-up in any of the analyzed outcomes.

El sodany et al., 2014 also, failed to show any superiority in functional effect as compared to the cervical manipulation. In this study, neck disability index was used to measure the functional status of the participants [44].

Shankar et al., 2015 [45] disagreed with our results when they compared the effects of Maitland and Mulligan's mobilization with exercises on pain response, (ROM) and NDI in patients with mechanical neck pain. The study showed that manual therapy interventions were not better than supervised exercises in reducing pain, improving ROM and neck disability.

The current study was not consistency with McNair, 2007 [46] finding as he failed to clarify any proprioceptive changes following treatment with SNAGs. The findings showed improvements in the ROM and pain reduction in response to SNAGs technique which was consistent with our findings.

CONCLUSION

It can be reasoned that both Mulligan self-mobilization and Mulligan SNAGs techniques have a similar effect in JPE, VAS and NDI favoring traditional in chronic mechanical neck pain patients.

Acknowledgements

The authors express their sincere gratitude to all subjects who kindly participated in the study.

Financial support and sponsorship

Self-funded.

Conflicts of interest

NIL.

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Citation

Said, S. M., Ali, O. I., Elazm, S. N., & Abdelraoof, N. A. (2017). MULLIGAN SELF MOBILIZATION VERSUS MULLIGAN SNAGs ON CERVICAL POSITION SENSE. *International Journal of Physiotherapy*, 4(2), 93-100.