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Mobilization versus massage therapy in the treatment of cervicogenic headache: A clinical study

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Abstract.
BACKGROUND AND OBJECTIVE: Cervicogenic headache (CGH) is a common problem associated with neck pain. In this study the effect of cervical mobilizations was compared with that of massage therapy in the management of CGH.
DESIGN: Thirty-six subjects with CGH, randomly assigned into two groups, participated in the study. The first group was treated with spinal mobilization techniques of the upper cervical spine, while the second group was treated with massage therapy of the neck region. All subjects underwent active neck range of motion, isometric and dynamic strengthening and endurance exercises in two sessions/week for 6 weeks. Pre- and post-treatment outcomes were assessed with means and standard error of the means of measured headache pain intensity, frequency and duration of headache attacks as well as via the functional Neck Disability Index (NDI) and active neck range of motion.
RESULTS: The results of the study showed significant improvement in all measured variables in each treatment group. Comparison between the two groups showed significant differences in all measured variables after intervention in favor of mobilization techniques with the exception of the functional NDI.
CONCLUSION: Upper cervical spine mobilization demonstrated more clinical benefits than massage therapy with regard to headache pain parameters and neck mobility for CGH subjects.

Keywords: Cervicogenic headache, manipulative techniques, spinal mobilizations, massage therapy, neck exercises

1. Introduction

Neck pain is a common problem in the general population with typical symptoms that include a limited range of motion and a subjective feeling of stiffness. In addition, headache, brachialgia and/or dizziness may also be present in conjunction with neck pain [1, 2]. By definition, chronic daily headaches must occur 15 days or more a month, for at least 3 months. These are considered true (primary) chronic daily headaches when they do not result from another condition [3]. Headaches have a multifactorial background that depends upon physical, psychological, and even pharmacological factors and each requires specific treatment modalities [4].

Cervicogenic headache (CGH) is a type of headache, which is currently recognized alongside migraine and tension-type headache [5], and where nociceptive input originating from an anatomical structure in the cervical spine is referred to the occipital region and felt as a headache [6]. Consequently CGH makes up a "final common pathway" for several neck disorders that may originate at different levels of the cervical spine [7]. Several authors have proposed theories for the subsequent pain of CGH. A neurophysiologic basis includes ascending fibers from the C1 and C2 nerve roots that

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probably generate pain in the sensitive structures in response to neck movements [6–9].

The mean age of a CGH sufferer is 33 years old. CGH displays a somewhat specific picture: unilateral headache, starting posterior and progressing to the frontal area, which is the most common headache location. It is usually accompanied by ipsilateral arm discomfort, reduced range of motion in the neck, and mechanical perceptibility of attacks/exacerbations. In some cases, prolonged awkward neck positioning and/or external pressure against circumscribed, hypersensitive areas occurs (e.g. tendon insertions) [5,10]. Physical therapy of the cervical spine, provided by musculoskeletal physiotherapists, is one treatment option considered suitable for headache sufferers [11].

There is, however, no definite, universal or optimal treatment for CGH [11]. Various options for the treatment of CGH include preventive medicines, anesthetic blocks, denervation procedures and surgery. The treatment choice must be made on an individual basis [10]. Several non-pharmacological approaches have been proposed in the literature for the management of headaches [12]. From these approaches, physical therapy, educating patients about headache and its management, identifying and managing triggers, modifying lifestyles and behavioral treatments (relaxation, biofeedback, and cognitive-behavioral therapy) are recommended by many authors. Interestingly, physical therapy is the most widely used [13]. Physical therapy modalities are either passive or active treatment methods. Passive treatment methods, e.g. massage, cervical traction, electrotherapy and manual treatment, may be used alone to decrease patient symptoms or be used to prepare the patient for exercise, which represents the active treatment. In the literature many studies report that exercise treatment has an important role in achieving long-term recovery [13,14].

The International Headache Society recognizes that headache is associated with pathomechanics of the cervical spine [13]. Consequently CGH is apparently related to joint dysfunction in the upper cervical segments, especially the C2/3 and C3/4 discs or facet joints [15]. Therefore, spinal mobilization or manipulation is a good treatment choice for this type of headache [12,16]. Many studies suggest that mobilization and/or manipulation, when used with exercise, are beneficial for persistent mechanical neck disorders with or without headache [17]. Manipulation consists of a high velocity and low amplitude localized force directed at cervical joint segments. Grimshaw suggests in his review that manual medicine is appropriate in the case of patients with CGH who have accompanying somatic dysfunction that correlates with their symptoms [18]. Moreover, Keays and Neher concluded in their clinical inquiries that spinal manipulative therapy is a simple intervention that reduces CGH symptoms and improves patient well-being [4].

Mobilization involves low velocity, small or large amplitude, passive movements within the patient's range of cervical motion and control [19]. Despite the belief that spinal mobilization is an effective treatment for headache, the data previously available in the literature do not support such definitive conclusions [20]. However, mobilization techniques are considered to be safer than cervical manipulation [21] as, spinal manipulation, particularly when performed on the upper spine, is frequently associated with mild to moderate adverse effects [20]. For this reason mobilization techniques are preferable to manipulation in the upper cervical spine. In a clinical trial study for the use of manipulation in subjects with CGH ($n = 100$), passive joint mobilization techniques were used in the vast majority of treatments. Physiotherapists participating in this study used cervical manipulation selectively and relatively conservatively, reflecting their due regard to safety in the treatment of the cervical region [21].

Massage therapy is also used as a soft-tissue treatment for headaches [22,23]. Muscle-specific massage therapy has the potential to be a functional, non-pharmacological intervention for reducing the incidence of chronic tension-type headache but there is only moderate support for the analgesic effects of massage on headache pain [22,24].

Until now the evidence for the effectiveness of physical/manual therapy for alleviating headache has remained to be elucidated [12,25,26]. Nevertheless, meta-analysis by Fernando-de-las-Penas suggests that there is insufficient evidence to support or refute the efficacy of physical therapy, exercise or spinal manipulation in the prophylactic management of tension-type headache as a headache model [27]. A greater number of well-designed, randomized, controlled trials are needed to confirm or refute the effectiveness of spinal mobilization or manipulation in the management of CGH. Therefore the purpose of this study was to compare the effects of cervical mobilizations with massage therapy in patients with CGH.

2. Methods and procedures

2.1. Study design

Thirty-eight subjects were enrolled in this clinical study from the Kaser El-Eini hospital from January

2007 to July 2008. The patients selected aged between 18 and 40 years and had shown recurrent headache and neck pain for at least 2 months [28]. Other inclusion criteria included symptoms of CGH, e.g. 1) unilaterality of pain; 2) reduction in the range of neck movement; 3) ipsilateral shoulder discomfort; 4) ipsilateral arm discomfort; 5) mechanical precipitation of exacerbations/attacks by awkward neck positions or external pressure against sensitive occipital structures [29]. Subjects were excluded from the study if they had migraine, cluster headache, cervical radiculopathy, entrapment neuropathy, myelopathy, rheumatoid arthritis or previous surgery of the cervical spine; pregnancy; whiplash trauma; or if they had received therapeutic treatment for neck pain or headache during the previous 6 months [14]. The approval for this study was given by the Institutional Review Board (IRB) of the Faculty of Physical Therapy Cairo University before starting assessments and treatments.

The subjects (16 women, 22 men) were informed that the recorded data would be submitted for publication and they signed an informed consent form. Subjects were randomly assigned to one of the two treatment groups after baseline assessment by an independent, blinded research assistant who opened sealed envelopes that contained a computer-generated randomization card. Group I ($n = 20$) received low velocity passive upper cervical mobilization techniques [19]. Group II ($n = 18$) received massage therapy. All subjects underwent stretching and active exercises. After 1 week of treatment, two subjects were dropped from Group I because they preferred medication. Follow-up assessment was performed for the 36 subjects from Group I and II who completed the program. The measurement and treatment programs were conducted in the outpatient clinic of the Faculty of Physical Therapy.

2.2. Assessment procedure

Each subject was evaluated before treatment intervention (pre-test) and after 1 week of intervention (post-test) using the following criteria:

1. Pain intensity of headache, frequency and duration of headache attacks:
   a) Headache pain intensity was measured by the visual analog scale, where the subject draws a mark along a visual analog scale (0–10 cm, where 0 = no pain and 10 = most pain) [30].
   b) Headache frequency was a measure of the number of headaches suffered in the 4 weeks before evaluation commenced [31].
   c) Headache duration was the average weekly duration, recorded to the nearest quarter hour [22,28].
2. Functional disability was evaluated by the Neck Disability Index (NDI). This questionnaire consists of ten sections. Four sections relate to subjective symptoms (pain severity, headache, concentration, and sleep) and the six remaining sections relate to daily living activities (personal care, lifting loads, reading, work activities, driving, and hobbies). Each section is scored from 0–5, giving a maximum score of 50. A higher score indicates more limitations in patients' function. The validity and reliability of the NDI has been shown in the literature [32,33].
3. Active neck range of motion was measured using a tape measure:
   a) Flexion (Distance from sternal notch to chin);
   b) Extension (Distance from sternal notch to chin);
   c) Rotation (Distance from acromion process to chin);
   d) Lateral Flexion (Distance from acromion process to the lowest point of the ear lobe).

The reported distance is the difference in measurement between the starting position (neutral neck position) and the ending position (position of maximum range subject can assume). All measurements were recorded in centimeters. Tape measurement has been proven to be a valid reliable method for clinicians to assess neck range of motion [34].

2.3. Treatment procedure

The treatment program was applied for 12 sessions (two sessions/week for 6 weeks) and each session was separated by at least 48 h. In the current study neck exercises were combined with mobilization or massage therapy for patients with CGH. This combination has previously been used by many authors [11,12,18,35, 36]. There are two main aims for using exercises. The first aim is a reduction of peripheral sensitization that consequently reduces central sensitization [35], while the second is an activation of descending inhibitory pathways that are stimulated by exercises [12]. All subjects received exercises in the form of active range of motion, isometric and dynamic strengthening and endurance exercises [37], in addition to the following:

Group I: 18 subjects received passive spinal mobilization in the form of low velocity/high amplitude,

Table 1
Demographic data of patients in the two groups

Patients	Group- I (Mobilization group)		Group-II (Massage group)		P-value
	X ± SD	SEM	X ± SD	SEM	
Age in years*	32.4 ± 6.5	1.54	31.0 ± 3.49	0.82	0.42†
Weight in k.grams*	76.4 ± 7.23	1.71	78.8 ± 11.5	2.71	0.47†
Height in meters*	1.69 ± 5.1	1.2	1.67 ± 5.7	1.3	0.23†
Male	10		*12*		
Female	8		*6*		

X: Mean SD: Standard deviation SEM: Standard error of mean;
† Non significant by using independent *t-test* (P- value > 0.05).

Table 2
Comparison of measured variables before and after mobilization in group- I

Variables	Pre-t-test		Post-t-test		p-value
	X ± SD	SEM	X ± SD	SEM	
H intensity	7.1 ± 0.7	0.17	2.2 ± 0.73	0.17	↓ 0.00*
H. frequency	6.1 ± 1.11	0.26	1.94 ± 0.64	0.15	↓ 0,003*
H duration	3.5 ± 0.51	0.12	1.4 ± 0.35	0.08	↓ 0.00*
NDI	46.7 ± 8.74	2.06	18.9 ± 3.7	0.86	↓ 0.00*
Neck flexion	1.92 ± 0.36	0.08	3.9 ± 0.4	0.09	↑ 0.00*
Neck extension	1.69 ± 0.32	0.07	2.92 ± 0.26	0.06	↑ 0.00*
N LT bending	1.84 ± 0.19	0.04	3.67 ± 0.36	0.09	↑ 0.01*
N RT bending	1.8 ± 0.23	0.05	3.71 ± 0.42	0.1	↑ 0.001*
N LT Rotation	1.64 ± 0.3	0.07	3.24 ± 0.55	0.13	↑ 0.001*
N RT Rotation	1.69 ± 0.21	0.05	3.61 ± 0.23	0.05	↑ 0.00*

X: Mean SD: Standard deviation SEM: Standard error of mean ↓: decrease ↑: increase H. Headache neck movement in cm * Significant by Paired t-test (P- value < 0.05).

small oscillatory movements to the upper cervical vertebrae (C1, 2, 3) within its normal range [19]. The mobilization techniques involved postero-anterior central vertebral pressure; unilateral and bilateral postero-anterior vertebral pressure; and transverse vertebral pressure [19]. Each session lasted approximately 30–40 min.

Group II: 18 subjects received massage therapy for approximately 30–40 min per session. The massage regimen consisted of six distinct phases [22]:

1. Warm-up (3 min): three passes of bilateral pressure from the lower cervical region to the occiput.
2. Myofascial release (5 min): bilateral palmar glide passes over the deltopectoral, deltoid, and posterior deltoid regions and upper trapezius.
3. Manual cervical traction (2 min): manual axial traction with one hand under the head and neck and the other on the forehead. Traction was held for 15sec. with the head in a slightl flexion, slight right lateral flexion and slight left lateral flexion.
4. Trigger point therapy procedure (15 min) for active trigger points in the upper trapezius, sternocleidomastoid, suboccipital, splenius capitis, levator scapulae, and temporalis by pincer or flat palpation with just enough pressure to elicit referred pain: 3 to 5 times on each trigger point. The pressure was maintained on the trigger point until the client reported that the referral pain had dissipated or for a maximum of 2 min followed by slow easing of the pressure to elicit vascular flushing.
5. Facilitated stretching techniques ("muscle energy techniques"; 5 min) for cervical paravertebral musculature: neck flexors as antagonist musculature were isometrically contracted, followed by passive stretching of the agonist paravertebral musculature.
6. Session closure (3–5 min): included relaxing effleurage (gliding) and petrissage (kneading) strokes of the cervical region until the end of the session.

2.4. Statistical analysis

Paired t-tests were used to compare the statistical significance of differences between the pre- and post-test data of all measured variables within each group before and after intervention. Independent t-tests were used to compare the statistically significant differences of all measured variables between the two groups. Results

Table 3
Comparison of measured variables before and after massage therapy in group- II

Variables	Pre t-test		Post t-test		p-value
	X ± SD	SEM	X ± SD	SEM	
H intensity	6.8 ± 0.62	0.15	4.3 ± 0.69	0.16	↓ 0.00*
H. frequency	5.9 ± 0.94	0.22	3.9 ± 0.47	0.11	↓ 0,003*
H duration	3.6 ± 0.73	0.17	1.64 ± 0.51	0.12	↓ 0.00*
NDI	48.3 ± 7.07	1.7	17.5 ± 3.5	0.83	↓ 0.00*
Neck flexion	1.9 ± 0.35	0.08	3.52 ± 0.47	0.11	↑ 0.00*
Neck extension	1.51 ± 0.29	0.07	2.59 ± 0.41	0.09	↑ 0.00*
N LT bending	1.61 ± 0.21	0.05	2.62 ± 0.17	0.04	↑ 0.01*
N RT bending	1.67 ± 0.25	0.06	2.74 ± 0.22	0.05	↑ 0.001*
N LT Rotation	1.67 ± 0.35	0.08	2.52 ± 0.46	0.11	↑ 0.001*
N RT Rotation	1.56 ± 0.2	0.05	2.55 ± 0.3	0.07	↑ 0.00*

X: Mean SD: Standard deviation SEM: Standard error of mean ↓: decrease ↑: increase H. Headache neck movement in cm * Significant by *Paired t-test* (P- value < 0.05).

Table 4
Comparison of measured variables between two groups before both treatment programs

Variables	Group I		Group II		p-value
	X ± SD	SEM	X ± SD	SEM	
H intensity	7.1 ± 0.7	0.17	6.8 ± 0.62	0.15	0.33†
H. frequency	6.1 ± 1.11	0.26	5.9 ± 0.94	0.22	0.75†
H duration	3.5 ± 0.51	0.12	3.6 ± 0.73	0.17	0.75†
NDI	46.7 ± 8.74	2.06	48.3 ± 7.1	1.7	0.53†
Neck flexion	1.92 ± 0.36	0.08	1.9 ± 0.35	0.08	0.85†
Neck extension	1.69 ± 0.32	0.07	1.51 ± 0.29	0.07	0.08†
N LT bending	1.84 ± 0.19	0.04	1.79 ± 0.17	0.05	0.41†
N RT bending	1.8 ± 0.23	0.05	1.67 ± 0.25	0.06	0.1†
N LT Rotation	1.62 ± 0.3	0.07	1.67 ± 0.35	0.08	0.8†
N RT Rotation	1.69 ± 0.21	0.05	1.56 ± 0.2	0.05	0.07†

X: Mean SD: standard deviation SEM: Standard error of mean;
H. Headache neck movement in cm † Non significant by using independent *t-test* (P-value > 0.05)

were considered to be statistically significant if the p-value obtained was less than 0.05 with 95% confidence interval of the difference.

3. Results

Comparison between the two groups by independent t-tests showed that there were non-significant differences between the subjects of both groups in age, weight and height ($p > 0.05$; Table 1). Paired t-tests were used to detect the significance of changes in all measured variables in each group. Headache pain intensity, frequency and the duration of headache attacks were significantly reduced after intervention in both groups. Functional activity and active neck range of motion were significantly increased after mobilizations (Table 2) and massage therapy ($p < 0.05$) (Table 3). Comparison between the two groups by independent t-tests showed non- significant differences between both groups before intervention (Table 4), while all measured variables after intervention revealed significant differences between both groups in favor of cervical mobilization, except in the NDI of functional activities (Table 5).

4. Discussion

The aim of this study was to compare two commonly applied therapeutic interventions for CGH: cervical spine mobilizations and massage therapy. Active neck exercises were performed for all participants. The results of this study showed significant reduction in headache intensity, frequency and duration. This was associated with significant clinical improvement of functional activity and neck mobility after both treatment options when compared with the baseline.

The subjects had experienced a combination of recurrent headache and neck pain for a minimum of 2 months. Headache and neck pain are commonly associated for many patients for whom a physical treatment can be carried out [11,28]. De Hertogh et al. treated patients with CGH by application of low velocity mo-

Table 5
Comparison of measured variables between two groups after two treatment programs

Variables	Group I		Group II		p-value
	X ± SD	SEM	X ± SD	SEM	
H intensity	2.2 ± 0.7	0.17	4.3 ± 0.68	0.16	0.00*
H. frequency	1.94 ± 0.64	0.15	3.9 ± 0.47	0.11	0.00*
H duration	1.3 ± 0.23	0.08	1.62 ± 0.51	0.12	0.008*
NDI	18.9 ± 3.7	0.86	17.5 ± 3.5	0.83	0.26†
Neck flexion	3.9 ± 0.4	0.09	3.52 ± 0.47	0.11	0.02*
Neck extension	2.92 ± 0.26	0.06	2.59 ± 0.41	0.09	0.007*
N LT bending	3.67 ± 0.36	0.09	2.62 ± 0.17	0.04	0.00*
N RT bending	3.71 ± 0.42	0.1	2.74 ± 0.22	0.05	0.00*
N LT Rotation	3.24 ± 0.55	0.13	2.52 ± 0.46	0.11	0.00*
N RT Rotation	3.61 ± 0.23	0.05	2.55 ± 0.3	0.07	0.00*

X: Mean SD: Standard deviation SEM: Standard error of mean;
H. Headache neck movements in cm * Significant by *Independent t-test* (P- value < 0.05).

bilizations with high amplitude, and small oscillatory manipulative therapy to a joint within its normal range, which was comparable to the manipulative therapy in current study [11]. This technique was selected because high velocity cervical manipulation presents concerns due to the risk of devastating side effects of trauma to the vertebral artery [20]. Consequently cervical mobilization techniques are preferable and considered safe by researchers [14,21]. The treatment techniques used by the manual therapist in the randomized, controlled trial of Groeneweg et al. consisted of very gentle mobilizations, without high velocity thrust techniques [14]. The treatment was applied to patients with non-specific neck pain for 6 weeks, which is similar to the period used in our study.

In the current study the clinically important changes and statistically significant differences between cervical mobilization and massage therapy were observed. Headache pain intensity, frequency and duration significantly reduced after mobilization (to 2.2 ± 0.7, 1.94 ± 0.64, and 1.3 ± 0.23, respectively) more than after massage therapy (with means 4.3 ± 0.68, 3.9 ± 0.47, and 1.62 ± 0.51, respectively) at follow-up assessment ($p < 0.05$). Some studies have previously been conducted that support these clinical improvements by mobilizations [16,31]. For example, Haas et al. found in their clinical trial that the difference in CGH pain intensity and the number of attacks between treatment and control groups strongly favored spinal manipulation over the control group [16].

In other study by Haas et al. four chiropractors applied techniques such as high velocity/low amplitude spinal manipulation of the cervical and upper thoracic spine [31]. The light massage group received 5 min of moist heat followed by 5 min of light massage in the form of gentle effleurage and gentle petrissage of the neck and shoulder muscles. The authors compared two treatments of spinal manipulative therapy and two treatments of light massage for CGH [31]. Their participants were randomized to 8 or 16 treatment sessions with either spinal manipulation or a minimal light massage. They found clinically important improvements in the spinal manipulation group. Their pilot study showed that a plateau effect might be in the range of 8 to 16 treatment sessions and support moderate treatments as a viable option for the treatment of CGH [31].

In contrast to our study, De Hertogh and colleagues found non-significant differences between usual care, alone or in combination with manual therapy, in patients with a combination of headache and neck pain [28]. They found significant improvements in the headache impact test and global perceived effect (primary measures) and reduction in headache frequency, pain intensity, medication intake, absenteeism and headache-related health care contacts (secondary outcome measures) in both treatment groups. The spinal mobilizations used in De Hertogh's study consisted of low and/or high velocity cervical joint mobilization techniques. Each therapist applied a technique based on his own clinical skills and the patient's situation. This variation in application may give variable results. In the current study the spinal mobilization techniques were standardized for all subjects with the same therapist. The exercise program is another difference between our study and that of De Hertogh. The exercises in De Hertogh's study consisted of low-load endurance exercises and mainly cranio-cervical flexion exercises. In our study more exercises were executed by the patients, e.g. active range of motion, isometric and dynamic strengthening exercises. Intervention duration in both studies was 6 weeks, but the outcome measurement in our study was only at the 7^{th} week with no subsequent follow-up. Follow-up measurements in De

Hertogh et al. study were taken at weeks 7, 12 and 26 after intervention [28].

Cervical active range of motion, measured in centimeters (in all directions), is another important finding in our study. The clinical changes observed in cervical range of motion after mobilization were 3.9 ± 0.4, 2.92 ± 0.26, 3.67 ± 0.36, 3.71 ± 0.42, 3.24 ± 0.55, 3.24 ± 0.55 for cervical flexion, extension, bending "LT, RT", and rotation "LT, RT", respectively, which were significantly increased compared to what was recorded after massage therapy (3.52 ± 0.47, 2.59 ± 0.41, 2.62 ± 0.17, 2.74 ± 0.22, 2.52 ± 0.46, 2.55 ± 0.3, respectively). This indicated that mobilization techniques are more efficient in increasing cervical range of motion in cases of CGH.

The results of neck mobility were in agreement with those of a previous study, where it was found that application of one single manipulation in patients with acute neck pain immediately resulted in less pain intensity and a greater range of motion when spinal manipulative therapy is applied to the painful side of the neck [30]. In contrast to this finding, Briem et al. did not confirm immediate effects of manual therapy on cervical flexion active range of motion in patients with neck pain with or without concomitant headache [38]. The selected manual therapy technique used in the study of Briem, called inhibitive distraction, was compared to the placebo effect. In addition they used cervical range of motion (CROM) goniometry in order to measure only cervical sagittal plane flexion. In contrast, in our study, passive spinal mobilization of upper cervical spine was applied in conjunction with active neck exercises and cervical range of motion was measured in all directions.

Regarding the functional NDI in the current study, neck disability was improved in two groups (18.9 ± 3.7 after passive upper cervical spine mobilization and 17.5 ± 3.5 after massage therapy) with no significant difference between the two treatment regimes. In contrast, Haas et al. found that spinal manipulation improves headache disability better than light massage [31]. This contradiction may be due to the fact that the modified Von Korff pain scale used in the study of Haas and colleagues differs from the NDI used in our study. In addition, manual therapy in their study consisted of high velocity/low amplitude spinal manipulation of the cervical and upper thoracic spine techniques, while we only applied low velocity/high amplitude spinal mobilization for the upper cervical spine.

Some authors have found that massage therapy is effective in reducing the number of headaches per week in chronic tension-type headache sufferers. Subjects with migraine have greater improvements in migraine frequency and sleep quality during the intervention period and at the 3 week follow-up [22,23]. These findings support the belief that the massage therapy technique has the potential to be a non-pharmacological intervention for individuals with chronic tension-type headache or migraine. The effect of massage in relieving headache pain and other parameters may be explained by the release of active muscle trigger points [39]. However, when massage was compared to mobilization, the latter showed greater benefits for patients with CGH [31].

5. The limitations of this study

Unfortunately the current study has some limitations, e.g. intervention in this study was limited to 6 weeks, and measurements in the study were performed only at baseline and 7 weeks after treatment with no further follow-up. Moreover, there was no control group in which to confirm the outcomes of treatment intervention.

6. Conclusion

Spinal mobilization for upper cervical vertebrae C1, 2, 3 within their normal range demonstrated more clinical improvement in headache pain intensity, frequency and duration of headache pain in comparison with manual massage for neck in patients with CGH. The neck range of motion in flexion, extension, rotation, lateral flexion for patients with CGH significantly increased after upper cervical mobilization and to a greater extent than with massage therapy.

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