Original Article

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Comparing the effect of myofascial release and muscle energy technique on craniovertebral angle and headache in tension-type headache patients

Comparando o efeito da liberação miofascial e técnica de energia muscular no ângulo craniovertebral e cefaleia em pacientes com cefaleia tensional

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ABSTRACT | INTRODUCTION: Tension headaches can be induced by forward head posture, and there is a wealth of evidence available for managing chronic headaches. The data support the use of manual therapy approaches to manage tension-type headaches. Because of the forward head posture, the suboccipital muscle region becomes short, resulting in an increase in lordosis and neck pain. Patients with an even more forward head posture have a smaller craniovertebral angle, which in turn causes tension-type headache. **OBJECTIVE:** This study aims to compare the effects of Myofascial release therapy (MFR) and Muscle energy technique (MET) with general neck exercises on the craniovertebral angle and headache in tension-type headache patients. **METHODS:** In total, 75 subjects with tension-type headache and suboccipital muscle tenderness were recruited and randomized blindly into three groups: the MFR group, the MET group, and the control group (25 subjects in each group). A pre-craniovertebral angle was taken by photographic method, and a pre-headache disability index questionnaire was filled in. The MFR group receives cranio-basal release in the suboccipital region with neck exercises, the MET group receives post–isometric relaxation in the suboccipital region with exercises, and the control group receives only exercises for two weeks. After two weeks, the postcranial angle and the headache questionnaire were taken and measured. **RESULTS:** Craniovertebral angle and headache index showed significant improvement in both the MET and MFR groups. There was no significant difference when MET and MFR groups were compared. When compared with the control group, both MET and MFR showed a significant increase in craniovertebral angle. There was a significant improvement in the headache index following MET, MFR, or routine neck exercise. **CONCLUSION:** Compared to the control group, MFR shows better results than MET on craniovertebral angle and headache.

KEYWORDS: Tension-type headache (TTH). Trigger points. Muscle energy technique. Myofascial release therapy. Craniovertebral angle. International headache society.

RESUMO | INTRODUÇÃO: Cefaleias tensionais podem ser induzidas pela postura da cabeça para frente, e há uma grande quantidade de evidências disponíveis para o manejo de cefaleias crônicas. Os dados corroboram uso de abordagens de terapia manual para gerenciar dores de cabeça do tipo tensional. Devido à postura anterior da cabeça, a região do músculo suboccipital torna-se curta, resultando em aumento da lordose e dor no pescoço. Pacientes com uma postura de cabeça ainda mais para frente têm um ângulo craniovertebral menor, o que, por sua vez, causa cefaleia do tipo tensional. **OBJETIVO:** O objetivo deste estudo é comparar os efeitos da terapia de liberação miofascial (LMF) e da técnica de energia muscular (TEM) com exercícios gerais do pescoço no ângulo crânio-vertebral e na cefaleia em pacientes com cefaleia do tipo tensional. **MÉTODOS:** No total, 75 indivíduos com cefaleia tensional e sensibilidade muscular suboccipital foram recrutados e randomizados cegamente em três grupos: o grupo LMF, o grupo TEM e o grupo controle (25 indivíduos em cada grupo). Um ângulo pré-crânio vertebral foi obtido por método fotográfico e um questionário de índice de incapacidade pré-cefaleia foi preenchido. O grupo LMF recebeu liberação crânio-basal na região suboccipital com exercícios de pescoço; o grupo TEM recebeu relaxamento pós-isométrico na região suboccipital com exercícios, e o grupo controle recebeu apenas exercícios por 2 semanas. Após duas semanas, o ângulo pós-craniano e o questionário de cefaleia foram coletados e medidos. **RESULTADOS:** O ângulo crânio-vertebral e o índice de cefaleia mostraram melhora significativa nos grupos TEM e LMF. Não houve diferença significativa quando os grupos TEM e LMF foram comparados. Quando comparados com o grupo controle, tanto o TEM quanto o LMF apresentaram aumento significativo do ângulo crânio-vertebral. Houve melhora significativa no índice de cefaleia após TEM, LMF ou exercício de rotina no pescoço. **CONCLUSÃO:** Comparado ao grupo controle, o LMF apresenta melhores resultados do que o TEM no ângulo crânio-vertebral e cefaleia.

PALAVRAS-CHAVE: Cefaleia do tipo tensional (CTT). Pontos-gatilho. Técnica de energia muscular. Terapia de liberação miofascial. Ângulo crânio-vertebral. Sociedade Internacional de Cefaleia.

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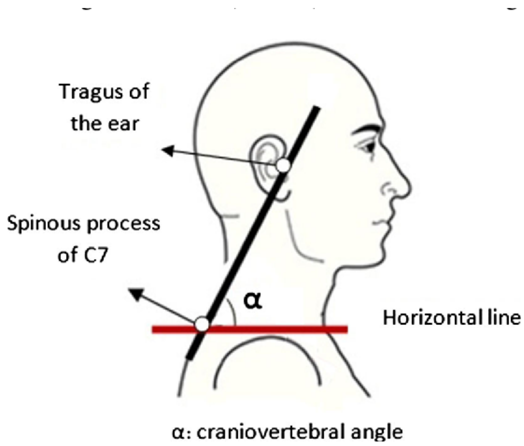
Introduction

Trigger point causes stress and pain in the muscle, which leads to muscle fatigue and the addition of more trigger points.[1] There is a correlation between trigger point and forward head posture (FHP), and the duration, frequency of headache, and the presence of trigger points in suboccipital muscles has an interrelationship with the degree of FHP.[2] In a study on the muscles' role in tension-type headache, the treatment included electromyography biofeedback, physiotherapy, and relaxation therapy for muscle.[3]

The craniovertebral angle serves as a reference point for assessing head and neck postures (Figure 1). In people with neck pain, the angle is much smaller. Reduced craniovertebral angle values are associated with a higher prevalence of forward head posture and a higher level of disability in persons with neck pain.[4] A decrease in the craniovertebral angle (CVA) indicates a more forward-facing head posture. Forward head position is defined as a CVA of less than 48-50 degrees.[5] According to a study conducted by Kim et al., forward head posture as determined by CVA can be employed as a major index for determining the ensuing neck functional impairment.[6] Previous research has established the reliability and validity of the CVA angle.[7]

Figure 1. Craniovertebral angle



Myofascial Release Therapy (MFR) is a universally applied manual therapeutics that involves a long duration of lesser mechanical force by which optimal length can be restored, and function will be improved with a decrease in pain.[8] Myofascial release is used to treat tension-type headache patients. Ajimsha et al. (2011) investigated in their randomized, controlled, single-blinded trial study that both indirect as well as direct MFR therapy is more helpful than the control group in TTH patients.[9] As per one randomized controlled trial study, MFR for suboccipital and sternocleidomastoid muscle (SCM) was found to be more effective than conventional therapy.[10]

Muscle Energy Technique (MET), consists of a discretionary muscle contraction in a controlled and defined manner while the therapist applies a counteracting force. Studies in the past demonstrated the effect of MET in alleviating trigger points. The muscle energy technique was found to be effective in treating patients with tension-type headaches; it also decreased cervical spine range and disorders related to tension-type headache.[11] It is also reported that the addition of suboccipital muscle energy technique to deep neck flexor exercise provided exceptional benefits compared to deep neck flexor exercise alone in an intervention designed for subjects with forward head posture.[12] Quek et al. illustrated that decreased craniovertebral angle is associated with increased FHP.[13] It was also suggested that accretion of suboccipital release to craniocervical flexion movement in intervention form for participants with forward head posture can provide remarkable benefits as differentiate to craniocervical flexion exercise alone.[6]

Numerous studies support the use of manual therapy techniques in the treatment of a variety of musculoskeletal problems. There is, however, a dearth of literature demonstrating the efficacy of manual treatments such as MET and MFR in the management of tension-type headaches. The purpose of this study was to determine the efficacy of MFR and MET on the craniovertebral angle and headache in individuals with tension-type headaches. The secondary purpose was to determine the optimal manual therapy approach to be used on patients with tension-type headaches in the future.

Methodology

Study design

A comparative study including faculty and students working on computers was selected by a convenient sampling method.

Study sample

Students and faculty working on computers from Manav Rachna International Institute of Research and Studies were selected. According to the norms of the International Headache Society, participants having tension type headaches and suboccipital region tenderness were selected.

Inclusion criteria

The participants were selected based on inclusion criteria that included both males and females between 20-50 years of age, faculty, and students working on computers for at least 5 hours a day, having trigger points in the suboccipital area, and having a complaint of headache.

Exclusion criteria

Participants with migraine, head injury, cervicogenic headache, head disability index score of less than 28, which are those having no headache or a mild headache, and those on medication for TTH in the last one year or more were excluded from the present study.

Sample size

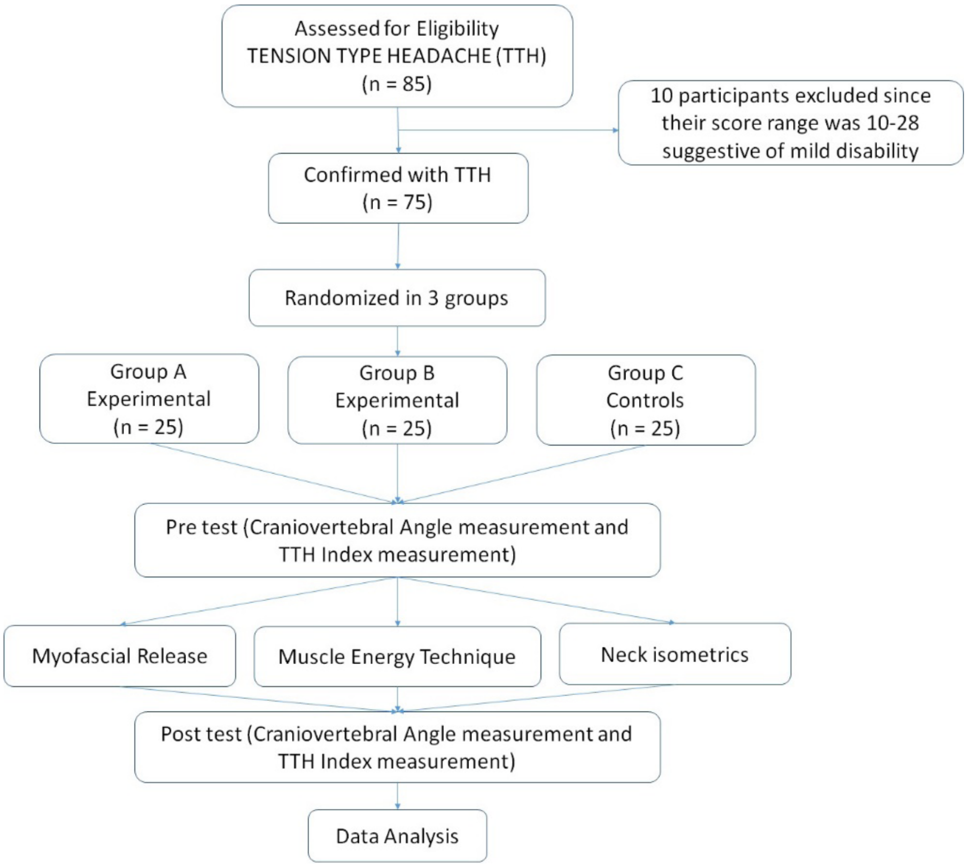
The number of subjects was determined through G*Power 3.1.9.4 using a statistical test of ANOVA (F-test) in three groups. The sample size of 75 was shown to be necessary based on the effect size of 0.4, an alpha level of 0.05, and power of 0.90. However, 85 participants were screened for this study considering the fact that all participants with neck pain might not have a headache disability index score of more than 28 (i.e. moderate to severe), which was the inclusion criteria for selecting the participants in this study.

Procedure

After explaining the aims and risks involved in the study, an informed consent form was signed. Furthermore, they were requested to fill out a pre-Headache Disability Index Questionnaire (HDI). The headache index contained 25 questions, and participants were asked to tick the appropriate answer as "yes" "no”, and "sometimes", for which the scoring was done as 4, 2, and 0, respectively. The total of pre-data from the total scoring of 25 questions was calculated before the treatment of 85 participants. Ten participants dropped out as they failed to meet the eligibility requirements for being considered to have a tension-type headache. Further, 75 participants were divided into three subgroups: group A, group B, and group C, with 25 participants in each group (Figure 2). To minimize bias and ensure research quality, the investigators designed the trial in such a way that the participants in the study were unaware of the allocation status, and the outcomes assessor was blinded to the group assignment. The method of the double-blinded trial was adopted for the process of randomization.

The craniovertebral angle was measured by placing double-sided tape on the C7 vertebrae and tragus of the ear, and a side view picture was taken. Groups A and B (experimental groups) received MFR and MET for two weeks (3 alternate days per week) in addition to neck exercises, while Group C (control group) only performed neck exercises for two weeks.

Figure 2. Consort Chart



Group 'A' intervention

Group "A" receives a myofascial release form (MFR) called cranio-basal release therapy in the suboccipital region (Figure 3). Participants were asked to lie in a supine position. The physiotherapist sits at the edge of the participant's head, applying and holding traction until the participant's occiput is released. While maintaining the traction, a firm stroke was given on the neck by the other hand. The alternate hand was used for traction and stroking several times. The final stroke was performed by both hands, ending with the heel of the hand just under the curve of the participant's skull with extended fingers along his neck. Fingers were flexed at the MCP joints, forming the right angle for the vertical stretch of tissues to begin. Maintaining the vertical stretch, knuckles were pushed forward towards the participant's feet. Again, with the fingertips under the occiput, the participant's head was pulled outwards, and it was held until the end feel was reached with the chin tucked in. The traction was gradually released. Furthermore, the physiotherapist instructed the participant to perform neck isometrics, chin tuck-ins (for 5 seconds hold and 5 repetitions each), and stretching of the trapezius, neck extensors, and neck flexors for 10 seconds hold and 5 repetitions each.

Figure 3. (A) Myofascial release therapy (MFR), (B) Muscle Energy Technique (C) Neck isometrics

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Group 'B' intervention

Group "B" received suboccipital muscle energy technique (MET) (Figure 3). The participant was asked to lie in a supine position with a pillow placed under the upper back so that the neck is extended. A physiotherapist sitting by the head side of the participant placed his hand at the curve of the skull with fingers at the base of the occiput and applied traction. Thereafter, the participant was asked to exert 20% downward force while resistance was applied by the therapist for 3 seconds, and the tissue would be released. Thereafter, a stretch to the new muscle barrier was performed, and again the participant was asked to apply downward force. Three repetitions were performed. Further, the participant performed neck isometrics with chin tuck in (five-second hold and five repetitions each), stretching of trapezius, neck flexor, and neck extensor (five repetitions and hold for 10 seconds each).

Group 'C' (control)

Group "C" participants performed only neck isometrics and chin tuck-in for five repetitions with a five-second hold, stretching of the trapezius, neck extensors, and neck flexors for five repetitions with a 10-second hold for two weeks (Figure 3).

Finally, after two weeks of respective interventions in groups A, B, and C, the post-cranial angle was measured and the post-headache disability questionnaire was filled out. The final analysis was tabulated based on the pre and post-assessment for both the experimental and control groups.

Statistical consideration

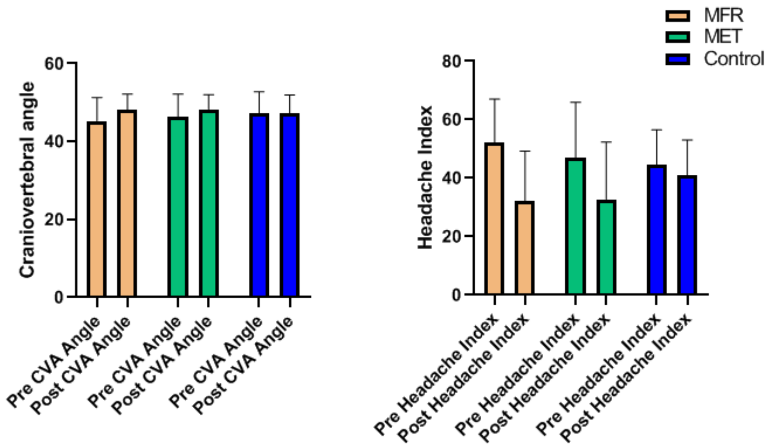
Statistical analysis was performed with the help of SPSS version 25.0. The assumption of normality was evaluated using a Shapiro-Wilk test. One-way analysis of Variance (ANOVA) was applied to arbitrate the difference between and within the three groups. Bonferroni post-hoc test was used to locate pairwise differences between the means. Paired sample t-test was used for comparing the pre and post-data of the three groups. The level of significance was set up to $p<0.05$ at a confidence interval set of 95%.

Results

The calculated sample was 75 having 25 subjects in each group of MFR, MET, and control. However, at the time of obtaining the samples, the prevalence of neck pain was found to be on the higher side. In addition, considering the fact that all these patients might not have a tension-type headache (moderate to severe), 85 patients having neck pain according to the defined inclusion criteria were screened. However, it was observed that 10 patients presented with mild disability index (score 10-28) and, as such, were excluded from the study making the sample size 75.

In group A, participants receiving MFR exhibited a significant increase in CVA from 45.3±6.0 (pre MFR) to 48.0 (post MFR). In group B, participants receiving MET, there was a significant increase in the CVA from 46.4±5.7 (before MET) to 48.3±3.7 (after MET). CVA difference before and after MFR was 2.68±2.63 as compared to a CVA difference of 1.88±3.00 before and after MET. As per these results, MFR may be more effective in alleviating neck function impairment or correcting forward-facing head posture. There was no variation in CVA measured before and after performing neck isometrics in the control group (group C) (Table 1). Headache index measured before and after neck isometrics was not significantly different in the control group. In group A, there was a significant decrease in the pre to post-headache index following MFR (pre vs. post = 52.1±14.9 vs. 32.1±17.1). In addition, in group B, there was a significant decrease in the pre and post-headache index following MET (pre vs. post = 47.0±18.9 vs. 32.8±19.5). Finally, in group C, although there was a slight decrease in the pre and post-headache index following neck isometrics, this difference did not reach a point of statistical significance (pre vs. post = 44.5±12.0 vs. 41.1±11.9) (Figure 4).

Figure 4. Pre and Post measurement of CVA and headache index in myofascial release form (MFR), muscle energy technique (MET), and control groups (CG).
(Data represented as Mean and Standard deviation)



Paired sample T-test showed that there is a significant change from pre to post-CVA (t = -3.13, p=0.005) and pre to post-headache index (t = 13.01, p<0.001) in the MET group (Table 1). Likewise, there is significant change from pre to post CVA (t = -5.10, p<0.001) and pre to post headache index (t =10.89, p=<0.001) in the MFR group. However, in the control group, there was no significant change in pre to post-CVA (t =0.12, p =0.91), while neck isometrics resulted in significant alteration in the headache index (t = 6.68; p<0.001).

Table 1. Paired sample T-test for comparing pre and post-CVA and headache index

	Group	Pre	Post	Mean Difference	95% CI		t-value	p-value
					Lower	Upper		
CVA	MFR	45.28±6.05	47.96±4.15	-2.6800	-3.7638	-1.5962	-5.104	<0.001
	MET	46.44±5.71	48.32±3.66	-1.8800	-3.1202	-.6398	-3.129	.005
	CG	47.12±5.55	47.08±4.8	.0400	-.6797	.7597	.115	.910
Headache Index	MFR	52.08±14.94	32.12±17.14	19.9600	16.1759	23.7441	10.886	<0.001
	MET	47.04±18.92	32.76±19.46	14.2800	12.0143	16.5457	13.008	.000
	CG	44.48±11.99	41.12±11.93	3.3600	2.3220	4.3980	6.681	.000

One way analysis of variance (ANOVA) displayed that there is significant variation between the mean difference of pre and post-CVA [F (2,72)= 7.73, p= 0.001] and headache index [F (2,72)= 44.31, p<0.001]. However, there was no significant change within the groups for pre and post-CVA and headache index (Table 2).

Table 2. Pre and post-comparison between the difference in pre and post-measurement of CVA and headache index (ANOVA)

Outcome Variables		F	Sig.	Sum of Squares	df	Mean Square
Pre CVA Angle	Between Groups	0.65	0.53	43.28	2	21.64
	Within Groups			2397.84	72	33.30
Post CVA Angle	Between Groups	0.57	0.57	20.35	2	10.17
	Within Groups			1288.24	72	17.89
Headache Index Pre	Between Groups	1.55	0.22	747.63	2	373.81
	Within Groups			17393.04	72	241.57
Headache Index Post	Between Groups	2.32	0.11	1260.83	2	630.41
	Within Groups			19557.84	72	271.64
Difference in CVA Pre to Post	Between Groups	7.73	<0.001	97.71	2	48.85
	Within Groups			455.04	72	6.32
Difference in Headache Index pre to post	Between Groups	44.31	<0.001	3558.91	2	1779.45
	Within Groups			2891.76	72	40.16

Bonferroni post-hoc multiple comparison analysis showed that there was no significant change in the mean difference of CVA from pre to post between MET and MFR while the mean difference of CVA from pre to post between MET & control and MFR and control was statistically significant. Further, there was significant change in the mean difference of headache index from pre to post between MET & control, MFR & control, and also MET and MFR (Table 3).

Table 3. Pre and post-comparison between CVA and headache index post-hoc multiple comparison (bonferroni)

Dependent Variable	Group	Group	Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Difference in CVA Pre to Post	MET	MFR	-.8000	.7111	.793	-2.543	.943
	MET	Control	1.9200*	.7111	.026	.177	3.663
	MFR	Control	2.7200*	.7111	.001	.977	4.463
Difference in Headache Index pre to post	MET	MFR	-5.680*	1.793	.007	-10.07	-1.29
	MET	Control	10.920*	1.793	.000	6.53	15.31
	MFR	Control	16.600*	1.793	.000	12.21	20.99

*. The mean difference is significant at the 0.05 level.

Discussion

The fascial system, defined as a dynamic and ongoing structural and functional unity of the body, has sparked a lot of interest in recent years. According to certain research, the fascia, which is made up of loose areolar fibrous tissue and thick fibrous tissue, forms a three-dimensional network that connects all bodily structures involved in posture control and maintenance.[14,15] In recent years, myofascial release therapy has grown in popularity, mostly as a treatment for hamstring tightness, low back pain, and other musculoskeletal disorders.[16] The muscle energy technique is a well-known osteopathic manipulative technique that is frequently used to treat spinal somatic dysfunctions.[17] Suboccipital release technique dramatically reduced CVA in asymptomatic patients.[18] We planned to compare the effects of myofascial release (MFR) and muscle energy technique (MET) on craniovertebral angle and headache in tension-type headache patients. In patients with forward head posture, CVA is known to be decreased (<480) because the longus capitis becomes weak and suboccipital muscles become hyper-contracted.[10]

Myofascial release (MFR) is a popular treatment for pain caused by musculoskeletal injuries, and it works best when the muscles around the injury are relaxed as much as possible.[19] Furthermore, for patients with cervical pain, MFR is the preferred physical therapy for stimulating blood circulation.[20] One of the previous studies confirmed the effect of Myofascial release in promoting maximum relaxation of tense tissues in addition to controlling pain from musculoskeletal lesions like myofascial trigger points and myofibrosis.[21] In the present study, participants receiving MFR and MET both exhibited significant increase in CVA. When comparing participants who received MFR to those who received MET, the mean difference between the two measurements of CVA from pre to post was greater in the MFR group. According to these findings, MFR may be more helpful in reducing neck functional impairment or correcting forward-facing head position than other approaches. In the control group, there was no difference between the measurements of CVA taken before and after performing neck isometrics.

Pain on the bilateral side of the head can be originated from referred pain in the suboccipital muscle. Tension-type headaches associated with suboccipital trigger points and forward head posture find in one research.[2] MFR releases the tight fascia by giving continuous pressure, and MET releases by giving traction to the fascia. This increases the CVA in the MET and MFR groups. Myofascial release to suboccipital and sternocleidomastoid was found to be more effective in decreasing pain and improving posture.[10] Pressure of the therapist's hand and traction at the dorsal area of the neck and suboccipital muscles instigate tissue lengthening and relieve tension in orifice.[10] Also, a study has reported that myofascial release with exercise therapy was effective in patients with TTH when compared to the control group.[22] Another theory states that in shortened deep cervical extensors, MET decreases hyperactivation and tightness. The headache index, which was measured before and after neck isometrics, did not differ substantially between the control groups. Again, both MFR and MET resulted in a statistically significant reduction in the headache index. Finally, although there was a modest decrease in the pre and post-headache index following neck isometrics in controls, this difference did not reach a statistically significant level in either group.

In the present study, the mean difference between before and post CVA and headache index showed substantial variation, while there was no significant change among the groups for pre and post CVA and headache index. The mean difference of CVA from pre to post between MET & MFR and MET & control did not change significantly from pre to post, according to a Bonferroni post-hoc multiple comparison analysis; however, the mean difference of CVA from pre to post between MFR and control was statistically significant. Furthermore, the mean difference of headache index from pre to post between MET and control and MFR and control was significantly different, whereas the mean difference of headache index from pre to post between MET and MFR was not significantly different. Lozano Lopez et al. (2016) also show favorable outcomes in patients with TTH receiving manual therapy than those who receive a placebo. Headache frequency and intensity seem to be reduced by manual therapy.[23]

On the other hand, Peñas et al. (2005) found that the superior oblique muscle has more number of trigger points in TTH.[24]

In participants with forward head posters (FHP), Muscle Energy Technique reduces hyperactivity and tightness in the shortened deep cervical extensors. The neurophysiologic mechanism behind this is that it activates Golgi Tendon Reflex, which inhibits alpha motor neurons and causes the inactivation of suboccipital muscles. When MET applies to suboccipital muscles, from neck to shoulders, it induces the downstream effect, as these are an important part of superficial back lines, so by applying MET suboccipital muscles release, which induces neck and shoulder muscles and thereby improving forward head posture.[12] An investigation also support that both myofascial and muscle energy techniques are efficient in reducing pain and potency in tension-type headache.[11] In the MET group, there was a significant change in both the mean difference between pre and post-CVA and the pre to post-headache index. In the MFR group, there is also a substantial shift in the mean difference between pre and post-CVA and pre and post-headache index. However, there was no significant difference between pre and post-CVA in the control group following neck isometrics, but there was a significant difference in the headache index.

Conclusion

The study concludes that both the manual therapy techniques i.e. Myofascial release therapy and Muscle energy technique with exercise change the craniovertebral angle headache index in TTH patients. When compared to the control group for CVA, MFR shows positive changes, whereas MET shows no significant changes. On the other hand, for headache index, MFR shows better results as compared to MET.

Limitation of the study

The number incorporation of the techniques has improved the CVA and headache index for the duration of 2 weeks, but the longitudinal effect was not studied making it a limitation of the study. The working posture was not changed for the study duration.

Clinical Significance

Both the manual therapy techniques can be given to patients having tension-type headaches and reduced CVA for management purposes, along with the incorporation of neck isometrics exercises.

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Ethical Approval

Ethical approval was obtained from the ethical committee at the Faculty of Allied Health Sciences in accordance with Ethical Principles for Medical Research Involving Human (WMA Declaration of Helsinki) having reference No: MRIIRS/FAHS/DEC/2021-M16 dated 9th April 2021.

Authors' contributions

Sharma A participated in the conception, design, search, and writing of the scientific article. Sharma A also participated in research data collection. Sharma A1 participated in the conception, design, data interpretation, and writing of the article. Rizvi MRR contributed to performing the statistical analysis of research data, data interpretation, and writing and forwarding of the scientific article. Kumari S participated in the writing of the review of literature and research articles. Sharma P was involved in the design, data collection, and framing conception of the article.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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