Original article

Physiotherapy and Occupational Therapy Journal
Volume 5 Number 4, October - December 2012

Comparison between the Effects of Cervical Therapeutic Exercise Programme and Myofascial Release Techniques on Cervicogenic Headache in a Randomized Controlled Trial

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Abstract

Background and Introduction: Cervicogenic headache is a very common condition which leads to significant disability. Cervicogenic headache was first introduced by Sjaastad in 1983 and is defined by the World Cervicogenic Headache Society as referred pain perceived in any part of the head caused by a primary nociceptive source in the musculoskeletal tissues innervated by cervical nerves. A number of studies have been conducted to find the effects of various therapeutic techniques on cervicogenic headache. In this study, comparison has been done between Cervical Therapeutic Exercise Programme for cervicogenic headache and Myofascial Release Techniques to find out the technique more effective in reducing cervicogenic headache parameters.

Method: 30 subjects selected according to the inclusion and exclusion criteria were randomly divided into 3 groups: Conventional group, Exercise group and MFR group to which Conventional treatment for Cervicogenic Headache, Cervical Therapeutic Exercise Programme and Myofascial Release Techniques respectively are administered. Pre and post treatment readings were recorded for Neck Disability Index score, Visual Analog Scale score, Headache Duration, Headache Frequency.

Results: After one week of treatment it was found that all the three treatment approaches were effective in reducing the Cervicogenic headache parameters. However on comparing three treatment approaches, Myofascial Release Techniques were the most effective in reducing the above parameters. ($p<0.05$)

Conclusion: Myofascial Release Techniques are more effective than Cervical Therapeutic Exercise Programme in reducing Cervicogenic Headache symptoms.

Key words: Cervicogenic Headache; Cervical Therapeutic Exercise Programme; Myofascial Release.

Introduction

Cervicogenic headache is referred pain perceived in the head and caused by musculoskeletal tissues innervated by cervical nerves.[1] Several cervical structures, such as cervical muscles and their attachments to the bone; as well as the capsule of the intervertebral joints and discs, ligaments, nerves and nerve roots, fascia, dura matter[2], sustained faulty neck postures like forward head posture[3] are thought to be pain generating candidates in CEH.[4] The neuroanatomical basis for CEH is the "trigemino- cervical nucleus" in the spinal grey matter of the spinal cord at the C1-C3 level, where there is a convergence on the nociceptive second order neurons receiving both trigeminal and cervical input.

Cervicogenic headache manifests itself as a unilateral head or face pain without side shift.[5] The pain starts at the posterior part of the head and/or neck spreads to the front following the scalp, over or around the ear, or through the upper part of the mandible and/or the zygomatic area.[6] The most widely used diagnostic criteria for many years were those

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(Received on 15.09.2011, accepted on 14.11.2011)

proposed by Sjaastad in 1990 and subsequently updated in 1998[7]

A number of treatment techniques are in use clinically for its cure. Among them are the Cervical Therapeutic Exercise Programme and Myofascial Release Techniques. The aim of the study is to find that which among the Cervical Therapeutic Exercise Programme and Myofascial Release is more effective in reducing cervicogenic headache parameters namely Neck Disability Index score, Visual Analog Scale score, Headache Frequency, Headache Duration in 30 patients with cervicogenic headache.

Methods

The study was performed on 30 subjects within the age group 16-60 years taken from the patients of cervicogenic headache coming in the physiotherapy OPD, Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences and Research, Balawala, Dehradun, Gurudwara O.P.D, Bala Pritam Dispensary and Physiotherapy O.P.D, Patel Nagar, Dehradun and Prayas Rehabilitation and Physiotherapy centre, Dehradun. Study was performed in accordance with ethical considerations of the institute and their consent was taken prior to the study. The subjects were selected on the basis of random sampling according to the inclusion and exclusion criteria and divided into 3 groups- Conventional, Exercise and MFR groups (n=10). The inclusion criteria was pain localized to the neck and occipital region and projecting to forehead, orbital region, temples, vertex or ears, limitation of cervical movements, abnormal tenderness on palpation of neck muscles, Unilateral headache with no side shift, pain precipitating or aggravating by neck movements or sustained pressure, homolateral shoulder or arm pain, stiffness and pain of the neck, patients between age group 16-60 years. The exclusion criteria was patients with other type of headache like tension headache, migraine, patients who underwent any recent surgery in the neck region, patients with vertebrobasilar insufficiency, patients with side shifting of pain, patients in whom pain is relieved by NSAID'S, analgesics, patients with continuous, unrelieving pain, nocturnal pain, patients with musculoskeletal injuries in the neck, patients with psychological problem and patients with hypo or hyper sensitivity.

The subjects were explained about the whole procedure in detail prior to starting the procedure and the pre treatment readings

Table 1: Mean and Standard Deviation of Age

Group	Mean	SD
Conventional	32.1	11.68
Exercise	27.2	9.36
MFR	29.9	11.42

Table 2: Comparison of means of pre and post protocol readings of Neck Disability Index (NDI) score, Visual Analog Scale (VAS) score, Headache Frequency (HF), and Headache Duration (HD) of each group

Variables	Pre protocol	Post protocol	t-value
CONVENTIONAL GROUP			
NDI	44.77±10.06	21.17±7.64	0
VAS	6.67±1.51	3.35±1.84	6.335
HF	6±2.16	3.2±2.20	0
HD	13.10±15.86	4.5±5.19	0
EXERCISE GROUP			
NDI	35.83±14.59	20.31±10.03	0
VAS	6.41±1.40	3.29±1.44	9.381
HF	5±2.11	2.4±1.90	0
HD	26.9±12.60	7.2±10.22	0
MFR GROUP			
NDI	40.33±17.01	11.82±4.50	0
VAS	5.85±1.68	1.25±0.82	8.615
HF	5±2.11	1±0.00	0
HD	32.40±8.10	1.8±1.23	0

were noted. The subjects in the conventional group were first given hydrocollator packs followed by TENS, manual cervical traction, cervical spine mobilization, kneading and in the stretching of trapeius and suboccipital muscles were performed. Subjects in exercise group were given the conventional same as that given to the subjects in the conventional group. Apart from this, they were made to follow a Cervical Therapeutic Exercise Programme. Subjects in the MFR group received apart from the treatment given to the subjects of exercise group additional myofascial release techniques- Cranial Base Release, Cervical Laminar Release, Bilateral Gross Stretch of Upper Trapezius. Post treatment readings were recorded on the 7th day after the treatment.

Results

Table 1 shows mean and standard deviation of age of the subjects in the three groups. Each group consisted of 10 subjects. The mean and standard deviation of age for the Conventional, Exercise and MFR were 32.1±11.68 years, 27.2±9.36 years and 29.9±11.42 years respectively.

Table 2 compares the means and standard deviations of the pre and post protocol readings of cervicogenic headache parameters in each group using dependent t test for Visual Analog Scale score and Wilcoxon signed rank test for Neck Disability Index score, Headache Frequency and Headache Duration.

For the Conventional Group, the t value for the comparison of mean values of Neck Disability Index score on Day 0 (44.77±10.06) and on day 7 (21.17±7.64) was 0 and was statistically significant. The mean values of Visual Analog Scale score on Day 0 (6.67±1.51) and on day 7 (3.35±1.84) had a significant difference with a t value of 6.335. The mean values of Headache Frequency on Day 0 (6±2.16) and on day 7 (3.2±2.20) and that of Headache Duration on Day 0 (13.10±15.86) and on day 7 (4.5±5.19) were with significant difference. The t value for both the variables was 0.

Similarly with the Exercise Group, the mean values of Headache Frequency on Day 0 (5±2.11) and on day 7 (2.4±1.90), Headache Duration on Day 0 (26.9±12.60) and on day 7 (7.2±10.22) and that of Neck Disability Index score on Day 0 (35.83±14.59) and on day 7

Table 3: Comparison of the pre and post protocol readings of NDI, HF and HD between the Conventional, Exercise and MFR groups

Variables	Pre H- value	Post H values
NDI	1.7238	9.5674
HF	1.1861	8.6587
HD	7.3149	

Table 4: Comparison of the mean difference of headache duration readings (0-7 session) between the conventional, exercise and MFR groups

Variable	H value	p value
HD	14.340	**p<0.05**

Table 5: Comparison of the improvement of mean difference for Headache Duration between the conventional, exercise and MFR groups

Variable	J value	p value
HD	3.998	**p<0.05**

Table 6: Jonckheere Trent Test for the post protocol readings of Neck Disability Index (NDI) score and Headache Frequency of the three groups

Variables	J Value
NDI	-2.803
HF	-3.130

Table 7: ANOVA for the comparison between the post protocol readings of Visual Analog Scale (VAS) score of the Conventional, Exercise and MFR groups.

Variable	F-value
VAS	6.968

Table 8: Post – Hoc Scheffe's Analysis for the post protocol readings of VAS scores

Dependent Variable	(I) Variable 00001	(J) Variable 00001	Mean difference (I-J)	Std. Error	Sig.	95% Confidence	
						Lower Bound	Upper Bound
VAS	Conventional	Exercise	.0600	.64048	0.996	-1.598	69.29
		MFR	2.1000(*)	.64048	0.011	0.441	147.76
	Exercise	Conventional	-.0600	.64048	0.996	-1.718	63.14
		MFR	2.0400(*)	.64048	0.013	0.381	144.68
	MFR	Conventional	-2.1000(*)	.64048	0.011	-3.758	-15.32
		Exercise	-2.0400(*)	.64048	0.013	-3.698	-12.24

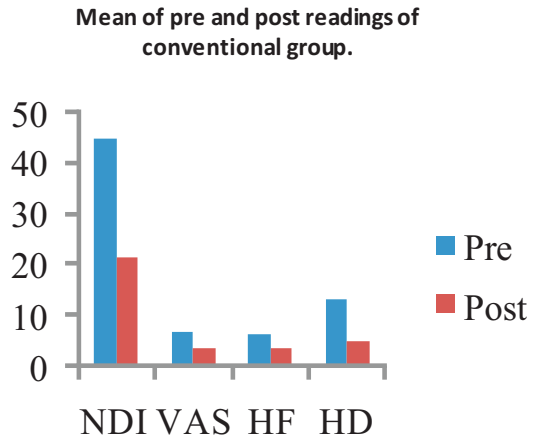
* The mean difference is significant at the 0.05 level

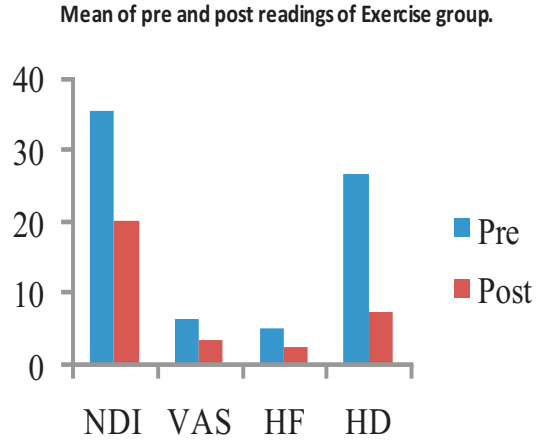
(20.31±10.03) were with significant difference. The t value for the above three the variables was 0 each. The t value for the comparison between the Visual Analog Scale score on Day 0 (6.41±1.40) and on day 7 (3.29±1.44) was 0 and were found to have a significant difference.

For the MFR group, the mean value of Neck Disability Index score on Day 0 (40.33±17.01) and on day 7 (11.82±4.50) was with significant difference (t=0). The mean value of Visual Analog Scale score on Day 0 (5.85±1.68) and on day 7 (1.25±0.82) was with significant difference (t=8.615). The mean value of Headache Frequency on Day 0 (5±2.11) and on day 7 (1±0.00) was with significant difference (t=0). The mean value of Headache Duration on Day 0 (32.40±8.10) and on day 7 (1.8±1.23) was with significant difference (t=0).

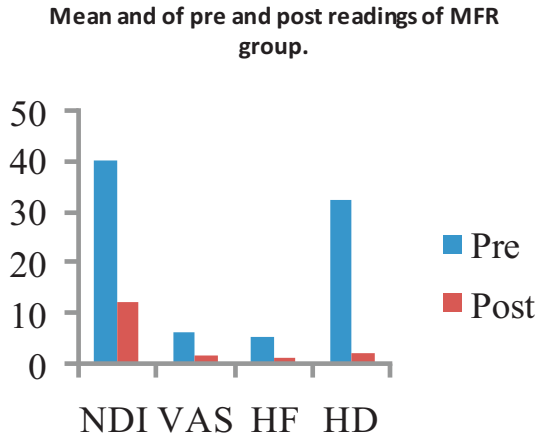
The above analysis reveals that all the three treatment approaches viz Conventional, Cervical Therapeutic Exercise Programme and Myofascial Release Techniques are effective in reducing the cervical headache parameters.

Table 3 compares the pre and post protocol readings of Neck Disability Index (NDI) score, Headache frequency (HF) and Headache





Duration (HD) between the conventional, exercise and MFR groups using Kruskal Wallis Test. The H value of pre NDI score (1.7238) and post NDI (9.5674) both were of significant difference. Similarly The Pre H value of headache frequency () value of Headache Frequency (8.6587) was of significant difference. The H value of Headache Duration (7.8813) was of significant difference. The comparison revealed that the three treatment techniques i.e. Conventional Treatment, Exercise Protocol and Myofascial Release Techniques produced significant difference in the Neck Disability Index score, Headache Frequency and Headache Duration.



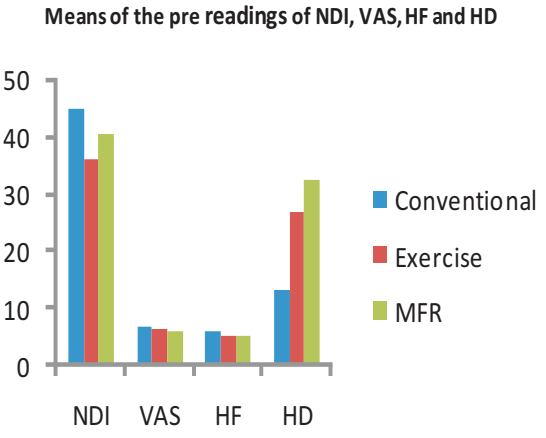
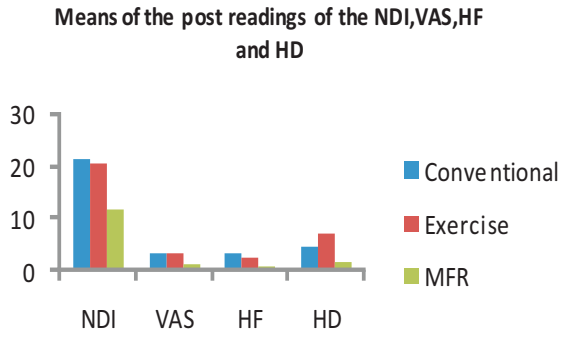


Table 4 compares the readings of headache duration at (0-7) session mean difference between the conventional, exercise and MFR groups. Its H value (14.340) was of significant difference. The comparison revealed that the three treatment techniques i.e. Conventional



Treatment, Cervical Therapeutic Exercise Programme and Myofascial Release Techniques produced significant differences in the Headache Duration

Table 5 compares results of Jonckheere Trend Test for the improvement of mean difference for Headache Duration (HD) between the conventional, exercise and MFR groups. The J value of HD (3.998) was of significant difference ($p<0.005$). The analysis reveals that there is a significant trend in the scores of improvement of mean difference for Headache Duration with MFR group having the maximum scores followed by Exercise group and with Conventional group having the least scores

Table 6 compares results of Jonckheere Trend Test for the post protocol readings of Neck Disability Index (NDI) score, Headache frequency (HF) and Headache Duration (HD) between the conventional, exercise and MFR groups. The J value of NDI (-2.803) was of significant difference. The J value of Headache Frequency (-3.130) was of significant difference. The J value of Headache Duration (-0.971) was non significant. The analysis reveals that there is a significant trend in the NDI scores and Headache Frequency with MFR group having the lease scores followed by Exercise group and with Conventional group having the highest NDI scores. The result also reveals that there is no trend in the values of Headache Duration of the three groups.

Table 7 compares the post protocol readings of Visual Analog Scale (VAS) score between the Conventional, Exercise and MFR groups.

The F-value of VAS (6.968) was of significant difference.

Table 8 shows the Post Hoc analysis of the post protocol readings of Visual Analog Scale (VAS) of the Conventional, Exercise and MFR groups using Scheffe's Test. The results indicate that there was no significant difference between the conventional and Exercise Group (p=0.996). The comparison between the Exercise and MFR Groups was significant (p= 0.013) with the MFR group having lower VAS scores. The comparison between MFR and Conventional groups was significant (p= 0.011) with the MFR group having lower VAS scores.

Discussion

The results revealed that treatment with the exercise protocol showed significant effect on all the cervicogenic headache parameters i.e. Neck Disability Index score, Visual Analog Scale score, Headache Frequency and Headache Duration. The results accord with those of Jull et al., 2002. They found in their study that exercise treatment significantly reduced headache frequency and intensity and the neck pain index immediately after treatment and the results were consistent.[8] These effects may be brought about by an improvement in the strength and endurance of the deep cervical extensor muscles. According to Jull 1999 dysfunction has been identified in general neck flexor strength and endurance in patients with neck pain and headache.[9] Furthermore Watson and Trott in their study found that cervical headache sufferers: (i) exhibit forward head posture; (ii) demonstrate weakness of the upper cervical flexor musculature; (iii) lack endurance of the upper cervical flexor musculature; and (iv) present with a forward head posture and concomitant lack of isometric endurance of the upper cervical flexor musculature.[3] This exercise program specifically addresses impairments in deep neck flexor and extensor muscles. The exercise approach is a motor relearning program where the emphasis is on rehabilitating the impaired coordination of the cervical and scapular muscle synergies and on retraining the endurance capacities of the deep neck flexor and extensor muscles and shoulder girdle muscles at low levels of load as is required for their function of support and control of cervical joints and posture. This exercise protocol is a specific low load exercise to reeducate muscle control of cervicoscapular region instead of muscle strengthening. The exercises directly address the muscle impairment found in cervicogenic headache patients.[8]

The results indicate that treatment with the Myofascial Release Techniques showed significant effect on all the cervicogenic headache parameters i.e. Neck Disability Index score, Visual Analog Scale score, Headache Frequency and Headache Duration. There is less literature available to explain the mechanism behind the changes in these variables. A number of mechanisms have been proposed explaining the mechanism by which these myofascial release techniques works: Viscoelastic, neurophysiologic, piezoelectric reactions[10]

Viscoelastic

The improvements seen after treatment with Myofascial Release techniques are probably due to stretching of the elastic component, a change in the viscosity of the ground substance from a more solid to a gel state.[11] Myofascial Release Techniques cause the thixotrophic gel to change to a more fluid state, allowing for decreased pressure on pain sensitive structures and increased motion, and allows the solidified, dehydrated thixotrophic gel to transition to a liquid state. This rehydration of the ground substance allows for a complete release all the way down to the cellular level.[12] The viscosity of the ground substance has an effect on the collagen since it is believed that the viscous medium that makes the ground substance controls the ease with which collagen fibers rearrange themselves. This is because a change in viscosity increases the production of

hyaluronic acid and increases the glide of the fascial tissue.[11] This results in an increase in soft tissue flexibility which relieves tissue tension within the elastocollagenous complex. While the density and viscosity of the matrix (ground substance) decreases resulting in improved metabolism and health.[13]

Neurophysiologic

Fascia is densly innervated by interstitial tissue receptors. Slow and deep pressure as is applied in myofascial release techniques stimulates interstitial and Ruffinin mechanoreceptors, which results in an increase of vagal activity, which changes then not only local fluid dynamics and tissue metabolism, but also results in global muscle relaxation.[14] Furthermore, stimulation of interstitial mechanoreceptors triggers the autonomic nervous system to change the local fluid pressure in the fascial arterioles and capillaries. And these receptors if strongly stimulated, can also lead to extravasation of the plasma from the blood vessels into the interstitial fluid matrix. Such a change of local fluid dynamics means a change in the viscosity of the extracellular matrix. This first autonomic feedback loop is called Intrafascial Circulation Loop. Another Hypothalamus Loop was proposed according to which, stimulation of intrafascial receptors increases the vagal tone which leads to a more trophotropic tuning of the hypothalamus resulting in lowered overall tonus of the body musculature and , emotional, cortical and endocrinal changes that are associated with deep and healthy relaxation. Apart from this Fascial Contraction Loop was proposed. According to this loop, stimulation of intrafascial mechanoreceptors triggers the Autsonomic nervous system to alter the tonus of intra fascial smooth muscles. Thus to sum up, practitioner's manipulation stimulates intrafascial mechanoreceptors, which are then processed by central nervous system and autonomic nervous system. The response of the central nervous system changes the tonus of some striated muscle fibers. The autonomic nervous system response includes the altered muscle tonus, a change in local vasodialatation and tissue viscosity, and a lowered tonus of intrafascial smooth muscles.[15]

Piezoelectric reactions

This property establishes that when a crystal is subjected to a mechanical tension, potential differences and electrical load appears on its surface. The crystal deforms under the application of electrical forces when an electrical force is applied. The crystals in our body are liquid crystals. When a mechanical action is performed, for example, the stretching of a muscle tendon, the fascial system is activated and a tiny electrical pulsation is produced. This pulsation is electrically transmitted crossing the fundamental substance of the connective tissue.[10] This piezoelectric event changes the electrical charge of the collagen amd proteoglycans within the extracellular matrix affecting the ground substance (changing it from a sol to a gel state)[16]

It was found that significant differences was found in the scores of Neck Disability Index, Headache Frequency, Visual Analog scale with the group on which Myofascial Release techniques were applied showed lowest scores followed by the group on which exercise protocol was applied. However headache Duration did not show any trend in its scores. This shows that Myofascial Release Techniques are most effective in reducing Neck Disability Index scores, Visual Analog Scale scores and Headache Frequency. Fascia covers the muscles, bones, nerves, organs, and vessels down to the cellular level. Therefore, malfunction of the system due to trauma, poor posture or inflammation can bind down the fascia.[11] The myofascial system tends to dehydrate after trauma or inflammatory processes, turning the ground substance into the equivalent of glue or cement.[12] It is through that process that this binding down or restriction may result in poor or temporary results achieved by therapeutic treatments. This is because exercise programs affect only the muscular and elastic components of the fascial systems.[11] But they

do not change the dehydration and resultant solidification of the ground substance.[12] Only MFR with its emphasis on using bioenergy and piezoelectric effect that occurs as we sustain the releases, barrier after barrier, affects the total fascial system.[11]

Conclusion

Thirty patients of cervicogenic headache were investigated to compare the effectiveness of an Exercise Protocol and Myofascial Release Techniques on Neck Disability Index (NDI) score, Visual Analog Scale (VAS) score, Headache Frequency (HF) and Headache Duration (HD) over a period of 7 days. From this study it is suggested that null hypothesis does not hold valid and so alternate hypothesis can be accepted. Thus we can conclude that the present study shows that both Exercise Protocol and Myofascial Release Techniques were effective in treating reducing NDI, VAS, HD, HF. However, on comparing both the treatment techniques Mofascial Release Techniques were more effective than the exercise protocol in reducing NDI, VAS, HD, HF.

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