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Original Research Article

Myofascial Trigger Point Release in Chronic Non-Traumatic Neck Pain

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ABSTRACT

Objective: The objective of this study is to investigate the effect of myofascial trigger point release prior to craniocervical flexor exercise on cervical joint position sense in chronic non-traumatic neck pain.
Materials and Methods: 30 subjects with an age range of 25 - 35 years were recruited for the study. Subjects were selected on the basis of inclusion and exclusion criteria by purposive sampling method. Subjects were randomly assigned into two groups. Subjects in Group A (control group) received craniocervical flexor exercise and Group B (experimental group) received myofascial trigger point release in the form of Muscle Energy Technique (MET) prior to craniocervical flexor exercise. Ergonomic advices, stretching exercises, free exercises of neck and shoulders and isometric neck exercises were commonly taught to all subjects. The subjects were measured for neck pain intensity, cervical joint position sense and disability level by Numeric Rating Scale (NRS), Joint Reposition Error (JRE) and Neck Disability Index (NDI) respectively.
Results: The outcome measures were analysed using paired 't' test and independent 't' test. Both groups A and B showed significant differences ($p<0.05$) in neck pain intensity, cervical joint position sense and disability level within the group before and after interventions. The experimental group showed significant reduction of neck pain intensity (1.86 ±0.63), joint reposition error (1.86 ±0.63) and disability level (6.60 ±1.29) when compared with the control group.
Conclusion: Myofascial trigger point release prior to craniocervical flexor exercise enhances cervical joint position sense and also brings positive outcome on neck pain intensity and disability level.

Key Words: Myofascial trigger point, Craniocervical flexor exercise, Muscle energy technique, Joint position sense and Joint reposition error.

INTRODUCTION

Neck pain is one of the major health problems encountered by public which affects their personal health, overall well-being and serves as an indirect expense to them. [1] Neck pain is classically defined as pain which is perceived by an individual in a region between the superior nuchal line and an imaginary transverse line through the first thoracic vertebra spinous process. Chronic pain is defined as a disease process that lasts more than 3 months. [2] The incidence of neck pain is increasing throughout the world and its range is reported as 10.4% to 21.3% with a higher incidence observed among office and computer workers. The recovery rate of neck pain at 1 year is between 33% and 65%. Most of the cases run as an episodic course in a person's lifetime and recurrences are common. Prevalence is generally higher in women, high-income countries and urban areas when compared with low-income, middle-income countries and rural areas. [3]

Neck pain is a common musculoskeletal disorder (MSD) that affects approximately one-third of adults. Co-morbidities of neck pain such as low back pain, shoulder pain, arm pain and wrist pain among computer based professionals are more prevalent. It was also reported that myofascial pain syndrome (MPS) was the commonest diagnosis in subjects with neck pain. [4] Myofascial pain syndrome is a painful muscle disorder that occurs following stress or injury to the muscle. A trigger point is characterized by the following features: 1) presence of tenderness in a taut band of muscle fibers; 2) stimulation of the trigger point produces local twitch of the taut band of muscle fibres; 3) reproduction of the patient's symptoms when stimulated; 4) muscle weakness without atrophy; and 5) limited range of motion. Diagnosis of trigger point is made by identification of these features on physical examination. Trigger points are treated with various manual and invasive techniques. Treatment involves inactivation of the myofascial trigger point for instant pain relief and changes in biomechanics to give sustained improvement and restoration of normal function. For the treatment to be effective the predisposing factors in the formation of trigger points need to be eliminated. Corrections of comorbid disorders like postural and psychological stressors are necessary for the treatment to be successful. [5]

Subjects with neck pain demonstrate an impaired activation of the deep cervical flexors that result in altered neuromotor control. During craniocervical flexion, subjects with chronic non-traumatic neck pain have an altered neuromotor control strategy. This may result from reduced activity in the deep cervical flexors and an increased activity in the superficial cervical flexors. The subjects also showed reduced isometric endurance of the deep cervical flexor muscles. [6] There is a relationship between altered deep cervical flexor muscle activity and chronic neck pain symptoms. [7] The cervical spine receptors have vital connections with vestibular, visual apparatus and many areas of central nervous system. The integration, timing and tuning of sensorimotor control can be altered due to change in afferent input because of cervical receptors dysfunction in neck disorders. Measurable changes of cervical joint position sense in patients with neck disorders can be related to sensorimotor control alterations. [8]

Analysis of posture, movement patterns and gait provides a lot of clinical information about the cause of increased muscle tension. Muscle imbalance is not just a response of an individual muscle. It occurs due to reactions of the whole muscle system. This view is strongly supported by the recent findings of neurodevelopmental kinesiology. Weakness or tightness of muscles does not occur randomly, they take the form of typical "muscle imbalance patterns". Muscle imbalance develops mainly between "tonic" muscles and "phasic" muscles. Tonic muscles are those that are more prone to develop tightness and phasic muscles are muscles that are prone to develop inhibition. According to Janda, levator scapulae muscles are considered as postural muscles which have the tendency to develop tightness in both normal and pathological conditions. Forward head posture results in muscle imbalance which leads to tightness of neck extensors (levator scapulae) and weakness of deep neck flexors. Poor quality and movement control can produce harmful stresses on mechanics of the joints and muscles. [9]

Neck posture mainly depends on the kinaesthetic proprioception and core muscles of cervical spine. Because of prolonged stress & strain, muscles develop trigger points that leads to muscular imbalances and altered joint position sense. There are no studies that have analyzed cervical joint position sense through myofascial trigger point release in the form of Muscle Energy Technique (MET) prior to craniocervical flexor exercise. Therefore, the objective of this study is to investigate the effect of myofascial trigger point release in the form of MET before performing craniocervical flexor exercise on cervical joint position sense in chronic non-traumatic neck pain. We hypothesized that neck pain intensity and disability level would also be decreased.

MATERIALS AND METHODS

Study Design, Setting and Population: An experimental study was conducted with 30 subjects. Subjects were selected for the study on the basis of inclusion and exclusion criteria by purposive sampling method. A study was conducted in Asia metropolitan university for 12 months duration. Subjects were randomly assigned into two groups namely Group A (control group) and Group B (experimental group). Subjects in Group a received craniocervical flexor exercise and Group B received myofascial trigger point release in the form of MET and craniocervical flexor exercise.

Inclusion criteria includes both genders, age between 25 to 35 years, office workers, presence of latent/active trigger point in the levator scapulae muscles, complaining of non traumatic neck pain for more than 3 months, presence of altered movement pattern of cervical flexion and demonstrate poor performance (unable to achieve 24 mm Hg or inability to sustain for a period of 10 seconds) on the clinical test of craniocervical flexion as defined by Jull et al. Exclusion criteria were specific cervical spine disorders such as trauma, cervical spine instability, inter vertebral disk prolapse, cervical radiculopathy and/or myelopathy, cervical spondylosis, spinal stenosis, spasmodic torticollis, postoperative conditions, fibromyalgia and pregnancy. These conditions were assessed by the subjects' medical history and by clinical examination. The duration of intervention for each subject was 6 weeks (5 times / week). The university research ethical committee approved the study and informed consent was obtained from all subjects after the study protocol had been explained to them.

Outcome Measures: Neck pain intensity was assessed by Numeric Rating Scale (NRS), where 0 denoted "no pain" and 10 "worst pain possible", and neck position sense by Joint Reposition Error (JRE) and disability by Neck Disability Index (NDI).

Cervical joint position sense was assessed by JRE. To measure JRE, a strap with a laser on its top was placed on each subject's head. The subjects were seated comfortably with their head and neck in neutral position, thorax and shoulder unfixed and exactly 90 cm away from the target (white screen). Each subject was asked to maintain the head in neutral resting position by looking straight at the white screen in his / her perceived most comfortable position with the eyes opened. The laser point on white screen was marked. With eyes closed, each subject was asked to move the head five times in all planes (flexion and extension, right and left side flexion and rotation) as far as comfortable and then reposition the head to the starting position. The point where the laser came to a rest on the target was marked. Measurement was taken from starting point of laser marking to the reposition point of laser marking in centimetres which represents the JRE in first attempt. Following the measurement of JRE, subject was then aided in returning his/her head back to the start position by opening the eyes. The same process was repeated. No practice trials were allowed and the mean of the 3 trials was used in the analysis. [8, 10]

Intervention Procedures: Subjects with chronic non-traumatic neck pain were randomised into two groups such as control and experimental groups. Interventions for both groups were conducted over a 6-weeks period. All subjects in both groups were commonly taught stretching and free exercises of neck and shoulders and isometric neck exercises. Subjects were advised to perform all exercises twice a day, morning and evening at home. The physiotherapist supervised the exercise session for all subjects immediately after intervention to ensure that all the exercises were performed in a proper manner. None of the exercise sessions were longer than 15 - 20 minutes. The exercises were to be performed without any provocation of neck pain. All subjects were supplied with an exercise diary and requested to practice their respective regime twice per day for the duration of the trial. Ergonomic advices were also taught for all subjects before commencing interventions. Subjects were requested not to receive any other form of specific intervention for their neck.

Trigger points were assessed and released over the levator scapulae muscles by myofascial trigger point release in the form of MET. These techniques were performed 5 times a week only for experimental group followed by craniocervical flexor exercise. Levator scapulae muscle originates from dorsal tubercles of the transverse processes of C1-C4 and is inserted into the superior angle of scapula and adjacent part of the medial border of scapula. The primary function of the muscle is extension and lateral flexion of the cervical spine and also raises, abducts and rotates the scapula. [5, 11]

Muscle energy techniques are a class of soft tissue osteopathic manipulation methods that incorporate precisely directed and controlled, patient initiated, isometric and/or isotonic contractions, designed to improve musculoskeletal function and reduce pain. The method used in treating the levator scapulae muscle involved Lewit's post-isometric relaxation approach. The subject was in supine lying position with the arm of the side to be treated stretched out alongside the trunk with the hand separated. The therapist, standing at the head side of the table, passed his contralateral arm under the neck to rest on the subject's shoulder on the side to be treated, so that the therapist's forearm supported the subject's neck. The therapist's other hand supported and directed the head into subsequent positioning. The therapist's forearm lifted the neck into full flexion (aided by the other hand). The head was turned fully into side-flexion and rotation away from the side being treated. With the shoulder held caudally by the therapist's hand and the head/neck in full flexion, side-flexion and rotation (each at its resistance barrier), all available slack was removed in the levator scapulae, from both ends. The patient was asked to take the head backwards towards the table, and slightly to the side from which it was turned, against the therapist's unmoving resistance, while at the same time, a slight (20% of available strength) shoulder shrug was asked for, and resisted. Following the 7-10 seconds isometric contraction and complete relaxation of all elements of this combined contraction, the neck was taken to further flexion, side-bending and rotation, where it was maintained, as the shoulder was depressed caudally with the subject's assistance, following the instruction, 'As you breathe out, take your shoulder blade towards your pelvis'. The stretch is held for 30 seconds. From the new position, the process was repeated three to five times in one intervention session. [12]

MET – LEVATOR SCAPULAE ON THE LEFT SIDE

Craniocervical flexor exercise is a low load exercise to more specifically train the deep cervical flexors. Training of the craniocervical flexor muscles followed the protocol described by Jull et al. The exercise targets the deep flexor muscles of the upper cervical region, the longus capitis and longus colli muscles, rather than the superficial flexor muscles like the sternocleidomastoid and anterior scalene. In this program, an emphasis was placed on first attaining the correct craniocervical flexion action, with minimal activity of the superficial cervical flexor muscles. Once the correct action had been achieved, the subject was guided by the feedback from the pressure sensor to sequentially reach 5 pressure targets in 2–mm Hg increments from a baseline of 20 mm Hg to the final level of 30 mm Hg. Subjects were instructed to "gently nod their head as though they were saying 'yes'." The physical therapist identified the target level that the subject could hold steadily for 10 seconds without resorting to retraction, without dominant use of the superficial neck flexor muscles and without a quick, jerky craniocervical flexion movement. Contribution from the superficial muscles was monitored by the physical therapist in all stages of the test using observation or palpation. Training was commenced at the target level that the subject could achieve with a correct movement of craniocervical flexion and without dominant use or substitution by the superficial muscles (sternocleidomastoid, hyoid and anterior scalene muscles). The subjects were taught to perform a slow and controlled craniocervical flexion action. For each target level, the contraction duration was increased to 10 seconds, and the subject trained to perform 10 repetitions. At this stage, the exercise was progressed to train at the next target level. [6,13] Exercises were progressed with increasing hold time and repetitions. All subjects were requested to perform craniocervical exercise for a period of 6 weeks, 5 times a week; totally 30 intervention sessions.

Statistical Analysis: Data analysis is the method by which the validity of a research study is evaluated. The outcome measures were analysed using paired 't' test and independent 't' test. Continuous variables were represented as mean ± standard deviation (SD). The mean difference within and between the groups and a 95% confidence interval (CI) were calculated for all outcome measures. A 2-tailed p value of < 0.05 was considered statistically significant. All analyses were performed using SPSS version 20.

RESULTS

Thirty subjects were recruited for the study. The base line characteristics of the subjects are presented in Table 1. Fifteen subjects (8 females, 7 males) were allocated to control group and 15 to the experimental group (9 females, 6 males).

Table 1: Baseline characteristics of subjects.

Variables	Control group (n =15)			Experimental group (n =15)		
	Mean ±SD	Median	Range	Mean ±SD	Median	Range
Age (yrs)	28.86 ± 2.44	29	8	28.80 ± 3.32	28	10
Height (cm)	166.4 ± 10.3	170	35	162.4 ± 8.2	163	21
Weight (Kg)	69.6 ± 3.6	70	12	70.6 ± 7.1	68	25
Neck pain history (Months)	6.0 ± 1.79	6	6	5.9 ± 2.10	5	8
Average duration of working hours/ day	5.4 ± 1.06	5	3	5.8 ± 1.32	6	4
NRS (0-10 cm)	7.1 ± 0.74	7	2	7.3 ± 0.89	7	3
JRE (cm)	6.2 ±1.08	6	4	6.1 ±1.06	6	4
NDI (0-50)	23.6 ± 2.31	24	8	23.2 ± 1.26	23	5

NRS-Numeric Rating Scales, JRE-Joint Reposition Error, NDI-Neck Disability Index.

Table 2: Control group: Pre and post test differences were compared by paired't' test.

Outcome Measures	Pre intervention		Post intervention		Mean change	95% CI of Mean change	p
	Mean	SD	Mean	SD			
Pain intensity	7.13	0.74	4.13	0.74	3.00	2.48, 3.51	.000
NPS	6.20	1.08	3.40	0.73	2.80	2.37, 3.22	.000
Disability level	23.66	2.31	9.60	1.63	14.06	12.83, 15.29	.000

Table 3: Experimental group: Pre and post test differences were compared by paired't' test.

Outcome Measures	Pre intervention		Post intervention		Mean change	95% CI of Mean change	p
	Mean	SD	Mean	SD			
Pain intensity	7.33	0.89	1.86	0.63	5.46	4.87, 6.05	.000
NPS	6.13	1.06	1.86	0.63	4.26	3.65, 4.87	.000
Disability level	23.20	1.26	6.60	1.29	16.6	16.05, 17.14	.000

Table 4: Post test differences of control & experimental groups were compared by independent't' test.

Outcome Measures	Control		Experimental		Mean change	95% CI of Mean change	p
	Mean	SD	Mean	SD			
Pain intensity	4.13	0.74	1.86	0.63	2.26	1.74, 2.78	.000
NPS	3.40	0.73	1.86	0.63	1.53	1.01, 2.04	.000
Disability level	9.60	1.63	6.60	1.29	3.00	1.89, 4.10	.000

For both groups, paired 't' test was used to analyze the difference between pre and post values of neck pain intensity, neck position sense and disability level. In the control group (Group A), significant differences ($p<0.05$) were found between pre (7.13±0.74) and post (4.13±0.74) values of neck pain intensity. The experimental group (Group B) also demonstrated significant differences ($p<0.05$) between pre (7.3±0.89) and post (1.8±0.63) values of neck pain intensity. In relation with neck position sense, group A showed significant differences ($p<0.05$) between pre (6.2±1.08) and post (3.4±0.73) interventions. Group B also demonstrated significant differences ($p<0.05$) on neck position sense between pre (6.1±1.06) and post (1.8±0.63) intervention. Both groups A and B showed significant differences ($p<0.05$) in disability level before and after interventions. The values for group a pre and post interventions were 23.6±2.31 and 9.6±1.6 and group B were 23.2±1.26 and 6.6±1.29 respectively.

Reduction of neck pain intensity between the groups were compared using independent 't' test. The subjects in experimental group (1.86 ±0.63) showed significant reduction of neck pain intensity ($p<0.05$) when compared to the control group (4.13 ±0.74). There were significant changes over head relocation accuracy ($p<0.05$) in experimental group (1.86 ±0.63) compared with the control group (3.40 ±0.73). While comparing the disability level between groups, the experimental group (6.60 ±1.29) showed significant reduction in disability ($p<0.05$) compared with control group (9.60 ±1.63).

DISCUSSION

The results of the present study showed that myofascial trigger point release in the form of MET prior to craniocervical flexor exercise interventions were most effective in improving the cervical joint position sense and reducing neck pain and functional disabilities compared with the control group. An important factor contributing to chronic neck pain might be the presence of trigger points that may lead to pain, muscular imbalances and impairment of kinaesthetic sensibility in subjects with chronic non-traumatic neck pain.

Occupational activities that produce repetitive stress on a specific muscle or muscle group commonly cause chronic stress in muscle fibers, leading to trigger points. A muscle with trigger points shows weakness without atrophy and is not neuropathic or myopathic. It is usually rapidly reversible on inactivation of the trigger point, suggesting that it is caused by inhibition of muscle action. Structural imbalances may also result from chronically shortened muscle groups. A trigger point in one muscle can inhibit the contractile force of another muscle, suggesting a role for central motor inhibition. Stretching the affected muscle through MET reduces the sensitivity of the trigger points and also helps in relieving the tightened sarcomeres of the knots in the trigger point. [14,15] Key postural muscles will be facilitated by specific postural-correction strategies. [16]

Subjects with moderate to severe neck pain show impairment of neck function. Inactivation of trigger points and strengthening of cervical core muscles improve the neck position sense. Muscle spindles play major role in kinaesthetic sensation. Mechanoreceptive inputs arising from muscle spindles are responsible for neck posture and movement through appropriate motor response. Bilateral activation of anterior and posterior neck muscles at various layers is responsible for head relocation accuracy. Head relocation accuracy is reduced due to impairment of kinaesthetic sense following movement in subjects with neck pain. Muscle spindle discharge is changed due to pain resulting in altered proprioception. Motor control abnormality may expose the spinal components to abnormal and repetitive strain. [17]

It would appear that manual and exercise therapy are complementary to each other, providing additive benefits in terms of pain relief. Both intervention techniques appear to have pain-modulating properties that may have some neurophysiological basis. Improvement in neck pain following muscle training denotes enhancement of physical support for the cervical vertebra column due to improvements in activation, strength, endurance, fatigability and proprioceptive acuity of the cervical muscles and spine. [18]

When comparing both groups, the experimental group showed significant differences on all outcome measures. These changes might be associated with inclusion of MET for inactivation of trigger points over the levator scapulae muscles. Trigger point is a dysfunctional motor end plate whose abnormal activity is modulated in some way by the sympathetic nervous system resulting in pain. These manual techniques brought significant changes over the outcome measures due to inactivation of the trigger points that resulted in restoration of the muscles optimal length. Several studies have lent support for the concept of neurological muscle relaxation in MET by providing evidence of a strong, brief neuromuscular inhibition following isometric muscle contraction. [5, 12] The ability to maintain neutral posture of the cervical spine may be reduced due to sensorimotor control deficits which occur soon after the onset of pain. The cervical spine receptors play a major role in sensorimotor control. Functional impairment of cervical muscles could alter the cervical spine mechanoreceptors function. Specific treatments to the neck such as manual therapy and craniocervical flexion training have improved cervical joint position error in patients with neck pain. [(8)]

In agreement with previous studies, the control group also showed significant positive changes on all outcome measures such as pain intensity, joint relocation error and disability level. These changes following only 6 weeks of craniocervical flexor exercise may be associated with neuromuscular adaptations such as greater synchronization of motor units, altered sensitivity of muscle receptors and reduced recruitment of nonprimary muscles. [(19)] There were several limitations in this study. The limitations were small sample size, lack of blinding, (although standardized testing and intervention methods were used), no treatment control group and no follow-up.

CONCLUSION

The findings of this study suggest that myofascial trigger point release in the form of MET prior to craniocervical flexor exercise enhances cervical joint position sense and also brings positive outcome on neck pain and physical disability. Inactivation of trigger points using MET prior to cervical core muscle strengthening and traditional physiotherapy interventions such as stretching, free exercises, isometric neck exercises and ergonomic advices could be used to obtain more beneficial effects on subjects with chronic non-traumatic neck pain.

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