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Original Research Article

A Comparative Study on the Efficacy of Ischaemic Compression and Dry Needling with Muscle Energy Technique in Patients with Upper Trapezius Myofascial Trigger Points

Dr Tanusree Basak[1], Dr Tapas Kumar Pal[2], Ms Munmun Sasi[3], Dr Shabnam Agarwal[1]

[1]Associate Professor, [2]Assistant Professor, [3]Post graduate Scholar,
Nopany Institute of Healthcare Studies, Kolkata- 700006, India

Corresponding Author: Dr Tanusree Basak

ABSTRACT

Background: Myofascial pain is one of the most common examples of musculoskeletal pain arising from Myofascial Trigger Point (MTrP) frequently in Upper Trapezius Muscle. Ischemic compression (IC) is the application of direct, sustained digital pressure on the MTrP with sufficient strength and specific time duration, to slow the blood flow and relieve tension of that muscle. Muscle Energy Technique (MET) is another manual approach for achieving tonus release (inhibition) in a muscle. Dry Needling (DN) is a non-manual intervention where needle is inserted directly into an MTrP.
Objective: To evaluate the effect of IC and DN with common intervention of MET in patients with upper trapezius MTrP.
Intervention: Individuals (n=28) aged 18 to 30 years with palpable taut band in Upper Trapezius Muscle were randomly allocated into two treatment groups. Group A received IC and MET for 3 sessions for 1 week and Group B received DN and MET for 3 sessions for 1 week.
Study design: Comparative Experimental Design.
Outcome measures: Pain Pressure Algometry, Spin T Goniometry to measure cervical ROM, Neck Disability
Results: Within group analysis revealed significant improvement in either groups ($p<0.05$) after 1 week of intervention. However when both groups were compared, there was no statistical significant difference found.
Conclusion: IC and DN were equally effective in combination with MET in the treatment of upper trapezius MTrPs.

Keywords: Upper Trapezius Myofascial Trigger Point, Ischemic Compression, Dry needling, Muscle Energy Technique, Pain Pressure Algometry, Spin T Goniometry.

INTRODUCTION

Myofascial trigger point (MTrP) is a hyperirritable spot located within a taut band of a skeletal muscle which is painful on compression or stretch and can give rise to a typical referred pain. MTrPs are considered as a major source of pain in 30% of individuals with musculoskeletal dysfunction. [1]

The MTrPs are activated either due to structural inadequacies, postural stresses, immobility or jerkiness of movement, shortening of muscle and nutritional inadequacies. [2] They are activated by acute or persistent muscle overload on the muscle. [3] The formation of muscle TrPs may result from overuse, mechanical overload, psychological stress, joint dysfunction, or motor control impairments. [2] Acute sports injuries or repetitive stress also predispose a patient to the development of trigger points. [4] Lack of exercise, poor posture, vitamin

deficiencies, sleep disturbances, and joint problems may all predispose to the development of micro-trauma. [5] Several mechanical or chemical noxious events may hence excite and sensitize muscle nociceptors and play a role in the development of muscle Trigger Points (TrPs). [6]

Gerwin et al. have suggested that the pathogenesis of TrPs could result from injured or overloaded muscle fibers, which could lead to endogenous and involuntary shortening, loss of oxygen supply, loss of nutrient supply, and increased metabolic demand on local tissues. [7]

MTrPs also be related to integration in the spinal cord of response to the disturbance of nerve endings and abnormal contractile mechanism at multiple dysfunctional endplates. [8]

In a Danish study, 37% of males and 65% of females aged 30-60 had localized Myofascial pain. Focal neck muscle tenderness (Latent trigger point) was prevalent in 45% of male and 54% of female air force personal with an average age of 19 years. [9]

Patients with mechanical neck pain had active muscle MTrPs in neck-shoulder muscles. [10]

Chronic tension in upper trapezius muscle tends to elevate the shoulders, draw the head forward and the occiput downward, causing the neck to lose vertical dimension and creating pressure on the discs and facet joints in the neck; also it is often placed in a shortened position by poor ergonomics. The signs and symptoms related to MTrPs are head and neck pain, muscle stiffness, restriction of movement, dizziness, sweating, insomnia, limitation in daily activities with a very high recurrence rate, persisting for long periods. A positive jump sign is the presence of the typical referred pain pattern of the MTrP, and restricted range of motion of the affected tissues. [11] The commonly encountered locations of trigger points and their pain reference zones are consistent. Pressure pain threshold measures are used in clinical settings for diagnosis of myofascial pain syndrome characterized by myofascial trigger point with the help of algometer. [12]

Ischemic compression is the application of direct digital pressure sustained over point with sufficient strength and specific time duration, to slow the blood flow and relieve tension in the muscle involved. [13] Ischemic pressure on the trigger point stops blood from flowing into the affected area making it ischemic (deprived of oxygen). The person should feel comfortable pain as if pressure is being released. After 8 to 20 seconds, the pressure is released and the circulation of blood, oxygen, and nutrients to the area increases. In addition, it is important to apply general massage to the surrounding muscles of the upper trapezius, this helps keep the cervical functioning correctly and speeds up the rehabilitation process. [14]

Muscle energy technique is another manual approach which is superior to other manual technique in the treatment of upper trapezius trigger points. Muscle energy technique is commonly utilized method for achieving tonus release (inhibition) in a muscle before stretching. The approach involves the introduction of an isometric contraction to the affected muscle producing post-isometric relaxation through the influence of the Golgi tendon organs (autogenic inhibition). It may also be applied to the antagonistic muscle group producing reciprocal inhibition in the offending agonistic muscle. [15]

Dry needling (DN) is a non-manual intervention to treat latent myofascial trigger point. It is a minimally invasive procedure in which an acupuncture needle is inserted directly into a MTrP. [16] The advantages of DN are being increasingly documented and include an immediate reduction in local, referred, and widespread pain and restoration of range of motion and muscle activation patterns. [17] The stimulation of particular nerves or tissues by needles could bring about an increased input to the central biasing mechanism, which would close the pain gates to inputs from

selected body areas. [18]

A study on Manual pressure release (MPR) and Strain counterstrain (SC) techniques showed superiority to sham ultrasound in immediately reducing pain in patients with upper trapezius MTrP, but MPR technique is better than SCs technique. The manual pressure technique, referred to in this paper as MPR was previously denoted as 'ischemic compression' [19]

MTrP is a common cause of neck pain in our society affecting an individual's physical and social functioning, interfering with the daily activities. Upper fiber of trapezius is one of the common postural muscles where myofascial trigger points develop leading to pain, shortening of muscle which restricts cervical range of motion. There are a variety of treatment methods for the treatment of MTrP available in literature however the most effective treatment method remains an area of debate. There is lack of evidence about the effectiveness of IC in combination with MET in relieving pain, improving cervical contralateral flexion and neck disability. Therefore the purpose of this study is to find the effect of IC and DN with common intervention of MET in patients with upper trapezius MTrP.

MATERIALS AND METHODS

This study was randomised clinical trial conducted in the physiotherapy department of Nopany Institute of healthcare studies (NIHS), Kolkata between June 2016 to December 2016, all the procedures were carried out after obtaining approval from Institutional Human Research Ethics Committee considering the protection of rights of patients and safeguarding their welfare. All the patients were informed about the procedures that would be carried out and those that agreed signed an informed consent form. Patients were free to withdraw their participation without prejudice.

Female patients (n=30) aged between 18-30 years, presented with palpable taut band in Upper Trapezius Muscle and at least 1 hypersensitive tender spot in a taut band in response to 25N of pressure measured using pain pressure algometry were recruited for this study. 2 patients dropped out from the study as they were unwilling to the study procedure. Therefore 28 patients with a diagnosis of MTrPs were included. At the start of the study the two group were homogeneous ($p>0.05$) in relation to age, weight, height and BMI. The criteria of patients' exclusion consisted of Patient with fibromyalgia syndrome, history of cervical spine surgery and who undergone treatment for myofascial pain within past one month.

Methods:

Ischemic compression:

Patient: The subject lay supine with the cervical spine in a neutral position.

Technique: The therapist identified the latent MTrPs in the upper trapezius muscle by using pincer palpation. The physiotherapist applied non-painful pressure and slowly increased it with her thumb over the MTrPs until she felt a tissue resistance barrier. This level of pressure was maintained until release of the tissue barrier was felt; then, the pressure was increased until a new barrier was reached. This process was repeated until there was no MTrP tension tenderness or 60 seconds had elapsed, whichever occurred first.

Dosimetry: Three sessions in a one-week period with at least two-day break between each session.

Figure 1 Application of Ischaemic Compression over Upper Trapezius Myofascial Trigger Points.

Muscle Energy Technique for Upper fiber of trapezius:

Patient: The subjects were placed supine

Technique: The practitioner stabilized the shoulder on the affected side with one hand, while the ear/mastoid area of the affected side was held with the opposite hand. The head and neck were then side bent towards the contralateral side, flexed, and rotated ipsilaterally, placing the subject just short of their upper trapezius restriction barrier. The subjects then shrugged the involved/stabilized shoulder towards the ear with a sub maximal, pain-free, effort (20% of their available strength). The isometric effort was held for 7 to 10 seconds while a normal breathing rhythm was maintained. During the relaxation phase, the head and neck were eased into increasing degrees of side bending, flexion and rotation to increase the stretch placed on the muscle. Each stretch was held for 30 s, and this was repeated for three to five times per session.

Dosimetry: Three sessions in a one-week period with at least a two-day break between each session. Total 3 treatment sessions

Figure 2 Application of Muscle Energy Technique for Upper Trapezius Myofascial Trigger Points

Dry needling:

Patient: The patient was in a supine position

Technique: The treatment groups were treated with a 25 mm, 0.25G acupuncture needle. All acupuncture needles were used only once. The area needled was sterilized with an alcohol swab and the physiotherapist wore surgical gloves throughout the treatment. The MTrP was identified by using pincer palpation. The needle was then inserted between the fingers that had located the MTrP, and the needle penetrated the MTrP at an angle of about 30^0 to the skin whilst the patient was in a supine position. The fanning technique was used, in which the needle is repeatedly withdrawn from the MTP and reinserted to penetrate a new part of the MTrP at a different angle while maintaining the original entry point to the skin to elicit any local twitch responses. Care was taken to limit fanning so as to minimize post needling soreness. Here after, the needle was kept still for a few seconds so that it could exert its analgesic effects.

Dosimetry: Three sessions in a one-week period with at least a two-day break between each session

Figure 3 Application of Dry needling on Upper Trapezius Myofacial Trigger Point

Post intervention assessment was done after one week treatment period. Assessment of Pain pressure threshold , Contra-lateral cervical side flexion range of motion and neck disability were done by pain pressure algometry, spin T goniometry and neck pain and disability scale.

Outcome Measures:

Pain Pressure Algometer:

Pressure algometers are advantageous for quantifying the pressure pain thresholds of muscles the pressure pain threshold of a patient was judged to be abnormal when the pressure pain threshold of a certain site was at least 2 kg/cm^2 lower than that of the opposite site, or was lower

than the normal value, or was not >3 kg/cm^2. Reliability of PPT is quite high (r=0.990) [20]

Spin T Goniometer:

Spin T goniometer a valid instrument to measure the cervical range of motion. The subjects were stabilized in the sitting position and the spin T goniometer was mounted on the head of subject. Measurement were taken in the following sequence flexion, extension, lateral rotation right and left and lateral flexion right and left .The cycle was repeated 3 times . Intra class correlation for this scale is >0.96. [21, 22]

Neck pain and disability scale:

Neck pain and disability scale (NPAD), a complete patient specific questionnaire meant to measure functional neck problems. Intra class correlation of this scale is also high(r=0.86). [23,24]

STATISTICAL ANALYSIS

The primary analysis consisted of the use of descriptive statistics for calculating mean and standard deviation. The dependent t test was used to compare the difference between pre intervention and 1 week after intervention of Group A and Group B. It was used to compare the difference in pain pressure threshold, cervical contra-lateral flexion range of motion and neck disability within groups. The independent t test was used to compare the difference among the two groups' changes in pre-intervention and post-intervention scores.

The level of significance was set at p <0.05 and the analysis were performed using the SPSS version 17.

RESULT

Table 1: Comparison of mean difference of cervical contra-lateral flexion range of motion between Group A and Group B.

Group	Mean ± SD		Difference in mean SD	t value	p value
	GRA	GRB			
GRA [Post] Vs GRB [Post]	58.93 ±10.37	60.50 ± 10.69	1.57	- 0.395	0.696

Table 2: Comparison of mean difference of pain pressure threshold between Group A and Group B:

Group	Mean ± SD		Difference in mean SD	t value	p value
	GRA	GRB			
GRA [Post] Vs GRB [Post]	2.57 ± 0.85	3.07 ± 1.82	0.50	-0.932	0.363

Table 3: Comparison of mean difference of neck disability between Group A and Group B:

Group	Mean ±SD		Difference in mean SD	t value	p value
	GRA	GRB			
GRA [Post] Vs GRB [Post]	8.14 ± 10.37	5.21 ± 5.19	2.92	-0.945	0.356

From the above tables it was clear that Pain pressure threshold, Contra lateral cervical flexion and neck disability post intervention between the two groups which received IC with MET and DN with MET were not statistically significant.

DISCUSSION

The aim of the study was to compare the effectiveness of IC and DN with common intervention of MET in patient with upper trapezius myofascial trigger point.

Hong CZ proposed that, continuous irritation of the endplates lead to excessive release of acetylcholine which leads to constant localized muscle contraction [25] Chung JW et al proposed that the sympathetic nervous system activity may also increase motor activity and cause muscle pain at MTrPs. [26]

First objective of this study was to find the effectiveness of IC combined with MET on upper trapezius MTrPs on pain, ROM of cervical contralateral flexion and neck disability.

The mean improvement in group A may be due to the blanching of the nodules followed by hyperaemia when compression was released. This helped in flushing out of the muscle inflammatory exudates and pain metabolites; break down of scar tissue, desensitization of the nerve endings and reduction of the muscle tone. The counterirritant effect or a spinal reflex mechanism, probably producing reflex relaxation of the involved muscle and help to reduce pain. According to Travell ischemic compression decreases the sensitivity of painful nodules in muscle which is help to reduce pain. Post isometric relaxation approach of MET also has effect on reducing pain as per Chaitow. [27]

There was a significant improvement in contra lateral cervical side flexion range of motion. This may be due to increased blood circulation which helped to speed up the rehabilitation process, decrease of abnormal tension of the taut band and general pain reduction may also contribute to an increased ROM. [28]

The increased range of motion after passive stretching can be explained by the viscoelastic behavior and short term changes in muscle extensibility. Stretching of the muscle pulls out the sarcomeres to a length where there is too little overlap of myofilaments for maximum tension to be developed. Adding on sarcomeres could result in sarcomere length being restored to the optimum. [29] On the other hand, the reflex inhibition by MET helped to change the visco-elasticity and plastic changes in muscle structure.

The another objective of this study was to find the effectiveness of DN combined with MET on upper trapezius MTrPs on pain, contralateral cervical side flexion range of motion and neck disability on upper trapezius MTrPs.

Within group mean improvement in pain threshold in Group B may be due to the effect of DN producing mechanical stimulation of an MTrP causing pain relief. Inserting a needle into the tissue and its entry into the trigger point will increase the tissue blood circulation and helps to reduce pain. Dommerholt reported that Aδ fibers are stimulated 72 hours after needle insertion. Prolonged Aδ stimulation causes enkephalinergic to function in inhibitory interneurons in the posterior horn of the spinal cord, and this reduces pain. Activation of serotonergic and noradrenergic inhibitory systems is another mechanism which blocks out any disturbing stimulation on the posterior horn. [30]

The contralateral cervical side flexion range of motion may have improved due to local twitch effect of involved muscle which helped to restore the normal length of the sarcomere.

DN creates a local stretch in contracting cytoskeletal structures which causes sarcomeres to return to their relaxation length by reducing the amount of overlap between actin and myosin in the muscle with trigger point. [30] The overall effectiveness on neck pain and disability scale may have achieved due to analgesic effect of DN and increased flexibility of neck muscles.

The third objective of this study was to compare the effectiveness of IC combined with MET versus DN combined with MET on upper trapezius MTrPs .The between group analysis revealed that there was no statistically significant difference in PPT, contralateral cervical side flexion range of motion and neck disability between Group A and Group.

CONCLUSION

The study concludes that both IC and DN in combination with MET were equally effective as individual treatment options in improving the Pain pressure threshold, Contralateral cervical side flexion range of motion and Neck disability in patients with upper trapezius myofascial trigger points.

Future Recommendations and Limitations

Future research with larger sample size including both genders is recommended. Future research is required to

determine the treatment carry-over effects by taking follow up assessments for longer duration.

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