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Research Article

Comparison of Immediate Effect of Muscle Energy Technique in Upper Trapezius and Activation of its Antagonist Muscle i.e., Middle and Lower Trapezius with Thoracic Extension in Patients with Upper Trapezius Spasm

Vimmi Bhandari*

Physiotherapy, D.Y.Patil Hospital, Navi Mumbai, India

***Corresponding Author:** Vimmi Bhandari, Physiotherapy, D.Y.Patil Hospital, Navi Mumbai, India.

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Abstract

Background: The most common reason for neck pain is trapezitis. With digilization coming into picture in recent years, adaption of incorrect posture has been a common issue. Patients with trapezitis presents with over-activity of the trapezius and levator scapula and decreased strength of deep cervical flexors along with its antagonist muscles. Exercises have shown improvement in posture related musculoskeletal imbalances. Since M.E.T. have been used earlier for pain relief in trapezitis, the present study compares its effect with activation of its antagonist muscle which are lower trapezius and rhomboids with thoracic extension exercises.

Aim: To compare the effect of M.E.T. and activation of lower trapezius and rhomboids with thoracic extension exercises in patients with upper trapezius spasm.

Objectives: To assess the effectiveness of M.E.T. in patients with upper trapezius spasm. To determine the effectiveness of activation of lower trapezius and rhomboids with thoracic extension exercises in patients with upper trapezius spasm. Comparison of both groups.

Method: A total of 60 individuals were taken which was calculated using the sample size formula, 30 in each group were selected as per the inclusion and exclusion criteria. Outcome measures- tenderness grading scale, NRPS on rest and activity, intensity of pain using pain algometer, cervical range of motion- lateral flexion and rotation, scapular positioning, upper trapezius length, tragus to wall length, neck disability index were assessed pre and post intervention of three days.

Result: The intra-group comparison between group A and B showed statistically and clinically significant improvement in all outcome measures. The inter-group comparison of Group A and Group B showed that, group A had better improvement in the muscle length and ranges than group B. And group B show better improvement in scapular positioning and tragus to wall distance than group A.

Conclusion: The study concluded that both the techniques were equally effective in pain relief in individuals with trapezitis. M.E.T. was effective in improving the cervical range of motion and its length as M.E.T. directly works on upper trapezius muscle. And activation of anagonist muscles with thoracic extension exercises was effective in improving the posture as it works on the postural group of muscles of scapula.

Keywords: Upper Trapezius; Lower Trapezius; MET; Antagonist Muscle; Posture, Scapula

Abbreviations

FHP: Forward Head Posture; TENS: Transcutaneous Electro Nerve Stimulation; GOT: Golgi Tendon Organ; MET: Muscle Energy Technique; VAS: Visual Analog Scale; NPRS: Numerical Pain Rating Scale; NDI: Neck Disability Index; ROM: Range Of Motion; DCF: Deep Cervical Flexors; LSF: Left Side Flexion; RSF: Right Side Flexion; RSR: Right Side Rotation; LSR: Left Side Rotation; T3: Thoracic Spinous Process 3; AC: Acromion; SS: Spine Of Scapula; UTL: Upper Trapezius Length; MT: Middle Trapezius; LT: Lower Trapezius; TWD: Tragus To Wall Distance

Introduction

The most common traumatic and non-traumatic musculoskeletal pain is neck pain leading to upper trapezius spasm. About two-thirds of the overall general population suffer from neck pain at some point of time in their lives, out of which the middle age population shows the highest prevalence in life. Mechanical neck pain has a lifetime prevalence of 45-54% in the general population and up to 30% of men and 50% of women experience neck pain in the course of a lifetime. Around 14% of patients are proven to be at risk of their neck pain becoming chronic, increasing absenteeism from work and increasing their healthcare cost. The prevalence of trapezius pain is typical, about 10-15% in the general population [2].

It is a classical example of stress pain, and the most common cause is poor biomechanical posture. Any static position assumed by the body for an extended period increases the stresses over the body mechanics (bones, muscles, ligaments, fascia) thus leading to faulty postures, causing impairments in joints, muscles, or connective tissue. Prolonged hours of sitting or standing for work in a wrong posture leads to a faulty posture. Even smartphone users complains of neck pain and upper back pain after prolonged use of time. Due to the recent pandemic of covid, most of the work is from home, which requires long hours of sitting in front of computers and mobile phones. Due to prolonged hours of texting, browsing or gaming, the person requires to repeatedly press the screen with the upper extremities, which is constrained in static postures. This may induce unpleasant feeling, pain, stiffness and decreases in motor abilities (Gustafsson., *et al.* 2010). Neck pain is positively correlated with holding the neck in a flexed posture for a prolonged period of time thus leading to static loading of the musculoskeletal structures (Khatir R., *et al*. 2015). As Smartphone and computer users tend to maintain the forward head flexion posture (Maniwa., *et al*. 2013); this prolonged and/or frequent use of the Smartphone with the severe head flexion posture could be one of the main contributing factors for neck pain as well as trapezitis. The flexed neck posture can increase the moment of the cervical spine and induces muscle strain in adjacent parts of the cervical spine [9]. Faulty postures include sway back posture, flat back posture, forward head etc. Muscle tightness or weakness, or its imbalance with the antagonist muscle, contracture, general weakness, obesity, loss of proprioception etc. are some of the other reasons for faulty postures. The most common faulty posture adapted by is people who sit in front of the computer for prolonged period of time or stand is forward head and rounded shoulders.

Figure 1: Faulty posture while using mobile phones and computers.

Forward head posture (FHP)

Forward head position is characterized by dorso-extension of the head as well as the upper cervical spine (C1-C3) along with flexion of the lower cervical spine (C4-C7). Thus, increased flexion in the lower cervical spine causes forward translation of the head.

Figure 2: Forward head posture.

Rounded shoulders/protracted shoulder

The rounded shoulder is a protrusion of the shoulder joint's acromion relative to the body's centre of gravity, thus causing stooped posture. It causes elevation, protraction, anterior tilting and downward rotation of the scapula and an increased angle between lower neck bone and upper spine. Thus protraction of the shoulder causes an increase in the distance between the inferior angle of scapula.

Figure 3: Rounded shoulders.

Trapezitis

The trapezius may be a large, paired surface muscle extending longitudinally from the membrane bone that is an external protuberance of the occipital bone to the lower thoracic vertebrae of the spine and laterally to the spine of the scapula. It moves the scapula and supports the arm. The trapezius has three functional parts: an upper (descending) part which supports the weight of the arm and causes elevation of the shoulder; the middle trapezius (transverse), which causes retraction of the scapula; and the lower (ascending) part which medially rotates and causes depression of the scapula [1]. The accessory nerve (CN 11) and the cervical nerve roots (C1 to C4) innervates it. Trapezitis is a condition characterized by the inflammation of most commonly the upper fibres of the trapezius muscle. Patients with neck or shoulder pains often present with symptoms within the region of upper trapezius. Headaches, dizziness, neck pain and mid-back pain are the foremost common symptoms related to this muscle's tightness. It is a heavily used muscle in the body, and numerous causes can lead to strains and spasm. The upper trapezius is a postural muscle; hence it is highly susceptible to overuse and repetitive spasm. People with incorrect postures are at an increased risk of getting trapezius muscle spasm. The upper trapezius muscle is often placed in a shortened position by poor ergonomics, which causes tightness in the muscle, thereby causing spasm. The area of stressed soft tissue receives less blood supply, less oxygen and glucose; hence, it accumulates a high level of metabolic waste product; the end result of this event is the development of multiple knots in the muscle called trigger points felt like a taut palpable band. It leads to pain, stiffness, tightness and tenderness which is felt along the muscle's length. Tightness in the muscle will eventually lead to decrease in the R.O.M. of cervical joint, thus affecting daily living activities [1,3].

Figure 4: Upper Trapezitis and its referred pain.

This improper posture is defined as upper crossed syndrome. In this condition, pectorales, upper trapezius, and levator scapulae muscles are shortened whereas rhomboids, serratus anterior, and lower trapezius are weakened, thus causing pain from these muscle imbalances [9,10]. Lower trapezius muscle play a crucial role in stabilizing the scapula. Many studies suggested therapeutic approaches that strengthens weak muscles and elongates shortened muscles for an ideal posture. The O'Sullivan., *et al.* (2007) methods, which strengthen the lower trapezius without any compensation of the upper trapezius muscle, are emphasized, and examinations of the contraction of the lower trapezius using ultrasound are facilitated [11]. Previous studies suggested lower trapezius strengthening muscles as an intervention to patients with neck pain and proprioceptive changes within the scapula, but there is still an insufficient amount of evidence on the clinical results of lower trapezius activation in acute upper trapezius spasm while giving rest to upper trapezius. There are many studies on the appliance of varied exercise methods to neck pain patients. However, it had been only within recent years where the importance of lower trapezius thickness and contraction rate was emphasized. However, it has been only recently discovered that if the scapular muscles are not strong enough to hold the scapula in place, it will lead to an overworking upper trapezius and recurrence of spasm [13,14].

Figure 5: Upper cross syndrome.

Various treatment modalities are used for treating myofascial pain of upper trapezius, which includes manual therapy, acupuncture, stress reduction, electrotherapy, body mechanics and ergonomic training, nutritional counselling and a good range of pharmacological management (Borg-Stein, 2002). There is moderate evidence available for short-term relief of myofascial trigger points by Transcutaneous Electro Nerve Stimulation (TENS), acupuncture and magnet or laser therapy [14,15] Some studies have shown that acupuncture/dry needling can significantly affect pain in the short term. There is no evidence of effective treatment to reduce pain in the intermediate and long term periods [23] Ischaemic compression, stretching of the upper trapezius muscle, and transverse friction massage are manual techniques to help patients with TM. These techniques appear to possess instant improvement on pain. Long-term effects have not yet been well investigated [14,23]. However, there is not enough evidence on muscle energy technique for upper trapezius or activation of its antagonist muscle and thoracic extension and its effects on scapular positioning, forward head and length of upper trapezius.

Muscle energy technique

Muscle Energy Technique (M.E.T.) is a manipulative procedure designed to lengthen muscle, fascia and mobilize the joints by increasing its range. It can reduce pain, stretch the tight muscles and fascia, reduce muscle tonus, improve local blood circulation, strengthen weak musculature, and increase drainage of fluid from peripheral regions hence, restores the proper biomechanical and physiological function of the muscle. It uses controlled, voluntary isometric contractions of a targeted muscle group. It works on the principle of Autogenic and reciprocal inhibition. It occurs when certain muscles are inhibited from contracting, thanks to the Golgi tendon organ's activation (G.T.O.) and, therefore the muscle spindles. These two musculotendinous proprioceptors are located in and around the joints and muscles respond to muscle tension and length changes, which helps to improve the muscular control and coordination. The G.T.O. response plays a crucial role in flexibility. The G.T.O. inhibits the (agonist) muscle's contraction and allows the antagonist muscle to contract more readily, and then the muscle are often stretched further and easier. Autogenic inhibition is usually seen during static stretching, like during a low-force, long-duration stretch. After 7 to 10 seconds, muscle tension increases and activates the G.T.O. response, causing the muscle spindle within the stretched muscle to be temporarily inhibited, making it possible to stretch the muscle further [8]. M.E.T. by autogenic inhibition is commonly used for treating active trigger points in upper trapezius and has proved to be effective in the treatment of trapezius spasm [6,7].

Figure 6: Muscle energy technique.

Imbalance with antagonist muscle

Poor biomechanical posture causes postural kyphosis development, which results in weakness of scapular muscles and over activity of pectorals and trapezius. Thoracic Kyphosis increases the tension in the shoulder muscles, the pectorales, subclavius which causes excessive internal rotation of the shoulder. Also, the rotator cuff muscles responsible for the stability of scapula and shoulder, are weakened. As a result, the scapular alignment of individuals with kyphosis may not be normal. Correct alignment of the thoracic spine positively affects the position of scapula and alleviates muscle imbalance. A variety of studies on thoracic extension exercises for kyphosis have been conducted, but studies on scapular alignment impact are insufficient. Various authors have also proposed that rhomboids, middle and lower trapezius are underactive and weak may occur thanks to prolonged tightness or over activity of the upper trapezius, leading to postural adaptations and pain. However, individuals with neck pain have underactive, limited strength and endurance of the lower trapezius and rhomboids muscle. Exercises that enhance lower trapezius's ratio to upper trapezius strength tend to scale back this muscle imbalance and improve the symptoms. Hence, activation and strengthening of middle and lower trapezius could also be beneficial. Therefore, correcting the thoracic extension and activating the lower trapezius and rhomboids to suppress the overactive upper trapezius might help to alleviate the strain placed on upper trapezius [4,5].

Purpose of study

Evidence have shown that M.E.T. has been proven to be an effective technique in relieving upper trapezius spasm and improving neck range of motion [6,7]. There is no evidence of correction of thoracic extension and activating the antagonist muscles, i.e., the lower trapezius and rhomboids to suppress overactive upper trapezius muscle relieve upper trapezius spasm. Therefore, this study will add to the growing body of knowledge that which technique is more effective and maintainable, M.E.T. for upper trapezius, the target muscle or activation of its antagonist muscle and correcting thoracic extension.

Material and Methodology

- **Study design:** Interventional study.
- **Study population:** Patients having unilateral upper trapezius spasm.
- **Types of sampling:** Simple Random sampling.
- **Sample size:** 60 (30 in each of 2 groups)
- **Duration of study:** 1 year.
- **Inclusion criteria:** Age group from 24 to 50 years of age, Unilateral trapezius pain, Subjects with a taut palpable band of Upper trapezius- Tenderness grade 1 and above.
- **Exclusion criteria:** History of recent surgery or open wounds in the neck region, H/o cervical spine injury, Bilateral trapezius spasm, Individuals with structural kyphosis, Any sensory disturbances in the neck region, Cervical radiculopathy.
- **Outcome measures:** Tenderness grading scale, Numerical rating scale (N.R.S.), Pain pressure algometer, R.O.M. using universal goniometer, Scapular positioning, Upper trapezius length, Tragus to wall, Neck disability index scale.
- **Instrumental tool:** Universal goniometer, pain pressure algometer, measuring tape
- **Physical tool:** Assessment form, consent form.

Procedure

After obtaining approval from the ethical committee, the patients with upper trapezius spasm were assessed for inclusion and exclusion criteria. Patients were informed about the study and written informed consent was taken. After asking for their consent their history, pre-intervention evaluation was noted. Outcome measures were assessed.

Pre intervention evaluation: Site of pain, Duration of pain.

Outcome measures

Tenderness: Hold the sloping superior lateral portion between fingers and thumb and palpate from the origin towards the acromion and its insertion. Then patients were instructed to tell the therapist how much pain was and then accordingly, the tenderness was graded. Tenderness grading is as follows: 0- No tenderness, 1- Tenderness to palpation without grimace or flinch 2- Tenderness with grimace and or flinch to palpation, 3- Tenderness with withdrawal (+ "Jump sign"), 4- Withdrawal (+ "Jump sign") to nonnoxious stimuli (i.e., superficial palpation, pin prick, gentle percussion).

Figure 7: Palpation of tenderness.

Intensity of Pain using Numerical rating scale (NRS) - Patient was asked to indicate on the line where the pain is about the two extremes "no pain" and "worst possible pain". Measure from the left hand side to the mark. Total scores range from 0 to 10, with a higher score indicating more severe pain, 5 indicating moderate pain and lower score indicating mild pain. N.R.S. on rest as well as N.R.S. on activity was recorded.

Figure 8: Numerical rating scale.

Intensity of pain using pain pressure algometer: A digital pressure algometer was applied over the most tender point of upper trapezius spasm with pressure increasing at a rate of approximately 5 N/s. Patients were instructed to tell the therapist the precise moment the sensation changed from pressure to slightly unpleasant pain. As soon as the patient feels the pain he/she should immediately inform the therapist and the intensity was noted.

Figure 9: Intensity of pain using pain algometer.

Scapular positioning: The distance between the 3rd thoracic spinous process and root of the scapular spine, and the distance between the 3rd thoracic spinous process and postero-lateral acromion was measured. This distance was recorded bilaterally and was noted down in cms [16,24,25].

Figure 10: Scapular positioning.

Range of motion of cervical joint using universal goniometer Cervical range of motion- lateral flexion and rotation was recorded using an universal goniometer for both the sides.

Figure 11: Cervical R.O.M.- LF and ROT.

Upper trapezius length

The patient was made to lie in supine position with cervical spine maintained in 30 degrees of flexion. Two points that are the mastoid process of the mandible and the acromioclavicular joint, were palpated and marked. The distance between these two points was measured using a scale bilaterally and the length was written in centimetres.

Figure 12: Upper trapezius length.

Tragus to wall test: The patient was made to stand against the wall, head touching the wall, ensure that the head is in a neutral position, chin drawn in as far as possible. Ensure no cervical extension, rotation, flexion or side flexion occurs. Then the distance between tragus of the ear and the wall was recorded using a rigid ruler.

Figure 13: Tragus to wall distance.

Neck Disability Index (NDI) scoring- Patients were asked to mark their ability to perform each of the 10 activities before starting the treatment. It is a standard instrument for measuring self-rated disability due to neck pain. It consists of 10 items each of them is scored from 0-5. Thus the maximum score is 50.

After the outcome measures were assessed, for both the groups steam was given prior to the exercises for 10 minutes every day and an exercise program was taught to the patient which included the cervical isometric exercises, neck range of motion exercises and shoulder shrugs with correct postural advice post the treatment.

Figure 14: Steam.

Post steam, one group of patients (GROUP A) received treatment A whereas other group of participants (GROUP B) received treatment B.

- **Group A:** (Muscle energy technique): In this isometric technique, the patient was in supine position, head/neck flexed and side bent far away from the side to be treated, with the therapist stabilizing the shoulder with one hand and cupping the ear/mastoid area on an equivalent side with the opposite so as to bring into play all the varied fibres of the muscle, this stretch was applied with the patient's neck bent towards the contralateral side, flexed and ipsilaterally rotated. This manoeuvre could also be performed with the therapist's arms crossed, hands stabilizing the mastoid area and shoulder, or not, as comfort dictates and with therapist standing at the top or the side and comfort dictates. The patient introduces a resisted effort to take the stabilized shoulder towards the ear (a shrug movement) and the ear towards the shoulder. The double movement (or effort toward movement) is vital so as to introduce a contraction of the muscle from both ends. The degree of effort should be mild and no pain should be felt. The patient then shrugs the stabilized shoulder towards the ear at a sub maximal pain-free effort (20% of the available strength) after the 7-10 seconds of contraction, followed by complete relaxation of effort. Then the therapist gently eases the head/neck into an increased degree of side bending flexion and rotation to advance the stretch placed on the muscle. This position was maintained for 30 seconds and repeated three to 5 times per treatment session.

Figure 15: Technique of M.E.T.

- **Group B:** Correction of thoracic extension along with activation of lower trapezius and rhomboids: In this technique, the patient was sitting position with his/her foot touching the floor, hip knee at 90 degrees. The patient was asked to sit erect, lean forward, thereby keeping the therapist's hand on the thoracic vertebrae giving tactile feedback and asking the subject to increase the thoracic vertebrae's height manually correct the thoracic extension. The patient relaxes the upper limb - arms, forearms wrist. Then the patient retracts and depresses the shoulders on the therapist hand held under the elbow. The therapists thereby check for any compensatory movements like elbow extension, leaning towards one side or poor shoulder retraction. This position was maintained for 10 seconds and is repeated ten times per treatment session.

Figure 16: Activation of antagonist muscle technique.

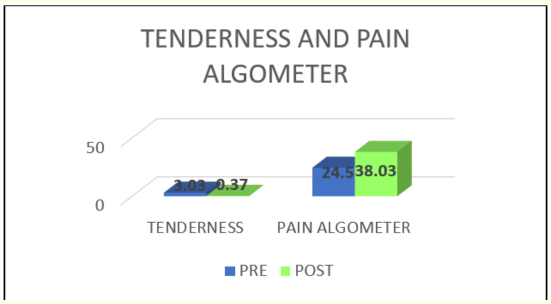
Post treatment both the groups were given conventional exercise program which included correct postural advice in sitting and standing positions, cervical isometrics in supine, cervical range of motion exercises and shoulder shrugs. Each exercise- 10 repetitions with 5 sec hold.

Results

Out of 60 subjects, 12 subjects (21%) were male and 48 subjects (78%) were females. Both the groups had a greater number of females than males and 54% were right side affected and 46% were left side affected.

Outcome measure	Pre	Post	P value
Tenderness	3.03 ± 0.850	0.37 ± 0.490	.000
Pain algometer	24.50 ± 8.191	38.03 ± 7.476	.000

Table 1.1: Tenderness and intensity of pain using pain algometer for group A.

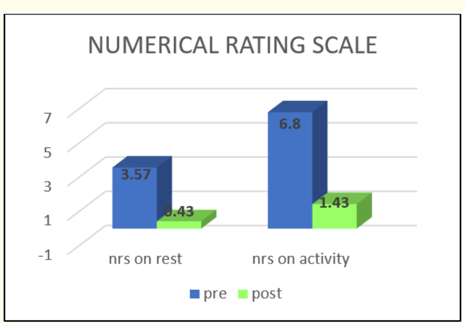


Graph 1.1: Tenderness and intensity of pain using pain algometer for group A.

The graph shows the pre and 3 days post values of tenderness and intensity of pain using pain algometer in Group A. Analysis reveals a significant difference between pre and 3 days post values of both tenderness as well as intensity of pain using pain algometer at 95% confidence interval.

Outcome measure	Pre	Post	P value
NRS on rest	3.57 ± 1.104	0.43 ± 0.504	.000
NRS on activity	6.80 ± 1.297	1.43 ± 0.774	.000

Table 1.2: Numerical rating scale for group A.

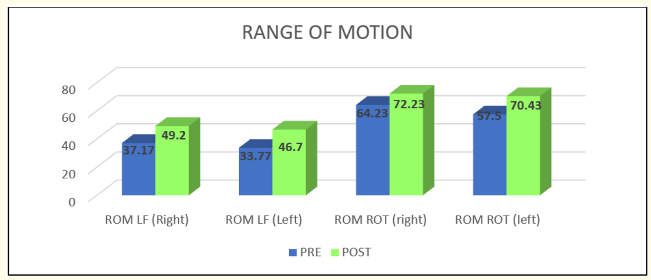


Graph 1.2: Numerical rating scale for group A.

The graph shows the pre and 3 days post values of Numerical rating scale at rest as well as on activity in Group A. Analysis reveals a significant difference between pre and 3 days post values of both NRS on rest as well as on activity at 95% confidence interval.

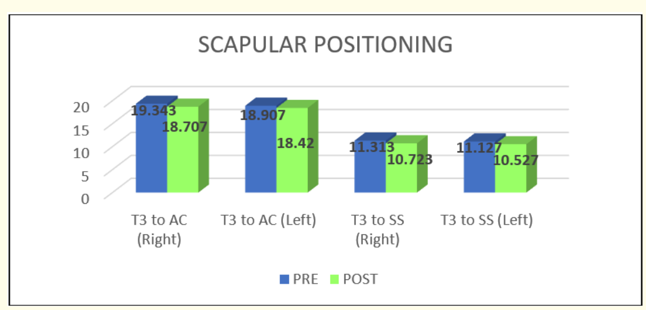
Outcome measure	Pre	Post	P value
ROM LF (Right)	37.17 ± 6.320	49.20 ± 4.788	.000
ROM LF (Left)	33.77 ± 11.578	46.70 ± 7.052	.000
ROM ROT (right)	64.23 ± 9.024	72.23 ± 4.523	.000
ROM ROT (left)	57.50 ± 6.564	70.43 ± 4.183	.000

Table 1.3: Range of motion for cervical for group A.



Graph 1.3: Range of motion of cervical for group A.

The graph shows the pre and 3 days post values of range of motion of cervical lateral flexion and rotation in Group A. Analysis reveals a significant difference between pre and 3 days post values of both the cervical range of motion that is lateral flexion and rotation at 95% confidence interval.



Graph 1.4: Numerical rating scale for group A.

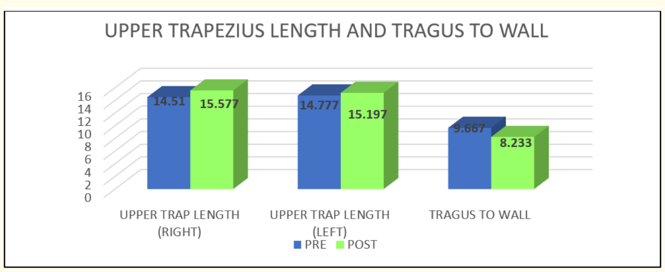
Outcome measure	Pre	Post	P value
T3 to AC (Right)	19.343 ± 1.4342	18.707 ± 1.4135	.000
T3 to AC (Left)	18.907 ± 2.0096	18.420 ± 1.8346	.006
T3 to SS (Right)	11.313 ± 0.9975	10. 723 ± 1.1708	.000
T3 to SS (Left)	11.127 ± 1.3992	10.527 ± 1.3567	.000

Table 1.4: Scapular positioning for group A.

The graph shows the pre and 3 days post values of scapular positioning which includes T3 to acromion process (AC) and T3 to spine of scapula (S.S.) in Group A. Analysis reveals that there is a significant difference between pre and 3 days post values of scapular positioning at 95% confidence interval.

Outcome measure	Pre	Post	P value
Upper trap Length (Right)	14.510 ± 1.5160	15.577 ± 1.3452	.000
Upper trap Length (Left)	14.177 ± 1.2375	15.197 ± 1.3312	.000
Tragus to wall	9.667 ± 1.8214	8.233 ± 1.8900	.000

Table 1.5: Upper trapezius length and tragus to wall for group A.

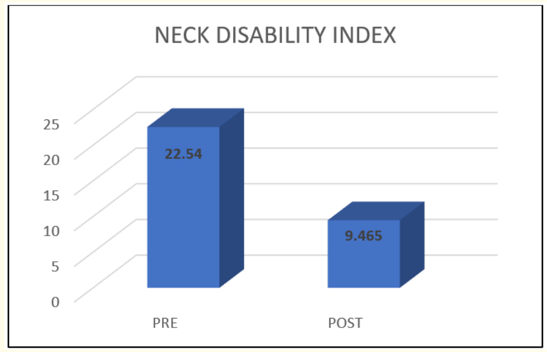


Graph 1.5: Upper trapezius length and tragus to wall for group A.

The graph shows the pre and 3 days post values of Upper trapezius length and tragus to wall in Group A. Analysis reveals that there is a significant difference between pre and 3 days post values of both upper trapezius length as well as tragus to wall distance at 95% confidence interval.

Outcome measure	Pre	Post	P value
NDI	22.540 ± 17.1119	9.465 ± 11.3600	.000

Table 1.6: Neck disability index for group A.

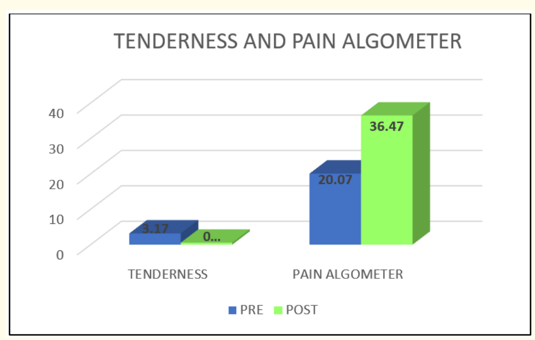


Graph 1.6: Neck disability index for group A.

The graph shows the pre and 3 days post values of neck disability index in Group A. Analysis reveals that there is a significant difference between pre and 3 days post values of neck disability index at 95% confidence interval.

Outcome measure	Pre	Post	P value
Tenderness	3.17 ± 0.747	0.57 ± 0.504	.000
Pain algometer	20.07 ± 8.738	36.47 ± 9.468	.000

Table 2.1: Tenderness and intensity of pain using pain algometer for group B.

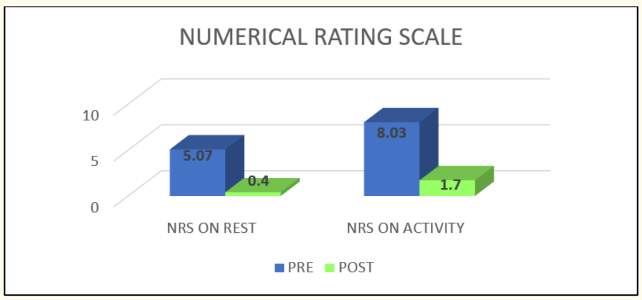


Graph 2.1: Tenderness and intensity of pain using pain algometer in group B.

The graph shows the pre and 3 days post values of tenderness and intensity of pain using pain algometer in Group B. Analysis reveals a significant difference between pre and 3 days post values of both tenderness as well as intensity of pain using pain algometer at 95% confidence interval.

Outcome measure	Pre	Post	P value
NRS on rest	5.07 ± 1.530	0.40 ± 0.498	.000
NRS on activity	8.03 ± 1.065	1.70 ± 0.915	.000

Table 2.2: Numerical rating scale for group B.



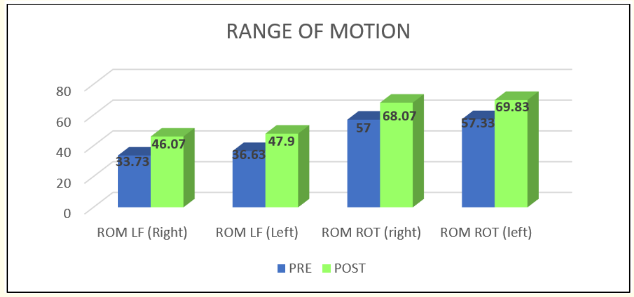
Graph 2.2: Numerical rating scale for group B.

The graph shows the pre and 3 days post values of Numerical rating scale at rest as well as on activity in Group B. Analysis reveals a significant difference between pre and 3 days post values of both N.R.S. on rest as well as on activity at 95% confidence interval.

Outcome measure	Pre	Post	P value
ROM LF (Right)	33.73 ± 9.468	46.07 ± 5.988	.000
ROM LF (Left)	36.63 ± 13.156	47.90 ± 10.199	.000
ROM ROT (right)	57 ± 12.961	68.07 ± 4.719	.000
ROM ROT (left)	57.33 ± 16.539	69.83 ± 10.137	.000

Table 2.3: Cervical range of motion for group B.

The graph shows the pre and 3 days post values of range of motion of cervical lateral flexion and rotation in Group B. Analysis reveals a significant difference between pre and 3 days post values of both the cervical range of motion that is lateral flexion and rotation at 95% confidence interval.



Graph 2.3: Cervical range of motion for group B.

Outcome measure	Pre	Post	P value
T3 to AC (Right)	19.187 ± 1.9244	16.863 ± 2.6236	.000
T3 to AC (Left)	19.127 ± 1.6335	16.567 ± 2.4184	.000
T3 to SS (Right)	10.987 ± 1.7144	9.477 ± 1.8798	.000
T3 to SS (Left)	10.657 ± 1.8641	8.817 ± 1.9488	.000

Table 2.4: Scapular positioning for group B.

Graph 2.4: Scapular positioning for group B.

The graph shows the pre and 3 days post values of scapular positioning which includes T3 to acromion process (AC) and T3 to spine of scapula (S.S.) in Group B. Analysis reveals that there is a significant difference between pre and 3 days post values of scapular positioning at 95% confidence interval.

The graph shows the pre and 3 days post values of Upper trapezius length and tragus to wall in Group B. Analysis reveals that there is a significant difference between pre and 3 days post values of both upper trapezius length as well as tragus to wall distance at 95% confidence interval.

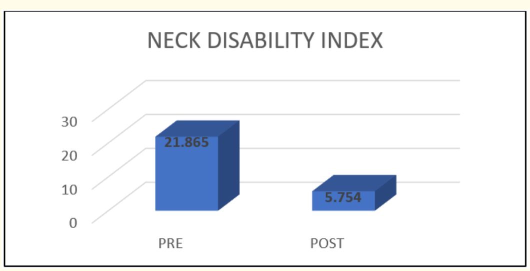
Outcome measure	Pre	Post	P value
Upper trap Length (Right)	13.5 ± 1.4147	14.03 ± 1.7761	.002
Upper trap Length (Left)	13.473 ± 2.0259	14.117 ± 2.0367	.008
Tragus to wall	11.113 ± 2.9858	8.680 ± 1.6247	.000

Table 2.5: Upper trapezius and tragus wall for group B.

Graph 2.5: Upper trapezius and tragus wall for group B.

Outcome measure	Pre	Post	P value
NDI	21.865 ± 11.8651	5.754 ± 5.6989	.000

Table 2.6: Neck disability index for group B.



Graph 2.6: Neck disability index for group B.

The graph shows the pre and 3 days post values of neck disability index in Group A. Analysis reveals that there is a significant difference between pre and 3 days post values of neck disability index at 95% confidence interval.

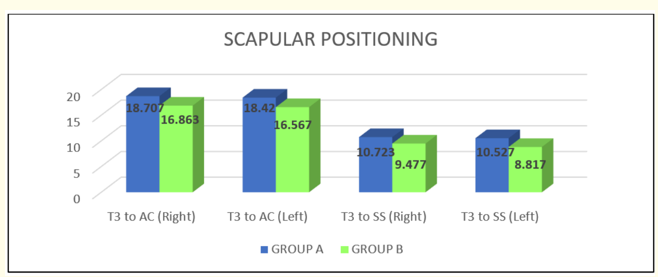
Outcome measure	Group A	Group B	P-value
Tenderness	0.37 ± 0.490	0.57 ± 0.504	.125
NRS on rest	0.43 ± 0.504	0.40 ± 0.498	.798
NRS on activity	1.43 ± 0.774	1.70 ± 0.915	.228
Pain algometer	38.03 ± 7.476	36.47 ± 9.468	.480
ROM LF (Left)	46.70 ± 7.052	47.90 ± 10.199	.598
ROM ROT (left)	70.43 ± 4.183	69.83 ± 10.137	.765
Tragus to wall	8.233 ± 1.8900	8.680 ± 1.6247	.330
NDI	9.465 ± 11.3600	5.754 ± 5.6989	.115

Table 3.1: Comparison of post values of group a and group B.

Table 3.1 shows the comparison of 3 days post values of the above outcome measures of Group A and Group B. Analysis reveals that there is no statistical significant difference between group A and group B in the above outcome measures at 95% confidence interval.

Outcome measure	Group A	Group B	P-value
T3 to AC (Right)	18.707 ± 1.4135	16.863 ± 2.4184	.001
T3 to AC (Left)	18.420 ± 1.8346	16.567 ± 2.4184	.001
T3 to SS (Right)	10.723 ± 1.1708	9.477 ± 1.8798	.003
T3 to SS (Left)	10.527 ± 1.3567	8.817 ± 1.9488	.000

Table 3.2: Comparison of post values scapular positioning in group a and group B.

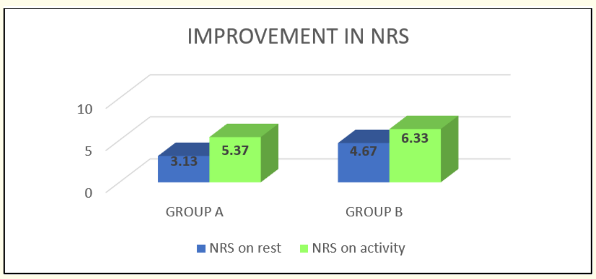


Graph 3.1: Comparison of post values of scapular positioning in group a and group B.

Graph 3.1 shows the comparison of 3 days post values of the scapular positioning of Group A and Group B. Analysis reveals that there is statistical significant improvement in group B as compared to group A in scapular position at 95% confidence interval.

Outcome measure	Group A	Group B	P- value
NRS on rest	3.13 ± 0.90	4.67 ± 1.30	0
NRS on activity	5.37 ± 0.96	6.33 ± 0.92	0

Table 3.3: Comparison of improvement seen in numerical rating scale of group A and B.

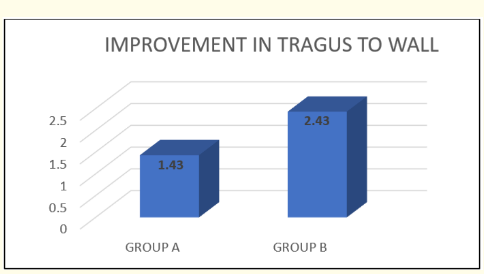


Graph 3.2: Comparison of improvement in numerical rating scale of group A and B.

Graph 3.2 shows the comparison of improvement in the Numerical rating scale in Group A and Group B. Analysis reveals that there is statistical significant improvement in group B as compared to group A in N.R.S. at rest as well as N.R.S. at activity at 95% confidence interval.

Outcome measure	Group A	Group B	P- value
Tragus to wall	1.43 ± 0.79	2.43 ± 2.08	0.017

Table 3.4: Comparison of improvement in tragus to wall distance in group A and group B.

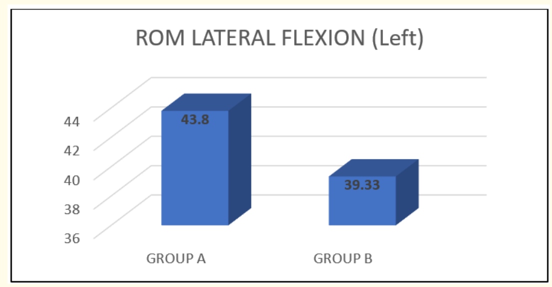


Graph 3.3: Comparison of improvement in tragus to wall distance in group A and group B.

Graph 3.3 shows the comparison of improvement in tragus to wall distance of Group A and Group B. Analysis reveals that there is statistical significant improvement in group B as compared to group A in tragus to wall distance at 95% confidence interval.

Outcome measure	Group A	Group B	P- value
ROM LF (Left)	43.80 ± 5.58	39.33 ± 7.05	0.056
ROM LF (Right)	48.50 ± 4.25	47.50 ± 3.34	0.492

Table 3.5: Lateral flexion range of motion in individuals whose right side is affected.



Graph 3.4: Lateral flexion range of motion in individuals whose right side is affected.

Graph 3.4 shows the comparison of left lateral flexion range of motion of Group A and Group B in individuals whose right side in affected. Analysis reveals that left side lateral flexion has improved statistically in group A as compared to group B in individuals whose right side is affected. However, there is no significant improvement in right lateral flexion in group A and B.

Outcome measure	Group A	Group B	P- value
Pain algometer	11.85 ± 4.86	18.50 ± 4.82	0.001

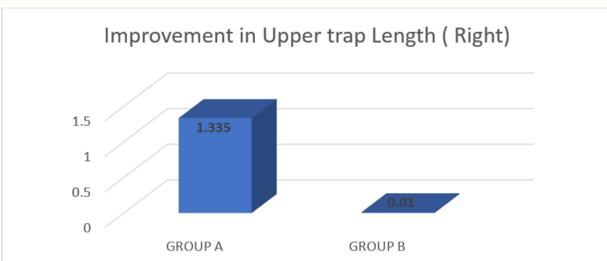
Table 3.6: Improvement in intensity of pain using pain algometer in individuals whose right side is affected.

Graph 3.5: Improvement in intensity of pain using pain algometer in individuals whose right side is affected.

Graph 3.5 shows the comparison of improvement in intensity of pain using pain algometer of Group A and Group B in individuals whose right side in affected. Analysis reveals that group B has shown statistically significant improvement as compared to group A in individuals whose right side in affected.

Outcome measure	Group A - 20	Group B - 12	P-value
Upper trap Length (Right)	1.335 ± 0.921	0.01 ± 1.09	0.001

Table 3.7: Improvement in right upper trapezius length in individuals whose right side is affected.



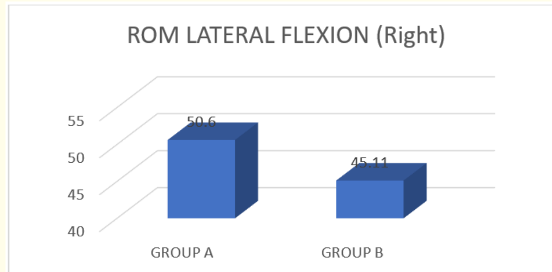
Graph 3.6: Improvement in right upper trapezius length in individuals whose right side is affected.

Graph 3.6 shows the comparison of improvement in Right upper trapezius length of Group A and Group B in individuals whose right side in affected. Analysis reveals that group A has shown statistically significant improvement in right upper trapezius length as compared to group B in individuals whose right side in affected.

Outcome measure	Group A - 10	Group B - 18	P- value
ROM LF (Right)	50.60 ± 5.7	45.11 ± 7.177	0.048
ROM LF (Left)	52.50 ± 6.205	53.61 ± 7.678	0.699

Table 3.8: Right lateral flexion range of motion in individuals whose left side is affected.

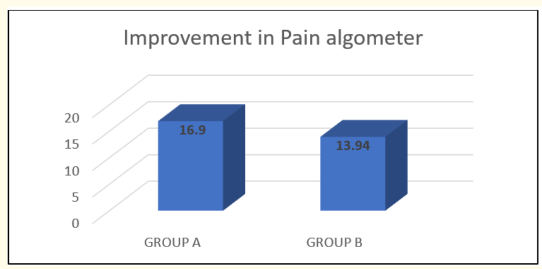
Graph 3.7 shows the comparison of right lateral flexion range of motion of Group A and Group B in individuals whose left side is affected. Analysis reveals that right side lateral flexion has improved statistically in group A as compared to group B in individuals whose right side is affected. However, there is no significant improvement in left lateral flexion in group A and B.



Graph 3.7: Lateral flexion range of motion in individuals whose left side is affected.

Outcome measure	Group A	Group B	P- value
Pain algometer	16.90 ± 5.646	13.94 ± 4.56	0.001

Table 3.9: Improvement in intensity of pain using pain algometer in individuals whose left side is affected.

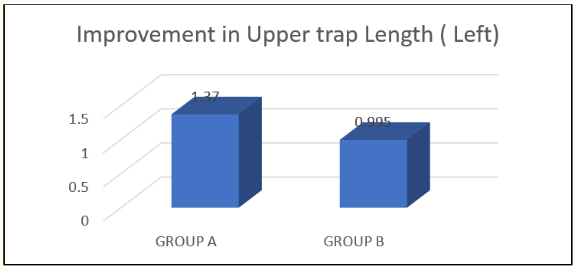


Graph 3.8: Improvement in intensity of pain using pain algometer in individuals whose left side is affected.

Graph 3.8 shows the comparison of improvement in intensity of pain using pain algometer of Group A and Group B in individuals whose left side is affected. Analysis reveals that group A has shown statistically significant improvement as compared to group B in individuals whose left side in affected.

Outcome measure	Group A - 10	Group B - 18	P- value
Upper trapezius Length (Left)	1.37 ± 0.507	0.995 ± 1.359	0.002

Table 3.10: Improvement in left upper trapezius length in individuals whose left side is affected.



Graph 3.9: Improvement in left upper trapezius length in individuals whose left side is affected.

Graph 3.9 shows the comparison of improvement in left upper trapezius length of Group A and Group B in individuals whose left side in affected. Analysis reveals that group A has shown statistically significant improvement in left upper trapezius length as compared to group B in individuals whose left side in affected.

Group A	Group B
Lateral flexion R.O.M. (contralateral side)	Scapular positioning
Upper trapezius length (ipsilateral side)	N.R.S, intensity of pain-by-pain algometer
	Tragus to wall

Table 4: Summary of improvement seen in each outcome measure in group A and group B.

Discussion

The present study was conducted to compare muscle energy technique and activation of antagonist's muscles with thoracic extension which showed better effect on patients with trapezitis.

60 subjects were taken with 30 subjects in each group and were analyzed using paired t-test for intragroup analysis and independent t-test for inter group analysis. The outcome measures taken were tenderness grading scale, numerical rating scale on rest as well as activity, intensity of pain using pain algometer, scapular positioning (T3 to A.C. and T3 to spine of scapula), range of motion of lateral flexion and rotation, upper trapezius length and tragus to wall distance.

The two groups were given steam as a form of moist heat for 10 minutes as a part of the treatment protocols. It is a superficial heating modality which causes vasodilatation of the blood vessels, improving the blood supply and oxygen to the upper trapezius. This improved blood supply flushes out the nociceptive chemicals, which reduces pain and upper trapezius muscle spasm. Steam also increases tissue extensibility thus producing a soothing effect on upper trapezius. It becomes more pliable and less resistant to active or passive stretching.

Conventional exercises given to both the groups were cervical isometrics, cervical range of motion, shoulder shrugs along with postural education. Researches have shown that both cervical flexors and extensors lose strength and endurance in the presence of trapezitis. It was observed that subjects with neck pain had reduced the deep cervical flexors's activity and increased activity of the superficial muscles and extensors due to which they had difficulty in relaxing the superficial neck flexors even under low load and when activity was ceased. Isometric exercises (flexion, extension, both side flexion and both side rotation) with 5 seconds hold, improves the strength and endurance, reduced the over activity of flexor muscles and extensor muscles of the cervical region, helped in aligning the head in the neutral position. Marloes Thoomes-de Graaf., *et al*. in his case report concluded that isometric exercises, resulted in an increase in cervical spine R.O.M. and reduction in pain, dizziness and limitation in activities.

Group A received muscle energy technique, a post isometric relaxation along with stretching to upper trapezius. Group A has shown statistically significant improvement in all the outcome measures (Table 1.1 to 1.6) with p value < 0.05. M.E.T. positively affects pain perception by increasing the stretch tolerance. Stretching and isometric contraction when co-occurs stimulate the muscle and joint proprioceptors and mechanoreceptors. This reduces pain sensation, which makes the consecutive stretch easier and more tolerable [26]. It causes lengthening of the contracted knot's sarcomeres in the affected muscle by using post isometric relaxation with stretching. This reduces muscle fibers's tension and provides pain relief in patients with myofascial trigger points in the upper trapezius. Thus, it shows statistically significant reduction of pain intensity recorded by pain algometer as well as tenderness (Graph 1.1). [28].

It also showed statistically significant reduction in the tragus to wall distance and significant improvement in neck disability index score (Table 1.5 and 1.6). This may have been observed because cervical isometrics which strengthens the deep neck flexors, were given. Deep cervical flexor muscle training is believed to enhance the ability and improves neuromuscular control of the deep cervical flexor muscles including the longus colli and longus capitis.

Group B has also shown statistically significant improvement in all the outcome measures with p value < 0.05 (Table 2.1 to 2.6). This technique works on thoracic extension and activation of upper trapezius's antagonist muscle, which are rhomboids, middle trapezius, lower trapezius, thereby giving complete rest to the prime muscle which is upper trapezius. The corrected scapular position relieves the pressure from the upper trapezius, further reducing pain. A study investigated the effects of thoracic extension exercise on scapular alignment, which suggested that a significant decrease in thoracic kyphosis significantly increases the strength of the spinal muscles, improves scapular alignment, and relieves the pressure from upper trapezius [29].

When group A was compared to group B, group B showed better improvement in scapular positioning. A significant decrease in the distance of T3 to A.C and T3 to spine of scapula was seen in group B as compared to group A (Table 3.2). This is because thoracic extension exercises improves the posture, resulting in the scapula's repositioning. Also, activating the rhomboids, middle trapezius and lower trapezius causes adduction and depression of the scapula, holding it in its anatomical position. When scapular alignment changes, the scapular muscle's length also changes, which relieves the pressure from levator scapulae and upper trapezius. Also cervical isometrics adds to a significant reduction in tragus to wall distance in group B as compared to group A (Table 3.4). Therefore, a normal scapular alignment is considered a factor affecting the shoulder muscle near the scapula [4,29]. Also, group B showed better significant improvement in reducing pain on N.R.S. at rest and activity as compared to group A (Table 3.3). This may be because in group B, the antagonist muscle's activation led to better scapular stabilisation and overactive upper trapezius muscle inhibition through reciprocal inhibition. Steam may have also enhanced the effect by relaxing the muscle and improving blood circulation.

Upper trapezius performs same side lateral flexion and its tightness will cause restriction of contralateral lateral flexion. Therefore, in individuals whose right side is affected showed better improvement in contralateral lateral flexion (Table 3.5) and ipsilateral upper trapezius length (Table 3.7) And viceversa for individuals whose left side is affected (Table 3.8, 3.10) in group A as compared to group B. This may be because group A was given upper trapezius M.E.T. along with neck range of motion exercises. M.ET. causes an inhibitory effect on the Golgi tendon organs of the muscle, causing reduction of the motor neuronal discharges by resetting its resting length. These reflexes causes relaxation in musculotendinous unit tension and decreased pain perception [27]. It could be proposed that M.ET. equalizes the length of the sarcomeres throughout each involved muscle fiber, thus normalizing the function of the contractile elements of the muscle. However, studies support that increased tolerance to stretching (hypoalgesia) is the primary mechanism for increasing muscle length.

However, there was no significant improvement in neck disability index statistically but showed improvement clinically. This may be because of the short duration of study.

Thus, the present study found that both the interventions were equally effective in improving pain and neck functions in subjects with upper trapezitis in a duration three days. However, group B showed better improvement in posture and pain relief whereas Group A showed improvement in cervical range of motion and upper trapezius length.

Conclusion

The present study found that three days sessions of MET and activation of antagonist muscle which is rhomboids, middle and lower trapezius along with correction of thoracic extension are equally effective in improving pain and neck functions in subjects with upper trapezitis in a duration three days. However, group B showed better improvement in posture and pain relief whereas group A showed increase in cervical ranges and upper trapezius length.

Limitations

Acute effects of M.E.T and activation of antagonist muscles were assessed in this study.

Application of the Study

Trapezitis should be treated with both M.E.T. and activation of antagonist muscle with thoracic extension exercises in acute stages.

Summary

This study was done to compare the effects of M.E.T. and activation of antagonist muscles which are lower trapezius and rhomboids with thoracic extension exercises in patients with upper trapezius spasm. A total of 60 individuals, 30 in each group were selected as per the inclusion and exclusion criteria. These subjects underwent a pre-assessment in which tenderness grading scale, NRS on rest and activity, intensity of pain using pain algometer, ROM, scapular positioning, upper trapezius length, tragus to wall distance were taken as outcome measures. Intervention program of 3 sessions was performed on each subject. Each session was conducted for 30 mins. Post-test evaluation was conducted with the same outcome measures. The results were taken and analyzed using excel 2016 and SPSS version 23.A paired t- test was done within the groups, which showed a statistical and clinical significant difference in all outcome measures in both group A and group B ($p < 0.05$). A comparison between post values of Group A and B was done using independent t-Test. Group A showed statistical significant improvement in ROM and upper trapezius length ($p < 0.05$) whereas Group B showed statistical significant improvement in scapular positioning, intensity of pain and tragus to wall distance ($p < 0.05$). Neck disability index did not show any statistical significant but showed improvement clinically because of short duration study. Thus, the study found that three days sessions of MET and activation of antagonist muscles along with correction of thoracic extension are equally effective in improving pain and neck functions in subjects with upper trapezitis in a duration three days.

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