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Effect of Muscle Energy Technique versus Instrument-assisted Soft Tissue Mobilization in Upper Trapezius Myofascial Trigger Points

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Abstract:
Purpose: To compare the effects of muscle energy technique (MET) with instrument-assisted soft tissue mobilization (IASTM) in terms of pain intensity level, pain pressure threshold (PPT), cervical range of motion (CROM), and neck functional disability level in patients with upper trapezius myofascial trigger points (MTrPs).
Methodology: The study included forty-five participants from both genders, with age ranged from 18-25 years. They had bilateral upper trapezius MTrPs. They were randomly allocated into three equal groups. **Group (A)** received conventional physical therapy (PT) program, while **Group (B)** received MET combined with conventional PT program, and **Group (C)** received IASTM combined with conventional PT program. Treatment was given three times a week for four weeks. Pain intensity level, PPT, CROM of all movements, and neck functional disability level were measured using the visual analogue scale, the Algometer, the CROM device, and the Arabic version of neck disability index respectively.
Results: There were no significant differences in post-treatment between groups comparison in all variables except for neck functional disability level which showed better improvement in **Group (B)** and **Group (C)** as compared to **Group (A).**
Conclusion: Muscle energy technique and IASTM can reduce pain intensity level, increase PPT, and CROM in patients with upper trapezius MTrPs. Furthermore, MET and IASTM can decrease neck functional disability level more than the conventional PT alone without significant difference between them.
Key words: Trigger points, muscle energy technique, instrument-assisted myofascial release, M2T blade.

1. Introduction:

Myofascial trigger points **(MTrPs)** are hyperirritable, palpable tender nodules found along taut bands of muscle fibers that is painful on compression or stretch and can give rise to characteristic referred pain and motor dysfunction. Commonly, they occur in the neck and shoulder muscles. The trapezius is the most frequently involved muscle (1, 2). Myofascial pain syndrome is a chronic pain caused by trigger points.

It is associated with musculoskeletal problems such as muscle spasm, restricted range of motion **(ROM),** and decreased fiber extensibility and autonomic symptoms that affect the patient's physical abilities (3).

Myofascial trigger points of the trapezius muscles were the most prevalent, in 93.75% of the participants. The most prevalent active MTrPs were located right (82.1%) and left (79%) in the nearly horizontal fibres of the upper trapezius muscle (4). Therefore, MPS is a common source of pain in

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subjects presenting chronic non-specific neck pain. The Philadelphia panel evidence-based practice guidelines for neck pain stated that therapeutic exercises are the only interventions that provide; clinically meaningful benefits relative to control treatments (5).

Currently, a large variety of both manual and non-manual interventions exists for the treatment of trigger point pains. Interventions include superficial heat, deep heat (ultrasound), dry needling, electrical stimulation, botulism toxin injections and exercise therapy (6-9). Manual approaches may include muscle energy technique **(MET),** active release therapy **(ART),** strain–counter-strain **(SCS),** and myofascial release (10-13).

Muscle energy technique is commonly utilized method for achieving tone release (inhibition) in a muscle before stretching. The approach involves the introduction of an isometric contraction to the affected muscle producing post-isometric relaxation **(PIR)** 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/s (14).

Fryer and Fossum (15) hypothesized that the sequence of muscle and joint mechanoreceptor activation by muscle energy approaches evokes firing of local somatic efferents. This in turn leads to sympatho-excitation and activation of the periaqueductal gray matter, which plays a role in the descending modulation of pain. Owing to stimulation of mechanoreceptors, simultaneous gating of the nociceptive impulses takes place in the dorsal horn of the spinal cord. Recently, practitioners have begun to depend on instrument-assisted soft tissue mobilization **(IASTM),** which is a useful tool in treating trigger points and their pain (16).

Instrumented assisted soft tissue mobilization is the use of a specially designed instrument to mobilize soft tissue, with the aim of reducing pain. Add to this, it help in improving ROM and function. Instrumented assisted soft tissue mobilization minimizes stress on the practitioner's hand and enables greater penetration to better access fascia and release restrictions (17). To the available knowledge, there is no study comparing effects of MET with IASTM in the treatment of upper trapezius MTrPs. Therefore, the purpose of this study was to compare the effects of MET with IASTM in terms of pain intensity level, pain pressure threshold **(PPT),** cervical range of motion **(CROM),** and neck functional disability level in patients with upper trapezius MTrPs.

2. Materials and Methods:

A. Study design and sample size calculation:

This study was conducted, from February 2021 to November 2021 at the Outpatient clinics, Faculty of Physical Therapy, Kafrelsheikh University, Egypt. A three-armed randomized controlled trial study design was conducted including three treatment groups.

Sample size was determined using G-power software program (version 3.1.9.4). Regarding F test study, alpha level of 0.05, confidence interval 95% and effect size of 0.25 (to detect small effects), three groups and 4 dependent variables, the total sample size was 45 patient.

B. Inclusion criteria:

Participants were included in the study if they had active MTrPs in the upper trapezius muscle bilaterally or had pain at rest, local twitch response, jump sign and referred pain lies over the lateral aspect of the upper trapezius fibers and superiorly to the ipsilateral occiput (18, 19). In addition, participants were recruited from both genders with age ranged from 18 to 25 years old (3), and body mass index **(BMI)** from 18 to 30 kg/m2 (20).

C. Exclusion criteria:

Participants were excluded from the study if they had shoulder instability, history of cancer, shoulder or neck fractures, systemic diseases such as rheumatoid arthritis, Reiter's syndrome, or diabetes, neurological diseases, or severe medical or psychiatric disorders (21).

D. Participants preparation and randomization:

To avoid selection bias, the patients were randomly allocated by simple random method via choosing one of three wrapped cards representing the three treatment groups. Forty-five eligible participants (14 males and 31 females) were allocated into three equal groups:

Group (A): included 15 participants (3 males and 12 females). They received conventional physical therapy program for 8 sessions over a four weeks period of time.

Group (B): included 15 participants (5 males and 10 females). They received conventional physical therapy program in addition to MET for 8 sessions over a four weeks period of time.

Group (C): included 15 participants (6 males and 9 females). They received conventional physical therapy program in addition to IASTM for 8 sessions over a four weeks period of time.

E. Measurement scales and instrumentations:

1. Calibrated weight-height scale was used to measure the weight and height to calculate BMI for each patient.
2. Visual analog scale **(VAS)**: a horizontal line, 100 mm in length, anchored by word descriptors at each end. The VAS score is determined by measuring in millimeters from the left hand end of the line to the point that the patient marks (22).
3. Cervical range of motion device: manufactured by Performance Attainment Associates, United States of America, designed to measure cervical spine motion, (**Figure 1**).

It was used to measure cervical active ROM in flexion, extension, and side bending and rotation directions. It consists of a headpiece (i.e., frame that holds three inclinometers) and a magnetic yoke. The inclinometers are located on the front and side of the CROM device; each contains an inclination needle that is influenced by the force of gravity. The third inclinometer, situated in the transverse plane, contains a compass needle that reacts to earth's magnetic field for measurement of cervical spine rotation (23).

4. The Arabic version of neck disability index **(ANDI):** used to assess neck functional disability level, which is a valid and reliable tool, consists of 10 items. Each item is scored from zero (no disability) to five (total disability), with the maximum possible total score being 50 (24).

5. Algometer: a handheld device that applies a manual pressure stimulus to assess PPT, (**Figure 2**). It has been broadly used and validated and can be used to identify the pressure and/or force eliciting PPT (25).

Figure 1: The cervical range of motion device.

Figure 2: Algometer.

Figure 3: M2T blade.

F. Treatment instrumentations:

1. M2T blade: a latest invention, which helps us to release myofascial pain using the M2T blade, (**Figure 3**).

2. Hot packs: commercially available hot packs that are usually made of bentonite, a hydrophilic silicate gel, covered with canvas. Bentonite is used for this application because it can hold a large quantity of water for efficient delivery of heat.

3. Transcutaneous electrical nerve stimulation: the devise made by EMS Physio ltd in England (SN 115514) used for treatment of pain in all groups. It was used as a non-invasive nerve stimulation intended to reduce both acute and chronic pain (26).

G. Clinical evaluation:

1. Detection of myofascial trigger points: MTrPs were identified either through a flat palpation technique or pincer palpation. The recommended diagnostic criterion for MTrPs (18) was used, that was as follows:

A. Presence of a palpable taut band in the skeletal muscle.

B. Presence of a hypersensitive spot in the taut band.

C. Local twitch response provoked by snapping palpation.

D. Production of a typical referred pain pattern in response to the compression of trigger points.

E. Spontaneous presence of the typical referred pain pattern.

If the first four points of criterion were satisfied, the trigger points were considered latent, and if all were satisfied, the trigger points were considered active (18, 27).

2.Measurement of pain intensity level: It was measured using VAS by asking the patient to mark on the line at the point that represents his/her perception of the current state.

3.Measurement of pain pressure threshold: It was measured using the manual algometer on the MTrPs then increase pressure by 1 kg/cm per second until the patient felt a sensation of pain guided by using a standard metronome. Once the patient felt pain, the patient said "now so, the level of pressure was recorded. It was measured three times with 30 seconds between each then the mean value of measurement was reported (28, 29).

4.Measurement of cervical flexion and extension range of motion:

The patient assumed sitting position on a chair with the head in the midline range. The CROM instrument was aligned on the nose bridge and ears and was fastened to the head by a Velcro strap. To assure full flexion in this multi-joint area, the therapist instructed the patient to "nod the head to make a double chin"(Suboccipital flexion). Then the patient was encouraged to flex further until full cervical flexion was obtained. The measurement on the sagittal plane meter was taken through the meter's beveled edge; from this angle, the pointer was magnified to the dial edge. To measure cervical extension, the subject was instructed to "nod the head back" (suboccipital extension). Then the subject extends further until full extension was achieved. The mean value of successive three trials was recorded as a measurement for cervical flexion and extension.

5.Measurement of cervical lateral flexion range of motion:

The patient was instructed to sit erect in a straight-back chair with the sacrum against the back of the chair, arms kept beside the body at sides and feet were flat on the floor. Before starting cervical lateral flexion, the patient was instructed to focus his eyes a point on the wall straight ahead to eliminate head rotation. Besides, the patient was instructed to keep the shoulder level during the measurement.

6.Measurement of cervical rotation range of motion:

The CROM instrument, the magnetic yoke and rotation arm were all used for rotation measurements. To obtain an accurate measurement, the north direction was first determined. Then the magnetic yoke was applied on the patient's shoulders with the arrow pointing to the north. The patient was instructed to sit erect in a straight-back chair with the sacrum against the back of the chair, arms kept beside the body and feet were flat on the floor. The coronal and sagittal plane meters must read zero for the rotation meter to be level. The patient was instructed to focus on a horizontal line on the wall, so the head was not tipped during rotation. Patients shoulders were stabilized by the therapist hand to keep shoulders level during measurement. If the patient head and shoulders are rotated together, the pointer will not move because the magnetic yoke positioned on the shoulders eliminates shoulder substitution. Cervical rotation to either side was recorded for three successive trails and then the mean value of measurement was reported.

7.Measurement of neck functional disability level using the Arabic version neck disability index:

The patient was relaxed and asked to complete the ANDI before and after the period of intervention.

H. Treatment procedures

Control Group (A): received conventional physical therapy program including hot packs, TENS, and exercise program for 2 sessions/ week for four weeks (30, 31).

1. Heat application: The patient is relaxed in prone position before application of electric hot pack. Hot pack placed over the neck and the upper part of shoulders musculature and applied for ten minutes (32).

2. Transcutaneous electrical nerve stimulation: The technical procedures of the TENS application was as following:

Patient position: Sitting on chair.

Placement of electrodes: Two electrodes Para spinal on upper fibers of trapezius of the affected side and the other two electrodes on dermatome according of level of spine affected C5/6 and /or C6/C7.

Pulse width: 100 – 150.

Pulse rate: 60 - 100Hz.

Output: Adjust to the most comfortable intensity level.

Treatment Session: 30 minutes (33).

3. Exercise program:

A. Stretching exercises for neck muscles; upper trapezius and neck rotators muscles.

B. Isometric strengthening exercises for neck muscles; neck extensors, neck rotators, and neck side bending muscles (31).

Group (B): MET; (PIR).

The participant was placed supine and the practitioner stabilized the affected shoulder with one hand, while the ear /mastoid area of the same side was held by the opposite hand. The head and neck bent towards the contralateral side, flexed and ipsilateral rotated. The participants then shrugged the stabilized shoulder towards the ear at a sub maximal pain-free effort (20% of the available strength). The isometric contraction was held for 7-10 seconds. This position was maintained for 30 seconds, and the same procedure was repeated three to five times per treatment session (34).

Group (C): IASTM.

The participant was seated in a comfortable position. The subject's forehead was rested on his/her forearm on a table in front of him. A lubricant (Vaseline) was applied to the skin around the neck area prior to treatment and the M2T blade cleaned with an alcohol pad. First, the M2T blade is used to find the exact areas of restriction in the upper trapezius. Then the M2T blade was used, at an angle of 45° to apply slow strokes along the muscle, without causing any discomfort or pain, from the muscle origin to its insertion (sweeping technique) for approximately three minutes. This procedure repeated two time a week for four weeks (35).

I. Statistical analysis:

Data of all participants in the three groups were collected and included; age (years), BMI (kg/m2), and gender. In addition, pain intensity level (VAS), PPT right, PPT left, neck functional disability level (ANDI), CROM of flexion, extension, side bending right, side bending left, rotation right, and rotation left pre and post-treatment period. The level of significance for all tests was set at p-value ≤ 0.05. The statistical package for social sciences version 26 for windows (Armonk, NY: IBM Corp) was used for data statistical analysis.

3. Results:

Before analyzing the collected data, they were screened for all assumptions regarding the used tests for statistical analysis like normality assumption via Shapiro–Wilk test using histograms with the normal distribution curve that showed each dependent variable was normally distributed and not violates the parametric assumption. In addition, homogeneity of variance was tested via Levene's test that revealed all data showed no violations of the assumptions of equality of variance with p-value > 0.05. The presence of univariate or multivariate outliers was tested using Mahalanobis distance that showed all data have no outliers, and finally, assurance that there is no multicollinearity through correlation analysis. All the findings of these tests were a pre-requisite that allowed us to conduct parametric analysis for the collected data.

A. Comparing the mean values of age and BMI for all participants in each group using a one-way ANOVA test. It revealed that there were no significant differences among them in age (p= 0.89) and BMI (p= 0.48). In addition, gender distribution for all participants among the three groups was compared using the Chi-square test. It revealed that there were no significant differences among them (p=0.48), **table (1).**

Table 1: Demographic data; age, body mass index, and gender.

Items		Mean ± SD			P-value
		Group (A)	Group (B)	Group (C)	
Age (years)		22.8 ± 1.74	22.8 ± 1.01	23 ± 1.07	0.89
BMI (kg/m²)		23.4 ± 3.33	24.53 ± 2.85	24.6 ± 2.90	0.48
Gender	**Males (%)**	3 (20)	5 (33.3)	6 (40)	0.48
	Females (%)	12 (80)	10 (66.7)	9 (60)	

SD: Standard deviation, χ^2: Chi-square, P-value: probability value.

B. Within group comparison of all variables in each group:

Comparing the pre and post-treatment mean values using paired t-test for all variables in **Group (A),** showed that, there were significant differences in tested dependent variables; pain intensity level (VAS) (p= 0.0001), PPT right (p= 0.0001), PPT left (p= 0.0001), neck functional disability level (ANDI) (p= 0.02), flexion (p= 0.0001), extension (p= 0.0001), side bending right (p= 0.0001), side bending left (p= 0.0001), rotation right (p= 0.0001), and rotation left (p= 0.0001).

Comparing the pre and post-treatment mean values using paired t-test for all variables in **Group (B),** showed that, there were found significant differences for pain intensity level (VAS) (p= 0.0001), PPT right (p= 0.0001), PPT left (p= 0.0001), neck functional disability level (ANDI) (p= 0.0001), flexion (p= 0.0001), extension (p= 0.001), side bending right (p= 0.0001), side bending left (p= 0.0001), rotation right (p= 0.0001), and rotation left (p= 0.0001).

Comparing the pre and post-treatment mean values using paired t-test for all variables in **Group (C),** showed that, there were found significant differences for Pain intensity level (VAS) (p= 0.0001), PPT right (p= 0.0001), PPT left (p= 0.0001), neck functional disability level (ANDI) (p= 0.0001), flexion (p= 0.0001), extension (p= 0.0001), side bending right (p= 0.0001), side bending left (p= 0.0001), rotation right (p= 0.0001), and rotation left (p= 0.0001).

C. Comparing the post-treatment mean values between the three groups using one-way ANOVA test, found that, there were found no significant differences between the three groups for pain intensity level (VAS) (p= 0.76), PPT right (p= 0.78), and PPT left (p= 0.64), flexion (p= 0.93), extension (p= 0.15), side bending right (p= 0.79), side bending left (p= 0.27), rotation right (p= 0.4), and rotation left (p= 0.64). While for neck functional disability level (ANDI), there were significant differences between the three groups (p= 0.007).

D. Using post hoc tests, post-treatment mean values of neck functional disability level (ANDI) were compared between each two groups. There was found a significant difference between **Group (A)** and **Group (B)** in favor of **Group (B)** (p= 0.04). There was found also a significant difference between **Group (A)** and **Group (C)** in favor of **Group (C)** (p= 0.008). On the other hand, there was found no significant difference between **Group (B)** and **Group (C)** (p= 0.81), **table (2),** (**Figure 4**).

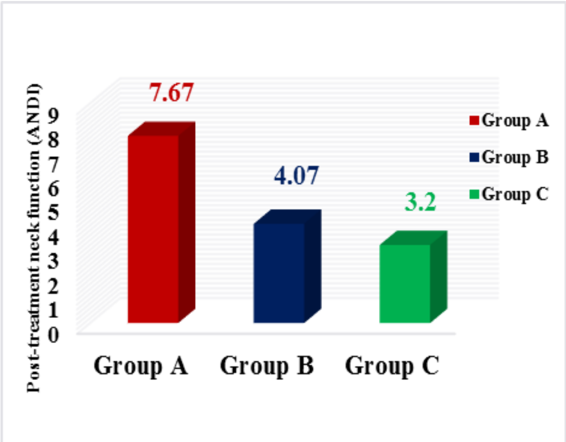

Figure 4: Pairwise comparisons between groups.

Table 2: Pairwise comparisons between groups.

Pairwise comparisons between groups: post hoc tests		
Groups	**P-value**	**Sig.**
Neck functional disability level (ANDI)		
Group (A) - Group (B)	0.04*	S
Group (A) - Group (C)	0.008*	HS
Group (B) - Group (C)	0.81	NS

P-value: probability value, S: Significant. Sig.: Significance, *: Statistically significant, NS: Non-significant, HS: Highly significant,

4. Discussion:

The purpose of this study was to compare the effects of MET and IASTM on pain intensity, PPT, neck function, and CROM in treatment of upper trapezius MTrPs. All the outcome measures were assessed by valid and reliable tools. Pain intensity was measured by VAS which is a valid and reliable scale for pain intensity measurement (36). Pain pressure threshold was measured by an algometry which is a valid and reliable tool to assess MTrPs (37). Functional disability was measured by ANDI which is a valid, reliable, and responsive tool that can be used to assess neck pain in the Arabic-speaking populations (24). Cervical range of motion was measured by CROM device which is considered a valid and reliable tool to assess CROM (38).

The first hypothesis in this study suggested that there is no statistically significant difference in pain intensity with MET and IASTM in patients with upper trapezius MTrPs. According to the results of this study this hypothesis is accepted as there were no significant differences among the three groups in post-treatment pain intensity (p= 0.76). The findings of this study are in line with a similar study of Ellythy, (39) who stated that MET is effective in reducing pain intensity in subjects with recurrent low back pain. Shah et al. (1) compared two treatment techniques; MET and ischemic compression on upper trapezius trigger point in subjects with non-specific neck pain. It was found that both the treatments were effective in reducing pain intensity level without statistical difference between them.

Another comparative study was conducted to compare between the effects of MET and mulligan sustained natural apophyseal glides (SNAGs), Tank et al. (40) found that both groups were improved after the study intervention by reducing their pain intensity level. Consequently, the study concluded that MET and mulligan SNAGS are equally effective and can be used as alternate treatment along with conventional therapy for treatment of mechanical neck pain. Post-isometric relaxation refers to the subsequent reduction in tone of the agonist muscle after isometric contraction. This occurs due to the stretch receptors, called Golgi tendon organ, that are located in the tendon of the agonist muscle. These receptors react to over stretching of the muscle by inhibiting further muscle contraction. In more technical terms, a strong muscle contraction against equal counterforce triggers the Golgi tendon organ. The afferent nerve impulse from the Golgi tendon organs enters the dorsal root of spinal cord and meets with an inhibitory motor neuron (41).

The improvements in patients who received soft tissue mobilization by the M2T blade can be explained by many mechanisms. Firstly, when an instrument is used to scrape the skin, it causes removal and loosening of scar tissues and adhesions (42). Secondly, it also induces vasodilation response, an increase in tissue temperature, and local inflammation. Thus, there is an increase in blood flow to the area which provides oxygen, nutrients supply, and removes metabolic end-products and inflammatory mediators (43, 44). It improves fibroblastic activity and proliferation, collagen synthesis, orientation and maturation and consequently, the healing process (45-47). The manual muscle treatment could be considered as anti-inflammatory through increasing anti-inflammatory mediators (48).

The decrease in pain level can also be explained by stimulating A-beta sensory fibres which block the transmission through A-delta and C fibres, so it closes the gate for their transmission of nerve impulses, and this is based on the gate control theory. This also plays in decreasing the production of inflammatory mediators (49). Another explanation of the effect of M2T blade the current study revealed that the higher treatment effect is the higher pressure produced by the tool than hands. Besides this, the M2T blade technique produces a higher vascular effect than the MET; this higher effect improved vascularity, the removal of waste products, and the healing process than the other groups (42).

Lee et al. (50) compared the Graston technique, one of the IASTM techniques, and general exercise. He found that both groups had pain relief, measured by VAS, with a greater effect for the Graston group. Naik et al. (51) also found that pain level, measured by VAS, was significantly decreased in patients having shoulder pain without a clear pathology after treatment with IASTM. Furthermore, Naik et al. (51) compared the effects of myofascial release using M2T blade against kinesiotape application. He found that both groups were effective in decreasing pain level with no significant difference between them. Motimath et al. (52) also investigated the effect of IASTM by using M2T blade on pain level for fifty patients with unilateral upper trapezius spasm. He applied one session of IASTM for 30 to 60 seconds and found that there was significant decrease in pain level for all participants. El-hafez et al. (3) investigated the effects of IASTM using M2T blade versus stripping massage on MTrPs of the right upper trapezius. He found that both groups showed significant effects in reducing pain intensity with no significant difference between them.

The second hypothesis in this study suggested that there is no statistically significant difference in neck disability level with MET and IASTM in patients with upper trapezius MTrPs. According to the result of this study we rejected this hypothesis as there were significant differences between the three groups (p= 0.007*). Furthermore, after multiple comparison, there was a significant difference between the MET and conventional physical therapy groups (p= 0.04*) in favor of the MET group, and between the IASTM and conventional physical therapy groups (p= 0.008*) in favor of the IASTM group.

The results agreed with Joseph and Palappallil, (53) who found that IASTM may be effective in acutely decreasing disability and improving function. Add to this, Tank et al. (40) compared between the effects of MET and mulligan SNAGs on neck functional disability level for individuals with mechanical neck pain. The results showed that subjects of both groups were improved after the study intervention by reducing their disability with an equal effect between them. Ellythy, (39) also found that MET can greatly improve neck function in subjects with recurrent low back pain. Instrument-assisted soft tissue mobilization using M2T blade was compared against stripping massage on MTrPs of the right upper trapezius regarding neck function measured by the neck disability index. The results showed significant post-treatment with no significant difference between them (3).

The third hypothesis in this study suggested that there is no statistically significant difference in CROM with MET and IASTM in patients with upper trapezius MTrPs. Based on the results of this study we accepted that hypothesis as there were no significant differences between the three groups in post-treatment CROM of neck flexion (p= 0.93), neck extension (p= 0.15), neck side bending right (p= 0.79), neck side bending left (p= 0.27), neck rotation right (p= 0.4), and neck rotation left (p= 0.64). It was reported that MET was used to lengthen potentially the shortened cervical muscle and fascia aiming to normalize the gross CROM. Furthermore, regional ROM barriers (flexion, extension, side bending, and rotation) of the cervical spine were increased using MET.

For that reason, MET is known as an effective treatment of restricted ROM and cervical pain (54, 55). Muscle energy technique when compared to ischemic compression on upper trapezius trigger points in subjects with non-specific neck pain showed that both the treatments were effective in improving CROM; however, MET had better results (1).

Another comparative study between the effectiveness of MET and mulligan SNAGs on CROM for individuals with mechanical neck pain was conducted by Tank et al. (40). The results showed that subjects of both groups were improved after the study intervention by increasing CROM. The findings of this study agree also with Ellythy, (39) who stated that MET is effective in improving ROM in subjects with recurrent low back pain. In addition, Lee et al. (50) compared the Graston technique, one of IASTM techniques, and general exercise. He found that both groups showed an increase in ROM with more significant results in favor of the Graston group. Naik et al. (51) also investigated the immediate effect of myofascial release using M2T blade on ROM, measured by the universal goniometer, in 7 badminton athletes with shoulder pain. He found that there were significant effects on improving ROM.

Furthermore, Baker et al. (42) applied three sessions of IASTM for one week on the hamstrings and triceps surae of men who had problems in the lower extremities, such as tightness and pain, and found that there was an increase in sit and reach (5 cm) and active straight leg raise (75º). Merkle et al. (56) found that applying two sessions of IASTM per week for 3 weeks in healthy collegiate baseball players significantly improve their hamstring ROM. Heinecke et al. (57) mentioned that applying two sessions of IASTM per week for 4 weeks to the shoulder area of collegiate softball, baseball, and volleyball players was helpful in preventing loss of ROM. Kim et al. (58) found that there was improvement in ROM after a single application of IASTM in the hamstrings of adult men and women. The results also agreed with Joseph and Palappallil, (53) who found that IASTM may be effective in acutely improving pain free flexion ROM.

It may serve as a valuable tool to restore ROM. The results of the current study also agreed with Laudner et al. (59) who found that IASTM can significantly improve ROM. The IASTM group showed significantly improved ROM when compared with the control group and a significant difference in glenohumeral internal rotation ROM was also found between the IASTM and control groups. Instrument-assisted soft tissue mobilization improves the extensibility of soft tissues by treating their restrictions (57), and as heat is generated from friction by the instrument, the viscosity of the tissue decreases, making it softer (60). Physiologically, a decrease in the viscosity of tissue improves ROM (61). Meanwhile, significant changes in ROM as a result of IASTM can also be explained by hypotheses related to the nervous system. When mechanical stress is exerted on the muscle fascia, intra-fascial mechanoreceptors become stimulated. This change alters the proprioceptive input sent to the central nervous system, which in turn changes the tension in tissue-related motor units (62).

The fourth hypothesis in this study suggested that there is no statistically significant difference in PPT with MET and IASTM in patients with upper trapezius MTrPs. The results of this study accept this hypothesis as there were no significant differences between the three groups in post-treatment PPT right (p= 0.78), and PPT left (p= 0.64). El-hafez et al. (3) investigated the effect of IASTM using M2T blade versus stripping massage on MTrPs of the right upper trapezius. He found that PPT, measured by a commander algometer, was improved in post-treatment assessment in both groups with no significant difference between them. There is paucity of literature regarding the effectiveness of MET or IASTM on PPT for patients with upper trapezius MTrPs, which needs well-designed randomized controlled trials to assess it.

5. Conclusion:

Muscle energy technique and IASTM can reduce pain intensity level, increase PPT and CROM in patients with upper trapezius MTrPs. Furthermore, they can improve neck functional disability level more than the conventional physical therapy.

Limitation:

The current work took a step in getting evidence of the best treatment modalities in the management of upper trapezius MTrPs, but it didn't study the long term effects of MET or IASTM.

Recommendations:

Future research needs to include different ages and a long term follow-up. In addition, similar studies need to be conducted for the patients suffering from MTrPs after other orthopedic disorders.

Ethical approval:

Ethical committee approval was obtained from Faculty of Physical Therapy, Cairo University, Egypt, number (P.T.REC/012/002874). Each participant signed a written consent form before participating in the study.

Authors contributions:

The authors cooperated in the article drafting and approved the final version submission for online publication.

Conflict of interests:

The authors declare no conflict of interest.

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