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Research Article

The Immediate Effect of a Combination of Pressure Release and Cervical Mobilization Techniques on the Active Range of Motion in the Latent Trigger Points of Upper Trapezius Muscle in Young Adult Females

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Abstract

Background: Myofascial Trigger Points (MTrPs) are a common source of musculoskeletal pain. The decreased cervical range of motion is one of the main symptoms of them.

Purpose: This study compared the immediate effect of a therapeutic pack including pressure release and cervical mobilization with pressure release only on cervical active Range Of Motions (ROM) in latent MTrPs.

Study Design: The study was a cross-over trial within a 15-day washout phase.

Patient Sample: Twenty-one girls (mean age 23.14±3.38 years) participated in the study.

Outcome Measures: active cervical range of motion.

Methods: The Subjects were randomly assigned to three groups: Pressure Release with cervical Mobilization Pack (PRMP), pressure release only, and sham algometry. All outcomes were measured before and immediately after the interventions. The study was funded by a personal research fund of $450. No conflict of interest is declared.

Results: The findings showed an immediate increase in all active ROMs in the PRMP group before and after treatment ($p<0.001$). The right/left side flexion and the right /left rotation ROM increased significantly in the pressure release group too ($p<0.001$). However, there was no significant improvement in the sham treatment. There was significant difference between PRMP with pressure release and sham group in all active ROM. Besides, there was a significant difference between pressure release and sham group in the left/right lateral flexion and the right rotation ROM.

Conclusion: The study suggests that pressure release technique in combination with mobilization is more effective in improving ROM in MTrPs involvements.

Keywords: Mobilization; Pressure release; Range of motion

Abbreviations

PRMP: Pressure Release and Cervical Mobilization Pack; ROM: Range Of Motion; MTrPs: Myofascial Trigger Point; K-S test: Kolmogorov-Smirnov

Introduction

Myofascial Trigger Points (MTrPs) are defined as palpable tender spots within the taut bands of skeletal muscle that can refer pain to a distant point and cause motor and autonomic disorders [1]. They are a common source of musculoskeletal pain [2-4]. The prevalence of MTrPs in scapular positioning muscles was reported 90% even in healthy adults [5]. Muscles of the head, neck and shoulders are more prone to involvement with MTrPs [1,6]. The most frequent involved muscle, which appears in MTrPs, is Trapezius muscle [4]. MTrPs is more common in women than in men [1,7].

Myofascial trigger points are classified clinically as latent and active. Latent MTrPs do not cause clinical complaints, but they produce referred pain in response to compression, stretch or overload. Latent MTrPs decrease the contractile efficiency of the muscles, restrict the range of motions [1], cause muscle weakness, fatigue, sensory-motor dysfunctions [8], change motor control function and disturb normal patterns of motor recruitment [9]. The main difference between the active and the latent forms of MTrPs is that the symptoms of latent MTrPs are not usual or familiar to patients. Latent MTrPs are more prevalent than the active ones. They can also be transformed into an active form under the influence of perpetuating factors [1,10,11].

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Table 1: Inclusion [1,14] and exclusion criteria [24,25].

Inclusion criteria	Exclusion criteria
Neck/shoulder pain or discomfort more than 1 month during the last year	history of whiplash, traumatic injuries or surgical interventions on the neck or upper limb
The presence of latent MTrPs on upper trapezius which was determined using the diagnostic criteria described by Simons et al	fibromyalgia syndrome osteoporosis cervical osteoarthritis Inflammatory diseases
Local pain more than 3 in visual analogue scale elicited by 2.5 kg/cm^2 of pressure on the MTrP	radicolopathic pain, myelopathy and malignancy infection or metabolic disease
Negative cervical spine instability test (integrity of alar and transverse ligaments) and arterial integrity test (vertebrobasilar artery)	having undergone myofascial pain therapy within the past month before the study

However, most techniques of treatment for active and latent trigger points are the same, but treatment of latent trigger points should be more conservative in order to avoid converting to the active once [1]. MTrP is typically diagnosed with physical examination and manual palpation. Sciotti et aldemonstrated that manual palpation is a reliable technique for finding the latent trigger points on upper Trapezius muscle [4].

The decreased cervical range of motion is one of the main symptoms of MTrPs [1]. Simons emphasizes that the significance of releasing muscle taut bands amounts to reaching a full range of motion. Pressure release is one of the most frequently used techniques in the treatment of MTrPs, which has a significant effect on decreasing pain indexes. And alsoit has a long-lasting therapeutic effect [12-15]. It should be noted, however, there is no unanimity on the effect of the pressure release technique in improving the cervical range of motion in MTrPs involvements [16,17].

Mobilization is one of the most widespread techniques in the treatment of dysfunctions relating the cervical spine [18] and its useful in improving the cervical range of motion that has been proven in the previous studies [19-21]. Furthermore, considering that mobilization has no adverse effect like arterial dissection, as seen in manipulation technique [22] it is hypothesized that a combination of mobilization and pressure release can improve MTrPs symptoms [23].

Hence, the present study aimed to compare the immediate effect of the therapeutic pack including Pressure Release and cervical Mobilization (PRMP), and the pressure release alone on the cervical active range of motions in latent MTrPs in young adult females.

Materials and Methods

This study was a randomized, sham controlled, cross-over trial. The approval for the study was obtained from the Physical Therapy Research Centre Ethics Sub-Committee (number: Ir.sbmu.ram.rec.1394.312).The sample size was determined with the help of software PASS 11 with type one error α=0.05 and type two error β=0.02 (power=0.8) to be 21 subjects per group.

Twenty-one volunteer participants were recruited from Shahid Beheshti University of Medical Sciences. All the participants were right-handed females, who had at least one latent trigger point in the upper Trapezius of the dominant side. The inclusion and exclusion criteria are listed in Table 1. Those participants who had met the required criteria were admitted to the study and were randomly assigned to one of three treatment groups: 1- Pressure Release with cervical spine Mobilization Pack (PRMP) 2- pressure release 3- sham algometer.

Table 2: Intra-rater reliability of the goniometer.

	ICC	SEM
Flexion	0.93	2.64°
Extension	0.94	2.30°
Left Lateral Flexion	0.92	3.37°
Right Lateral Flexion	0.90	3.74°
Left rotation	0.89	2.80°
Right rotation	0.88	3.65°

Intra-Class Correlation Coefficient (ICC); Standard Error of Measurement (SEM).

Interventions

Pressure release

The participants were asked not to take any pain killers at least 48 hours before the examinations [26]. Prior to the application of the techniques, they were also examined to identify and mark their MTrPs on the upper Trapezius muscle. To apply the treatment technique, the algometer disk was put on the marked point while the subject was lying supine. Then the pressure was gradually increased to the medium and tolerable levels (to 7 in VAS criteria). The pressure was kept at this level until the pain level reduced to 3 from 10, the pressure was then increased after the patient reported pain reduction up to 7 levels. This process lasted for about 90 seconds.

Pressure release and cervical mobilization pack

After applying pressure release, the mobilization technique was performed on the subject in the prone position. The subject was asked to cup her hands under her forehead with her palms up. The therapist stood near the subject's head, whose shoulders and sternum were positioned over the spinous process which be mobilized. The therapist's thumbs were placed next to each other over the spinous process, fingers spread around the side of her face and neck. Therapist's elbows were slightly bent and applied an oscillatory movement with both arms by rocking the body in and out in central posterior-anterior direction, on C2-C7 cervical vertebrae, 30 seconds for each segment, with grade III or IV Glides [20,25,27]. Breathing rhythm was used during the mobilization to keep the oscillation rhythm.

Sham algometry

Algometer was used as a sham treatment and the subject were asked to lie supine so the therapist could put the algometer in contact with the marked point without force for 90seconds.The algometer showed the amount of force applied, which indicated that the control group received no therapeutic pressure.

Table 3: Statistical findings about the three groups.

	Pressure release			PRMP			Sham algometer		
	pre	post	p-value*	pre	post	p-value*	pre	post	p-value*
Flex	43.46±4.89	44.20±5.19	0.09	44.20±6.41	47.66±6.48	<0.001	44.41±4.83	44.36±4.97	0.90
	a			B			a		
Ext	49.58±5.63	49.49±3.67	0.86	48.28±6.40	51.12±6.10	<0.001	49.57±5.87	49.95±5.53	0.30
	a			B			a		
LLF	29.96±4.85	33.52±5.36	<0.001	29.55±5.06	36.25±4.60	<0.001	30.36±5.07	31.07±4.79	0.12
	a			B			c		
RL F	32.74±3.82	35.31±3.66	<0.001	32.19±4.26	36.01±3.57	<0.001	33.07±3.97	33.39±4.27	0.31
	a			B			c		
Lrot	52.92±7.50	54.38±7.34	<0.001	52.42±7.17	55.15±7.15	<0.001	53.68±7.49	54.49±7.59	0.06
	a			B			a		
Rrot	51.03±7.11	53.66±6.97	<0.001	52.26±8.03	56.15±8.17	<0.001	51.20±7.65	51.68±8.56	0.29
	a			B			c		

Values are expressed in terms of means and standard deviations ± S.D.
Similar characters represent no significance findings, different characters represent significance findings (p<005).

Outcomes

Cervical range of motions: The range of motions for all cervical active movements was measured with a goniometer. Before starting the trial; a pilot study was carried out on 15 young healthy women to determine the intra-examiner reliability of the goniometer in measuring the cervical range of motions [28]. The results are shown in Table 2.

In order to measure the cervical ROM, first the patient's head was placed manually in a position that a hypothetical line was formed between the ear lobe and the base of naresin parallel to the floor [29].

To assess the flexion and extension of the cervical spine, the subject sat on a chair, the examiner standing by her side. After being instructed how to move accordingly, the examiner placed the center of the goniometer on the subject's ear lobe so that one arm of the goniometer would be perpendicular to the floor and the other arm aligned along the base of the nares. Then the subject was asked to bend her head forward (flexion) and backward (extension).

To assess the lateral flexion, the examiner stood behind the subject and placed the center of the goniometer on C7 vertebrae, one arm of the goniometer being perpendicular to the floor and the other arm parallel to the posterior surface of the skull. Then the subject was asked to move her ear close to her shoulder (lateral flexion).

Also, to assess the cervical rotation, the examiner stood above the subject's head, placed the center of the goniometer on the crown of the subject's head¸ one arm of the goniometer being aligned parallel to the crest of the nose and the other arm parallel to the prominence of the acromion. Then, the subject was asked to rotate her head and neck without any flexion or extension [29]. The examiner was mindful to make sure that the subject acted as instructed while assessing her movements.

Data analysis

The data were analyzed using SPSS (version16). Kolmogorov-Smirnov (K-S) test was applied to check if the quantitative data were normally distributed. The differences between pre- and post-treatment values were calculated using paired-samples t-test method. Repeated-measure analysis was used to compare the outcomes within the groups. Pair-wise comparisons were also made using Bonferroni method. Besides, Mauchly's test was used to evaluate sphericity. The P value was set at 0.05 and the statistical analyses were conducted at the 95% confidence level.

Results

Twenty-one asymptomatic right-handed young adult women who were diagnosed to suffer from latent MTrPs in their right upper Trapezius were asked to participate in the study between October 2015 and February 2016 voluntary participants were considered for enrolment. The entire participant completed the study. Since previous studies had claimed that the therapeutic effect of the pressure release remains for one week [17], a 15-day wash-out phase was considered in which the subjects were re-examined 15 days after each trial and were placed in the other treatment group. All the subjects were female with the following physical characteristics: age: 23.14±3.38 years; weight: 57.95 ± 4.10 kg; height: 1.65 ± 0.05 m; Body Mass Index: (BMI) 21.33±1.58.

The K-S test showed that the quantitative data of all variables were normally distributed.

The results of the study showed an immediate increase in all active ROM in the PRMP group after the treatment compared with before it (p<0.001). Also the right/left side flexion and the right /left rotation ROM increased significantly in the pressure release group (p<0.001). However, there was no significant improvement in the sham group in the post-treatment evaluations. On the contrary, repeated measure analysis indicated that there was significant difference in PRMP in the pressure release and sham groups in all active ROM. Furthermore, there was a significant difference between the pressure release and the sham group in the left/right lateral flexion and the right rotation ROM. Table 3 summarizes the statistical findings of the three groups.

Discussion

The present study revealed that the application of a therapeutic pack including manual pressure release with cervical mobilization technique over latent MTrPs in the upper Trapezius muscle was more effective in improving all active ranges of motion compared with pressure release alone and sham algometer technique.

This seems to be the first paper in which changes in the active ranges of motion following the application of PRMP in the young adult women with latent MTrPs were investigated.

The decreased cervical range of motions seems to be one of the main symptoms of MTrPs [1]. Previous studies have shown an interrelationship between MTrPs and joints dysfunctions [30,31]. They also showed that an increased tension in the taut band and a motor activity facilitation under the influence of MTrPs can lead to the displacing stress on the cervical spine [32] anterior-posterior joint hypomobility and decrease joint gliding [32-34]. Simons suggests that the restriction of ROM is related to the increased tension in the fascicles of the taut band due to the shortening of the sarcomeres length under the influence of MTrPs [35]. He contends that restricted ROM affects joint play besides kinesiological planes of voluntary motion [35].

An increase in the values of all active ROM after the treatment in the PRMP group indicates that the cervical mobilization, as an articular treatment in combination with pressure release as a soft tissue treatment, increases ROM. Therefore, our study confirms the findings of the previous studies regarding the interrelationship between upper Trapezius MTrPs and cervical dysfunctions [25,30,31].

Having observed an increase in the flexion and extension ROM after PRMP in the latent MTrPs subjects, we can claim that the involvement of the upper Trapezius latent MTrPs may affect other cervical ranges of motion besides the ipsilateral rotation and contra lateral flexion. Besides, a significant improvement was observed in the right/left side flexion and the right /left rotation ROM in the pressure release group too. In the previous studies, the belief was that the *recruitment* of upper Trapezius muscle fibers occurs mostly in cervical ipsilateral rotations and contralateral flexion movements [36]. And it was claimed that any shortness or involvement in Trapezius muscle directly affects ipsilateral rotation and contralateral flexion movements. Yet, the results of the present study suggest that dysfunction of cervical spine following the MTrPs involvement, can affect other cervical ROM. Further studies are required to clearly investigate the effect of MTrPs of upper Trapezius muscle on the cervical ROM restriction.

The pressure release group showed an effective improvement in the right/left rotation and the right/left lateral flexion in the post-treatment stage compared with pre-treatment stage. Besides, this technique proved to be more effective in increasing the ROM of the right rotation and the right/left lateral flexion compared with the sham technique. This result seems to be in agreement with certain previous studies [13,14,37]. There are other studies, however, which claim otherwise. They reported that pressure release is not effective in improving cervical ROM compared with other techniques [16,38].

It seems that pressure release can have an effect on ROM and can relieve muscle spasms through the spinal reflex mechanism and can equalize the length of sarcomeres by decreasing the height of sarcomeres and increasing their length [1].

The results also indicated that a combination of mobilization technique with pressure release was more effective than pressure release alone in improving active ROM in latent myofascial trigger points of upper Trapezius muscle. This result corroborates what have been found in the previous studies.

Fernandez-de-lasPeñas et al examined the usefulness of mobilization of T4-T1, C7-T1 and C1-C2 vertebrae along with manual techniques of MTrPs treatment in the tension-type headache subjects. Cervical mobilization was applied by Maitland protocol including grade III or IV central posterior-anterior mobilization, 30 sec over each segment. The result of the study showed significant improvements in the cervical extension, the right cervical rotation, the left cervical rotation, the pressure pain threshold, and the pain sensitivity scales. The selected manual therapy technique used in the study in order to inactivate MTrPs over cervical and shoulder muscles were soft tissue stroke, pressure release, or muscle energy techniques. It should be noted that the effect of interventions on other cervical ranges of motions like lateral flexion was not assessed in this study [23].

Ganesh et al. suggested that there was no difference between mobilization of C3-C4 cervical spine and ischemic compression in improving lateral flexion ROM and pressure pain sensitivity in latent upper Trapezius TrPs [39].

We need to mention that their opposing claim was based on the fact that they measured the lateral flexion of cervical muscles only and that they overlooked the role of other effective motions in upper Trapezius MTrPs involvements, especially the cervical rotation.

The anterior-posterior mobilizations of the cervical spine relieve spain in the free ranges of motion, causes muscle relaxation in adjacent muscles and improves arthrokinematic relationship [39]. The mobilization technique has a hypoalgesic effect which acts through a descending inhibitory pathway. Sterling et al. suggested that the hypoalgesic effect of mobilization could cause muscular relaxation in adjacent muscles [19]. Changes in motor activity after applying mobilization technique could be explained by more than one mechanism: changes in reflex responses due to muscle spindle [40], kinesthesia increase, and changes in proprioceptive awareness via excitation of gamma motor neurons, which can change muscle activity after applying the mobilization technique.

Our study is not, however, without its limitations. We only assessed the immediate effect of interventions. Further studies should be conducted, with long follow-ups, to investigate the long-term effect of the therapeutic pack. Besides, the treatment was applied for a single session, while it is necessary to examine the cumulative effects of a multi-session treatment. And finally, the participants, the examiner and the therapist in our study were unblinded from the treatment groups, which might have affected the results of study and is to be avoided in future studies.

Conclusion

This study suggests that cervical mobilization, as an articular

treatment in combination with pressure release, as a soft tissue treatment, can increase cervical ROM in the latent MTrPs of upper Trapezius muscle in the young adult women.

As a clinical advice, to combine another manual technique such as mobilization, which acts directly on the joints with pressure release can be more effective to relieve a range of motion restrictions, as one of the most important symptoms of MTrPs.

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