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Pressure Release Versus Thoracic Manipulation in Rhomboids Myofascial Pain Syndrome

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ABSTRACT

Background: Pressure release and thoracic manipulation techniques have been proven separately to have positive effect in treating the myofascial pain syndrome with active Rhomboids-trigger points.

Objective: To compare the effects of pressure release in combination with thoracic manipulation in treating the myofascial pain syndrome with active Rhomboids-trigger points.

Methods: Sixty-six participants, age ranging from 18 to 30 years suffering from active rhomboids trigger points in case of myofascial pain syndrome were randomly assigned into three equal groups. Group A was given traditional physiotherapy. Group B was given traditional physiotherapy in addition to pressure release. Group C was given traditional physiotherapy in addition to thoracic manipulation. Each group received treatments for three weeks/three sessions per week. Pre and post measurements were recorded measuring pain intensity level using visual analogue scale (VAS), thoracic range of motion (ROM) using digital inclinometer, pain pressure threshold (PPT) using digital algometer and measuring physical function of upper limb using Arabic-DASH questionnaire.

Results: following intervention for each group, there was significant decline in VAS and DASH scores, significant improvement in PPT and thoracic ROM compared to pre-treatment. Among groups comparison revealed that there was a significant decrease in visual analogue scale and DASH in group B and C compared with that in group A ($p < 0.01$). There was a significant increase in pain pressure threshold and thoracic range of in group B and C compared with group A ($p < 0.05$). There was no significant difference in VAS score, PPT (kg/cm), thoracic range of motion in degree and DASH questionnaire score between group B and C ($p > 0.05$).

Conclusion: Addition of either pressure release or thoracic manipulation to conventional physical therapy has shown clinical importance as the percentage of improvement in all parameters increased except in flexion range of motion, improved pain intensity level, thoracic ROM, ppt and physical function. So, both techniques are equally effective in treating the myofascial pain syndrome with active Rhomboids-trigger points.

Keywords: pressure release, thoracic manipulation, Rhomboids muscle, trigger points, Rhomboids myofascial pain syndrome.

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INTRODUCTION

Myofascial pain syndrome (MPS) is a prevalent chronic condition that manifests as persistent discomfort in the musculoskeletal region. The issue at question is of significant healthcare importance, as evident by its prevalence rates which vary from 15% among patients attending general medical clinics to as high as 85% among individuals at some stage in their lives[1].

Myofascial pain syndrome is an accumulation of symptoms and signs which are caused by myofascial trigger points (MTrPs). These trigger points induce irregularities in the sensory, motor, and autonomic systems[2].

The term MPS is classified as a type of regional pain distinguished by the existence of MTrPs in tense bands of skeletal muscle that are palpable. These trigger points radiate pain to a distance from the site of origin and may result in motor and autonomic complications[3].

Musculoskeletal distress, restricted mobility, weakness, as well as referred pain are all symptoms of MPS. Additionally, clumsiness and lack of coordination may manifest. According to Saxena et al.[1], for musculoskeletal problems, MTrPs are a "frequent cause of pain in clinical practice" along with a "very common, yet commonly overlooked" source of pain.

The pathogenesis of myofascial pain and MTrPs seems to involve multiple factors, including physical psychomotor retardation, ineffective biomechanics, repetitive postural dysfunction, and postural stresses. These factors are among the most frequent causes of myofascial pain and dysfunction overuse[4].

The MTrPs are categorized as latent or active[4]. While not always sensitive, A taut muscular band (TB) is a common way to describe MTrPs. A latent MTrPs may emerge within one or more palpable bands even when no symptoms are present at first, and this can be due to systemic pathological conditions, trauma, muscle overloads, or psychological stress[1,5,6].

The spontaneous onset of symptoms could occur if the dormant MTrPs were to become active in response to mechanical stress or other detrimental stimuli[1]. Some studies have shown that active MTrPs can spontaneously heal, shift back to the latent stage, or stay in a single location without progression. Active trigger points are those that elicit pain whether the target muscle is engaged in activity or at rest. Individuals who have active myofascial trigger points commonly experience chronic, localized pain, frequently accompanied by a limitation in their range of motion (ROM). Active MTrPs are characterized by their hardness, palpability and localization definition. They are situated within tense bands of skeletal muscle fibers and are noxious to the touch[7].

SUBJECTS, MATERIALS AND METHODS

The purpose of this research was to examine the efficacy of thoracic manipulation versus pressure release in reducing MPS associated with active Rhomboids-trigger points. It was conducted at the Outpatient Clinic of the Faculty of Physical Therapy, Heliopolis University for Sustainable Development, Egypt. The methodology of the guidelines established by the Institutional Ethical Committee Clearance **(P.T/012/004127)** were followed. Identifier: ClinicalTrials.gov **(NCT05688800).** The study was conducted from April 2023 to August 2023.

Design of the study

The study design is a pre-test post-test measurements, randomized controlled trial.

Sample size

To prevent type II error, the sample size was calculated using G*POWER statistical software (*Version 3.1.9.2; Franz Faul, Universitat Kiel, Germany*). The software determined that N= 66 was the minimum number of participants needed for this study, assuming significant differences between the groups. The parameters used for the calculation were α=0.05, power = 80%, and effect size = 0.4.

Participants

Sixty-six participants of both sexes took-part in the study. They were recruited randomly from a cohort of participants diagnosed and referred by orthopedic doctor, suffering from active rhomboids trigger points in case of myofascial pain syndrome. They were randomly assigned equally into three groups. Seven subjects have been excluded because they didn't fulfill the inclusion criteria, shown in Fig. (1).

Participants voluntarily signed an informed agreement before the study.

Inclusion Criteria

Participants are from 18 to 30 years old of both genders[8]. They were suffering from Rhomboids MPS with a minimum one active trigger point[8]. They suffered from myofascial pain syndrome for more than three months[9].

Exclusion Criteria

Exclusion criteria included: patients with the following conditions: cancer, vascular disorders, rheumatoid arthritis, scapular pain from degenerative diseases, osteoporosis, cardiac pacemaker, surgical treatment involving the neck or upper back, administration of anticoagulants, infection, a whiplash injury, open wounds, being pregnant, radiation or chemotherapy treatment, scapular fractures, open wounds, scapular fractures, vascular deficiency, as well as any contraindications for thoracic manipulation.

Randomization and allocation

Participants who fulfill the eligibility criteria were randomly assigned, into 3 equivalent groups, utilizing simple randomization by double blind closed envelope randomization technique. A researcher who was not engaged in participants recruiting or treatment used a computer-generated randomized table prior to data collection to conduct concealed allocation. The intervention group's names were printed on folded cards that were sealed in envelopes. Following the opening of the envelopes, patients were divided into two groups at random[2].

Group A

Twenty-two participants were given traditional physiotherapy treatment such as TENS, continuous ultrasound, infra-red radiation[4]. Also, it included both stretching for pectoralis major and strengthening exercise to Rhomboids muscle to induce a greater pain-relieving effect and correcting posture[10].

Group B

Twenty-two participants received the traditional physiotherapy treatment as well as pressure release technique[2].

Group C

Twenty-two participants received the traditional physiotherapy treatment as well as thoracic spine manipulation[8].

Each group was treated for three weeks/three sessions per week.

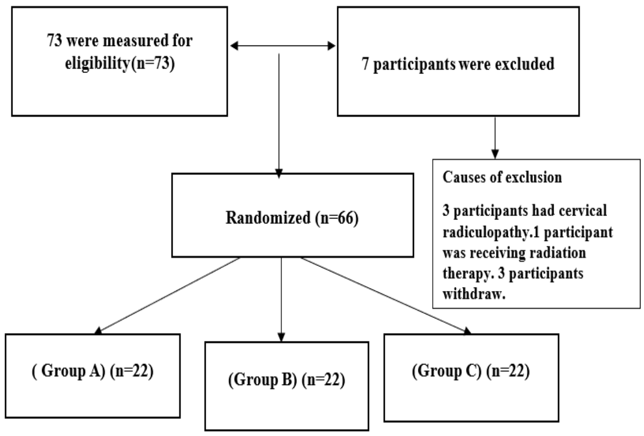

Fig (1): Flow Chart of the study

Instrumentations and tools:

Visual analogue scale (VAS); was utilized for measurement of pain intensity level. It consists of a 100-mm horizontal line, where one end corresponded to "no pain" (VAS score = 0) and the other to "severe intolerable pain" (VAS score = 100)[11]. According to Boonstra et al.[12] and de Boer et al.[13], VAS questionnaire has good validity and reliability. Fig. (2).

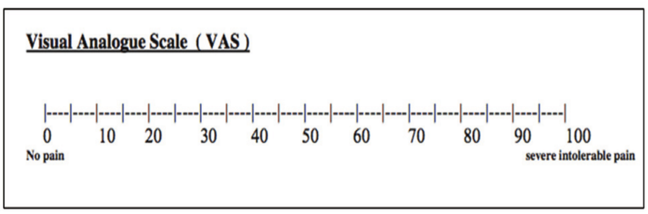

Fig (2): Visual analogue scale (Adapted from Aggarwal et al.)[11]

Digital Algometer: it is an objective instrument used to measure pain pressure threshold (PPT), to differentiate changes in MTrPs pre- and post-treatment. The digital algometer "Wagner force ten digital force gag model FPX50 (*Wagner Instruments, Greenwich, CT, USA*)" was utilized to measure PPT. PPT utilizes a pressure transducer probe after locating the MTrPs. PPT measured with a 1. 6 mm diameter probe reflects the pain of deep tissues. Digital algometer has been proven to be reliable to measure the threshold (kg/cm^2)[14,15]. It also proven to be a valid objective measurement instrument[16]. Fig (3)

Fig (3): Digital Algometer (Adapted from Stausholm et al.)[15]

Digital Inclinometer:
It is an objective instrument used to measure the ROM of thoracic spine allowing rapid and safe evaluation of spinal ROM and curvature. It has been demonstrated that the inclinometer is a reliable instrument for measuring the ROM in degrees[17,18]. Also, the accuracy of digital inclinometer has been demonstrated to be accurate[17,19,20]. Fig. (4).

Fig (4): Digital Inclinometer[18].

Disability of Arm, Shoulder, and Hand questionnaire:
This self-administered assessment examines physical function using a 30-item questionnaire. It is a widely applied region-specific patient-reported outcome measure (PROM) that quantifies upper extremity function (activity limitation) and symptom. This questionnaire's Arabic version is a valid, reliable, as well as sensitive upper extremity outcome measure for patients whose primary language is Arabic[21,22].

Treatment instruments:
Transcutaneous electrical nerve stimulation (TENS); The conventional TENS procedure, as seen in Fig. (5), uses a rectangular waveform with a pulse frequency ranging from 10-200 Hz and a pulse width ranging from 100-250 µs. The patient is administered two electrodes across the referred pain area, and the intensity is adjusted according to their tolerance[23,24].

Therapeutic Ultrasound (US):
Continuous US is used in chronic conditions of frequency 1MHZ and intensity 0.8 W/cm^2, for five minute each side[4]. It is most well-known for its thermal action[25], as shown in Fig. (6). This device is self-calibrated.

Fig (5): Transcutaneous electrical nerve stimulation (TENS)

Fig (6): Therapeutic Ultrasound

Infrared radiation (IR):
It is an instrument that produces thermal radiation which is a type of energy that can be found throughout the electromagnetic spectrum. Radiations with longer wavelengths than the red end of the visible spectrum and extending to the microwave region from 760nm to 1mm[4,26], as shown in **Fig. (7).**

Fig (7): Infrared radiation (IR)

Procedures:
Measurement procedures: After referral of the participants to the clinic full history examination of the participant and the eligible participant has been determined, then the evaluation procedures were done for every patient in the three groups prior to starting the treatment and following three-week of treatment. First Researcher start with Localization of Rhomboids muscle active trigger points. Each participant was positioned prone while his hand was resting on his back. Researcher stand by her/his side; palpating hand was placed with thumb at the mid-scapular level between the spinal column and the scapula. From the inferior to the superior aspect, palpate the Rhomboids while positioning the thumb perpendicular to the fiber direction to locate the Rhomboids active trigger points[27] as shown in Fig (8).

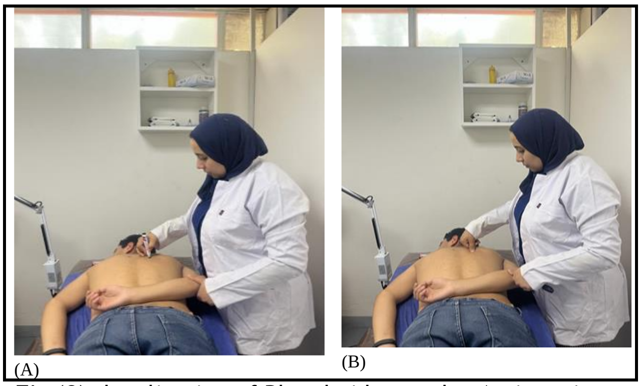

Fig (8): localization of Rhomboids muscles Active trigger point

Measurement of pain intensity level by visual analogue scale:

Pain intensity level was evaluated by applying the VAS. Each participant was made aware that the VAS as being 100 m horizontal line with one end defined as (no pain = 0), while the other end (sever intolerable pain = 100). Participant was instructed to put a mark on the line that relates to their level of pain that on a scale of 0–100 where 0 means absence of pain and 100 sever intolerable pain[11,28].

Measurement of Pain pressure threshold by digital Algometer:

After locating the Trigger point then marking it by removable pen, the contact head of the digital algometer was placed perpendicular over the target trigger point by the researcher. The first sensation of pain felt by the participant was recorded in kg/cm^2. Two measurements were taken, and the average was recorded[4,15]. **Fig. (9).**

Fig (9): Measurement of PPT of active Rhomboids trigger point.

Measurement of thoracic spine ROM by inclinometer:

Two digital inclinometers were used to measure the ROM of thoracic spine in degree. The participant assumed standing as neutral standing position, then T1 and T12 were marked by removable pen and both inclinometers were placed; one on T1 and the other on T12. The participant was asked verbally to do flexion of thoracic spine, extension, side bending to right and left and rotation to both sides[17,18]. **Figures (10,11,12,13,14,15).**

Measurement of Disability of Arm, Shoulder and Hand questionnaire:

Participant has filled out the Arabic version of DASH questionnaire which was created to assess the physical function and symptoms in individuals with upper limb musculoskeletal illnesses, the DASH scoring for disability/symptoms is calculated as follows: ([(sum of n responses]-1) / n) x (25), while n is the number of questions that were completed. You can get a score ranging from zero to one hundred. A maximum functional impairment of 100 points would indicate the most severe disability imaginable, whilst zero points would indicate full, unrestricted use of the upper limbs[21].

Springing Test: It is a screening test that was used with thoracic spine manipulation group only to detect the hypomobility of thoracic spinal segments T1 to T5 while patient was in prone position. The patient assumed a prone position while the researcher applied anteroposterior direction force using their pisiform on the spinous of the thoracic spine bilaterally[8]. **Fig. (16).**

Fig (10): Measurement of flexion ROM of thoracic spine.

Fig (11): Measurement of extension ROM of thoracic spine.

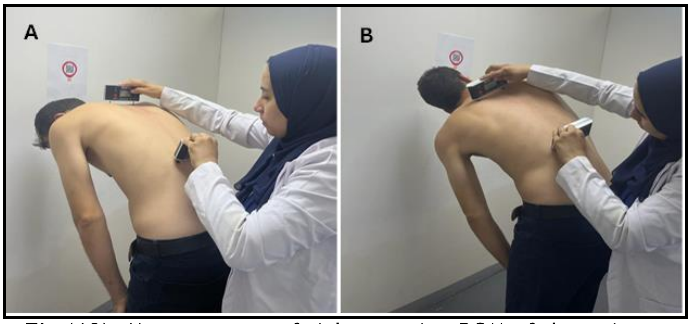

Fig (12): Measurement of right rotation ROM of thoracic spine.

Fig (13): Measurement of left rotation ROM of thoracic spine.

Fig (14): Measurement of right side binding ROM of thoracic spine.

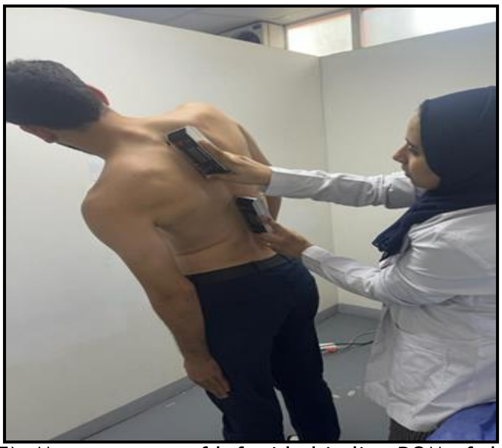

Fig (15): Measurement of left side binding ROM of thoracic spine.

Fig (16): Springing Test

Treatment Procedures:
Conventional physical therapy treatment: Traditional physical therapy was administered to the control group's participants, who were given 30-45 minutes of low-intensity conventional TENS at a frequency of 90–130 Hz[29], as well as continuous ultrasound using a frequency of 1 MHz as well as an intensity of 0.8 W/cm^2. The technique involved slow, circular, perpendicular motions with a little deep pressure. Both sides of the level of C7-T4 across the medial aspect of the scapulae were treated for 5 minutes. The inter-scapular area was treated with infrared radiation for fifteen minutes each, concentrated on the level of C7-T4 long, and between the two medial aspects of the scapulae (among the scapula). Moreover, stretching for pectoralis major in addition to strengthening exercise to Rhomboids muscle was added to gain its greater pain-relieving effect correcting posture[30], **Figures (17,18,19).**

Fig (17): Application of US on Trigger point.

Fig (18): Application of IR on trigger point.

Fig (19): Application of TENS on trigger point.

Fig (20): Strengthening Rhomboids muscle.

Fig (21): Stretching of pectoralis muscle.

Pressure release technique:
Individuals allocated to this group had both pressure release techniques and traditional physiotherapy. By applying pressure below the PPT, which depends on soft tissue release, the researcher performed the pressure release method while the subject was in the prone position. The degree of compression was raised as soon as the researcher saw a decrease in soft tissue resistance. It was a gentle, slow-paced application of pressure that would continue until the tissue barrier was released. More pressure was put on to get past a new limit. For sixty seconds, the pressure is there. As shown in Figure 22, the active MTrPs of the Rhomboids muscle[2] were treated using a non-painful manual treatment method using the thumb.

Fig (22): Application pressure release technique.

Thoracic supine manipulation:
The procedure involved manipulating the thoracic spine using a screw thrust technique, which involved forcing the transverse processes from the posterior to the anterior direction. Performing a springing test to the nearby spinous process identifies the tender and stiff segment, which in turn determines the direction of manipulation. The subjects were lying face down, and the researchers placed their hands such that the first was on the right side of the first set of vertebrae and the second was on the left side of the second set. The patient was shoved once after a slack had been taken up[8]. Fig. (23).

Fig. (23): Application of thoracic manipulation technique.

DATA ANALYSIS
The characteristics of the subjects were compared using an ANOVA test. gender distribution between the groups was compared using a chi-squared test. The data was tested for normality utilizing the Shapiro-Wilk test before analysis. Groups were tested for homogeneity using Levene's test for homogeneity of variances. Scores on the VAS, PPT (in kg/cm), thoracic ROM (in degrees), and the DASH questionnaire were compared using a mixed MANOVA. For the following multiple comparisons, post hoc tests were conducted utilizing the Bonferroni correction. All statistical tests were set to have a significance level of $p < 0.05$. For this study, we used SPSS 25 for Windows (*IBM SPSS, Chicago, IL, USA*) to perform all of our statistical analysis.

RESULTS
Participants characteristics
Group A, B, and C's subject features are displayed in Table (1). Age, weight, height, body mass index, and gender distribution did not change significantly ($p > 0.05$) between groups.

Table 1. Basic characteristics of participants.

Variables	Group A	Group B	Group C	p-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Age (years)	21.82±2.40	22.55±4.10	23.27±2.84	0.32
Weight (kg)	72.00±16.13	67.82±13.44	69.86±13.39	0.63
Height (cm)	165.86±8.10	165.41±9.59	166.64±9.07	0.90
BMI (kg/m²)	26.05±5.04	24.77±4.45	25.02±3.60	0.59
Sex, n (%)				
Females	11 (50%)	13 (59%)	9 (41%)	0.48
Males	11 (50%)	9 (41%)	13 (59%)	

SD: Standard deviation. **MD:** Mean differences. **p-value:** Level of probability

Effect of treatment on VAS, PPT, Thoracic ROM and DASH
The results of the mixed MANOVA showed that the variables treatment and time interacted significantly ($F = 14.64$, $p = 0.001$, Partial Eta Squared = 0.73). Partial eta squared = 0.97, and $p = 0.001$ indicate that time was a significant impact. Partial eta squared = 0.25 and a main effect of treatment of 1.83 ($p = 0.02$) were both statistically significant.

Within group comparison
There was a significant decline in VAS and DASH and a significant improvement in PPT-I and PPT- II in the three groups post treatment compared with that before treatment ($p < 0.001$, Table 2).
There was a significant improvement in thoracic ROM: flexion, extension, side bending and rotation in the three groups post treatment compared with that before treatment ($p < 0.001$, Table 3).

Between group comparison
No significant difference has been detected among groups pretreatment ($p > 0.05$).
A significant decline in VAS and DASH of group B and C was observed compared with that of group A ($p < 0.01$). There was a significant improvement in PPT, and thoracic ROM of group B and C in comparison with that of group A ($p < 0.05$). There was no significant difference in VAS score, PPT (kg/cm), thoracic ROM degree as well as DASH.
questioner score between group B and C ($p > 0.05$, Table 2).

Table 2. *Mean VAS, PPT-1, PPT-II, DASH pre and post treatment of group A, B and C*

Variables	Group A	Group B	Group C	p-value		
	mean ± SD	mean ± SD	mean ± SD	A vs B	A vs C	B vs C
VAS						
Pre-treatment	7.68±1.64	7.11±1.62	7.21±1.52	0.46	0.58	0.98
Post-treatment	3.23±1.14	2.12 ± 1.19	2.06±1.05	0.005	0.004	0.99
MD (% of change)	4.45 (57.94%)	4.99 (70.18%)	5.15 (71.43%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
PPT-I (kg)						
Pre-treatment	2.20±0.69	2.58±0.84	2.48±0.71	0.21	0.44	0.89
Post-treatment	3.54±0.88	4.70±1.12	4.88±1.15	0.002	0.001	0.83
MD (% of change)	-1.34 (60.91%)	-2.12 (82.17%)	-2.4 (96.77%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
PPT-II (kg)						
Pre-treatment	2.03±0.89	2.51±0.98	2.54±0.97	0.22	0.18	0.99
Post-treatment	3.26±1.16	4.35±1.09	5.02±1.18	0.007	0.001	0.14
MD (% of change)	-1.23 (60.59%)	-1.84 (73.31%)	-2.48 (97.64%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
DASH						
Pre-treatment	36.66±10.44	36.24±9.75	34.47±8.53	0.98	0.73	0.82
Post-treatment	24.66±8.76	17.54±6.15	15.67±8.17	0.01	0.001	0.71
MD (% of change)	12 (32.73%)	18.7 (51.6%)	18.8 (54.54%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			

SD: Standard deviation. MD: Mean difference. p-value, Level of probability.

Table 3. *Mean thoracic ROM pre and post treatment of group A, B and C*

ROM (degrees)	Group A	Group B	Group C	p-value		
	mean ± SD	mean ± SD	mean ± SD	A vs B	A vs C	B vs C
Flexion						
Pre-treatment	18.78±6.62	18.93±7.33	18.62±5.08	0.99	0.99	0.98
Post-treatment	20.53±6.56	28.29±6.67	26.37±5.33	0.001	0.008	0.56
MD (% of change)	-1.75 (9.32%)	-9.36 (49.45%)	-7.75 (41.62%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
Extension						
Pre-treatment	14.06±5.44	13.29±6.03	14.69±4.93	0.88	0.92	0.67
Post-treatment	16.14±5.20	23.15±6.17	20.91±5.51	0.001	0.01	0.39
MD (% of change)	-2.08 (14.79%)	-9.86 (74.19%)	-6.22 (42.34%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
Right bending						
Pre-treatment	11.05±4.03	10.73±4.38	11.36±3.59	0.96	0.96	0.86
Post-treatment	13.54±5.02	18.33±4.11	17.93±4.18	0.002	0.005	0.95
MD (% of change)	-2.49 (22.53%)	-7.6 (70.83%)	-6.57 (57.83%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
Left bending						
Pre-treatment	9.84±4.22	10.43±5.12	9.74±3.68	0.89	0.99	0.86
Post-treatment	12.60±4.95	18.07±5.72	17.03±5.32	0.003	0.02	0.79
MD (% of change)	-2.76 (28.05%)	-7.64 (73.25%)	-7.29 (74.85%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
Right rotation						
Pre-treatment	17.17±4.95	15.85±3.73	15.37±5.41	0.63	0.42	0.94
Post-treatment	19.59±4.70	23.94±3.47	26±4.83	0.005	0.001	0.27
MD (% of change)	-2.42 (14.09%)	-8.09 (51.04%)	-10.63 (69.16%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			
Left rotation						
Pre-treatment	15.07±3.62	14.86±4.73	14.33±5.72	0.98	0.86	0.92
Post-treatment	18.18±4.18	23.22±4.58	24.22±4.58	0.001	0.001	0.73
MD (% of change)	-3.11 (20.64%)	-8.36 (56.26%)	-9.89 (69.02%)			
p-value	***p = 0.001***	***p = 0.001***	***p = 0.001***			

SD: Standard deviation. MD: Mean difference. p-value, Level of probability

DISCUSSION

This study was done to examine the impact of pressure release versus Thoracic manipulation on active Rhomboids trigger points. Sixty-six participants with active Rhomboids trigger points with Myofascial pain syndrome were recruited and randomized into three equivalent groups: Group A had traditional physiotherapy treatment and was utilized as the Control group. Group B received pressure release therapy as well as traditional physiotherapy treatment, whereas Group C received thoracic manipulation therapy as well as traditional physiotherapy treatment. All groups were given three treatments for a duration of 3 weeks, with three sessions each week. The pain intensity level, ROM of the thoracic spine, PPT, as well as disability in the arm, shoulder, and hand were evaluated before and after treatment using the VAS, digital inclinometer, digital algometer, and DASH questionnaire.

The result of the current study has stated that all groups exhibited a significant improvement post treatment in reducing pain intensity in all three groups comparing to pre-treatment scores as measured by VAS scale (p = 0.001) but comparing among groups there was a statistically significant reduction in group B comparing to group A (p = 0.005). Also, there was statistically significant improvement of group C compared to group A (p = 0.004). Moreover, in comparing group B and C there was no statistically significant difference between the two groups.

In addition, when comparing PPT-I levels before and after treatment in all three groups, we found a statistically significant improvement (p = 0.001) in the treatment group. When comparing the three groups Group B's PPT-I was significantly higher than Group A's (p = 0.002). When comparing groups, A and C, PPT-I was significantly higher in group C (p = 0.001). Groups B and C did not differ significantly from one another on PPT-I (p = 0.83).

Also, for the impact of treatment on PPT-II There was a substantial improvement of all three groups in PPT-II after treatment in comparison with that pretreatment (p = 0.001).

But in comparison among groups post treatment The PPT-II levels of group B were significantly higher than those of group A (p = 0.007).

In comparison to group A, group C's PPT-II was significantly higher (p = 0.001). while we did find that groups B and C did not differ significantly on PPT-II (p = 0.14).

In this study, we found that the Dash questionnaire significantly reduced disability in the arm, shoulder, and hand after treatment compared to before treatment in the three groups (p = 0.001). However, when comparing different groups, the difference between groups A and B in terms of DASH was statistically significant (p = 0.01). When comparing groups, A and C, there was a statistically significant drop in DASH (p = 0.001). The difference in DASH scores between groups B and C was not statistically significant (p = 0.71). Additionally, compared to before-treatment levels, after-treatment levels of thoracic spine flexion ROM increased in all groups (p = 0.001). There was no statistically significant difference in flexion ROM between groups B and C (p = 0.56), but there was a significant rise in ROM for groups B and C when compared to groups A and A, respectively (p = 0.001 and p = 0.008, respectively).

We found that when comparing the three groups' extension thoracic ROM levels before and after treatment, there was a statistically significant increase in all three groups (p = 0.001). A statistically significant difference was observed between groups A and B concerning extension ROM (p = 0.001). group C's extension ROM was significantly higher than group A's (p = 0.01). When comparing groups B and C, we found no statistically significant difference in extension ROM (p = 0.39).

When we compared the three groups' right-side flexion thoracic ROM after treatment to ROM before treatment (p = 0.001), we found that treatment had a significant beneficial impact on ROM. Compared to group A, group B had significantly more ROM when side flexion at the right angle to the chest (p = 0.002). Additionally, when comparing group, A and group C, the difference in right-side flexion thoracic ROM was statistically significant (p = 0.005). In addition, the ROM for right side flexion was not significantly different between groups B and C (p = 0.95).

Regarding the treatment's impact on left-side flexion ROM, all three groups showed statistically significant increases in left-side flexion ROM after treatment compared to before (p = 0.001).

However, after treatment, group B's left-side flexion ROM was significantly higher than group A's (p = 0.003).

When comparing groups, A and C, there was a statistically significant improvement in group C's left-side flexion ROM (p = 0.02). However, we discovered that Group C and Group B didn't differ significantly in terms of left-side flexion ROM (p = 0.79).

Additionally, when comparing the groups' right rotation ROM before and after treatment, we found that all of them improved (p = 0.001). When comparing the three groups, group B's right rotation ROM was significantly higher than group A's (p = 0.005). Group C's right rotation ROM was significantly higher than group A's (p = 0.001). However, group C and group B did not differ significantly (p = 0.27) in terms of right rotation ROM.

Additionally, as for the impact of our treatment on left rotation ROM, all groups showed an improvement in the ROM after treatment compared to before (p = 0.001). Group B's left rotation ROM was significantly higher than Group A's (p = 0.001) when comparing the three groups. When comparing groups, A and C, the left rotation ROM of group C was significantly higher (p = 0.001). Nonetheless, groups B and C didn't differ significantly (p = 0.75) in terms of left rotation ROM.

The present study findings came in line with Pecos-Martin et al.[2] who stated that the technique of pressure release is strongly advised as a manual therapy for myofascial trigger points (MTrPs) as pressure release technique can be suggested as an approach of improving PPT and strength in latent MTrPs over a short period of time. It was also suggested by Albaker[31] that the technique of pressure release might be more efficient for the treatment of Rhomboids MTrPs. Also, Dayanlr et al.[32] stated in a randomized control trial study that pressure release has shown improvement in VAS in treating MTrPs. In a different study conducted by Alghadir et al.[33] that focused on the active myofascial trigger points of the Trapezius muscle (MTrPs), it was found that adding it to muscle energy technique resulted in a notable enhancement in the short-term impact on VAS and DASH. This approach proves to be highly efficient in alleviating MTrPs pain within a short duration, while also being cost-effective, noninvasive, and providing relief without significant discomfort. Moreover, the results of Müggenborg et al.[34] this systemic review indicate that manual trigger point therapy may have potential benefits for patients with MTrPs in the orofacial region. Although manual trigger point therapy did not provide a distinct benefit over alternative conservative therapies, it was determined to be an efficacious therapy for patients with MTrPs in the orofacial region, surpassing control groups regarding pain pressure threshold and pain intensity level.

However, Bron et al.[35] argued that passive manual therapy approaches were not suitable for treating latent MTrPs, despite their ability to deactivate the MPS. Furthermore, Gemmell et al.[36] demonstrated that ischemic compression and pressure release had no significant effect on PPT and cervical range of motion (CROM) during side bending. However, the level of agony was reduced. Another a systematic review done by Xu et al.[37] with only randomized control studies involved and outcomes like pain intensity, PPT, ROM, and pain related disability it was stated that Ischemic compression is a recommended method for providing immediate and short-term pain relief, as well as increasing the pressure pain threshold and range of motion. Regarding thoracic manipulation our results came into agreement with Waqas et al.[38] in his randomized control study stating significant improvement on VAS and quality of life questionnaire specially when it was added to thoracic exercises. Also, in this systemic review it was concluded that thoracic spine thrust manipulation effectively decreases pain and lowers neck impairment in adult individuals with chronic mechanical neck pain when compared to alternative therapies. The results of this review affirm the therapeutic advantage of TM in alleviating pain[39]. In another randomized control trial done by Bilal et al.[40] his result come in agreement with our research as adding thoracic manipulation to conventional physical therapy exercises had a greater improvement regarding decreasing shoulder pain also upper limb disability (DASH) score and rom of shoulder joint. Our study has found that when comparing Group A to other groups, PPT and thoracic ROM showed a significant improvement in groups B and C.

These finding came inro agreement with Fahmy et al.[4] who revealed that in 3 weeks intervention on Rhomboids trigger point ischemic pressure is more effective than isometric relaxation in improving PPT. furthermore in a randomized control trial pressure release showed statistically significant improvement in PPT, ROM, and a decrease in pain intensity[2]. Dayanlr et al.[32] in their study stated that a total of forty-eight individuals were diagnosed with chronic nonspecific LBP and had at least one active MTrPs. These patients saw improvements in pain intensity, PPT, active range of motion (AROM), and impairment associated with pain. Our results came into agreement with a systemic review by Mart et al.[41] whose objective was to combine and analyze the available information regarding the impact of manual therapy interventions, such as pressure release, on ROM in patients with MTrPs. Our results indicate that manual therapy interventions could be a successful method to enhance the ROM in adult patients from both genders with musculoskeletal pain[42]. Furthermore, our results came in agreement with Saleem et al.[43] who treated trapezius trigger point by 4 weeks intervention and has revealed significant findings in reducing the severity of pain, the impairment in the neck, and enhancing the ROM in the neck for the comparison.

According to Haleema et al.[8] there was a significant improvement in PPT ($p<0.05$) with the administration of TM. Further research has shown that TM is superior to other methods for alleviating pressure sensitivity of MTrPs in the rhomboids and interscapular discomfort. Moreover, our result agreed with Lehtola et al.[44] that stated manipulative therapy is more beneficial to placebo in the treatment of pain produced by mechanical dysfunction of the thoracic spine, as evidenced by increased pain pressure threshold measurements one week following the final treatment.

Our results came in agreement with Erdem et al.[45] who concluded that when treating minor mechanical neck pain, a single session of thoracic manipulation appears to be ineffective in terms of joint position sensation. Nevertheless, thoracic manipulation could potentially serve as a viable approach to enhance flexion and rotation of the cervical region in conjunction with treatment. Treatments involving cervicothoracic or thoracic manual physiotherapy techniques, such as non-thrust and thrust manipulation, do not effectively alleviate pain or lower disability among patients with upper-quarter musculoskeletal conditions, according to the results of this systematic analysis[46,47].

Also, Bilal et al.[40]; Joshi et al.[48] have stated that thoracic manipulation has a significant effect in improvement ROM of cervical spine and shoulder joints.

Limitations

The study was limited by the following psychophysiological factors which affected patients' performance and response.
Lack of financial support.

Conclusion

In light of the study results, it could be concluded that Addition of either pressure release or thoracic manipulation to conventional physical therapy has shown clinical importance as the percentage of improvement in all parameters increased except in flexion range of motion. improved pain intensity level, thoracic ROM, ppt and physical function. So, no technique is more effective than other in the management of the myofascial pain syndrome with active Rhomboids-trigger points.

Recommendations

Further study should be conducted on a large sample size. Also, it should be conducted in a different age group. A study is recommended to investigate lone term effect of treatment program and follow up. A study involves measuring the EMG activity of the muscle while treating trigger points is recommended. Additional studies should be carried-out to examine the impact of both techniques on another area of treatment.

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