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The Effects of Manual Passive Muscle Shortening and Positional Release Therapy on Latent Myofascial Trigger Points of the Upper Trapezius: A Double-Blind Randomized Clinical Trial

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Abstract

Background: Positional release therapy (PRT) has been suggested as an effective treatment for myofascial trigger points (MTrPs). Considering the mechanism of PRT, a new modified technique, known as Manual Passive Muscle Shortening (MPMS), is introduced for the treatment of MTrPs.
Objectives: To compare the effects of MPMS and PRT on the sensitivity of latent MTrPs in the upper trapezius and determine the active cervical lateral flexion range.
Methods: In this double-blind randomized controlled trial, 30 female university students, who were identified with latent MTrPs of the upper trapezius, were recruited from Tabriz University of Medical Sciences, Tabriz, Iran. The participants were randomly allocated into experimental (n, 15) and control (n, 15) groups. The experimental group was treated with the MPMS technique, while the control group received PRT. The participants took part in 3 treatment sessions, as well as a follow-up session 1 week after the third session. During each session, the second physiotherapist, who was blind to the pretreatment information, applied the appropriate technique. The visual analogue scale (VAS), pressure pain threshold (PPT), and bilateral active range of cervical lateral flexion were recorded to assess the effects of treatment. The first physiotherapist, who was blind to the treatment approach for the participants, recorded the outcomes before treatment, during the first session, after treatment (third session), and in the follow-up.
Results: A total of 30 participants were included in the data analysis. In the follow-up, intergroup changes indicated a significant increase in PPT (P = 0.000), a significant decrease in VAS scores (P = 0.002), and a significant increase in the right lateral flexion (P = 0.012) in the experimental group. Left lateral flexion also increased in this group, although it was not statistically significant (P = 0.254). At the end of the study, there were no significant differences between the groups (P > 0.05).
Conclusions: According to the results, both MPMS and PRT were effective techniques in immediate pain relief of upper-trapezius MTrPs. Therefore, MPMS may be used as a new technique in the treatment of MTrPs.

Keywords: Myofascial Trigger Point Pain, Trapezius Muscle, Pain Threshold, Randomized Controlled Trial

1. Background

Positional release therapy (PRT) is an indirect and passive manual technique, which uses tender points and comfort position to relieve musculoskeletal pain and related dysfunctions. In this technique, the affected part of the body is moved through all 3 planes of movement, while palpation of tender points is used as a guide to determine the position of comfort (usually the shortened position of a muscle). Pressure on the position of comfort (90 seconds in orthopedic patients and 3 minutes in neurologic patients) evokes therapeutically significant physiological responses in tissues and results in pain relief, improved mobility, and resolution of dysfunction (1-3).

Previous studies have reported the use of PRT in the treatment of different disorders, such as low back pain (4), ankle sprain (5) and plantar fasciitis (6). One of the applications of PRT is the management of myofascial trigger points (MTrPs). MTrPs are hyperirritable spots in the taut and palpable bands of a skeletal muscle or its fascia. MTrPs are painful on compression and can result in referred pain, motor dysfunction, referred tenderness, and autonomic phenomena (7).

Although MTrPs can develop in any muscle groups, previous studies have revealed that the upper trapezius is probably the most commonly affected muscle by MTrPs (8, 9). It seems that PRT has beneficial effects on MTrPs. In this regard, Kelencz et al. reported that PRT was effective in reducing pain and muscle tension among patients with upper-trapezius MTrPs (3). Moreover, Mohammadi Kojidi et al. found decreased pain intensity and MTrP sensitivity in patients with upper-trapezius MTrPs following 3 treatment sessions of PRT (10).

Although PRT can be an effective technique for the treatment of MTrPs, it has few disadvantages: 1) therapist's fatigue while holding and moving the whole limb in 3 planes of movement, and 2) careful adjustment of the patient's position, considering the small range of motion (ROM) causing optimal relaxation of tissues (typically 2 to 3 degrees). It may be assumed that movements further than the ideal ROM stretch the antagonistic muscles or opposing fascial tissues, resulting in a proprioceptive or neural spillover and reactivation of the facilitated segment (11).

Considering the mechanism of PRT, we suggested a new technique, known as Manual Passive Muscle Shortening (MPMS) in which the origin and insertion of the involved muscle were approximated by the therapist, and the position was held for 90 seconds. It is assumed that this modified technique can have the same effects as PRT.

2. Objectives

The objective of this trial was to compare the effects of the suggested therapeutic technique (MPMS) and PRT on pain intensity and pressure pain threshold (PPT) of latent MTrPs in the upper trapezius and to determine the active range of cervical spine lateral bending.

3. Methods

3.1. Design, Population, and Setting

This double-blind, parallel-group, randomized clinical trial was conducted in a referral governmental physiotherapy clinic, affiliated to Tabriz University of Medical Sciences, Tabriz, Iran. The regional ethics committee of Tabriz University of Medical Sciences approved the study protocols (code, TBZMED.REC.13940940). This study was also registered in the Iranian registry of clinical trials (registration number, IRCT2015100724412N1).

Female university students, identified with latent MTrPs in the upper trapezius, were recruited from Tabriz University of Medical Sciences via posting on the university's notice board between May 2016 and July 2016. At baseline, a physiotherapist evaluated the presence of latent MTrPs in the upper trapezius muscle by manual palpation, using the diagnostic criteria described by Simons and colleagues. These criteria included the presence of a hypersensitive tender spot in a taut band of the upper trapezius muscle, local twitch response, and reproduction of the typical referred pain pattern of MTrP in response to compression (7). Once the MTrP was located, its position was stabilized on the skin with a waterproof marker. Afterwards, the volunteers were evaluated in terms of the inclusion criteria.

The inclusion criteria were as follows: 1) age, 18 - 35 years; 2) a latent trigger point in the upper trapezius muscle on the left or right side (11, 12); 3) normal body mass index (BMI); 4) local pain score of 3 - 7/10 on the visual analogue scale (VAS), elicited by 2.5 kg/cm^2 pressure with an algometer (13, 14); and 5) being nonathletic.

On the other hand, the exclusion criteria were as follows: 1) diagnosis of cervical radiculopathy or myelopathy by a primary care physician (11, 14-16); 2) diagnosis of fibromyalgia syndrome (11, 14, 16); 3) neck or shoulder surgery within the past year (13, 15); 4) history of myofascial pain therapy in the cervical region within the past month before the study (13, 14, 16); and 5) sensory disturbances in the trapezius region (14). All the participants were given clear explanations of the tests and treatments and signed the informed consent forms before participation in this study.

Based on the data (mean $\pm$ SD) reported by Alagesan et al. (17) about the effects of PRT on MTrPs, 15 subjects were recruited in each group (80% power; 5% alpha; and 10% attrition rate).

3.2. Randomization and Interventions

The participants were randomly allocated into experimental and control groups, using a computer-generated randomized block of numbers (block size, 2; allocation ratio, 1:1). A therapist, not involved in the study, performed the allocation procedure. Participants in both groups received 3 treatment sessions (10, 18) on 3 consecutive days. The experimental group was treated with the MPMS technique, while the control group received PRT. In each treatment session, the second physiotherapist, who was blind to the pretreatment information, applied the appropriate technique.

3.2.1. MPMS

In the MPMS technique, the subject remained in a prone position with the cervical spine in a neutral position and therapist standing on the affected side. The origin and insertion of the upper trapezius muscle (base of the neck and acromion process of the scapula bone) were approximated by the therapist's hands; this position was maintained for 90 seconds. The procedure was repeated 3 times within 1-minute intervals.

3.2.2. PRT

In this technique, the participant remained in a supine position with the cervical spine in a neutral position, while the therapist stood on the affected side. Digital pressure was applied on the identified MTrP, and the subject rated the level of pain. Pressure on MTrP was maintained to identify the position of ease. Then, the head was laterally flexed towards the side of the trigger point, while the therapist held the subject's forearm and abducted the shoulder to approximately 90°. The ideal position of ease, ie, the position where a reduction of at least 70% in pain was produced, was maintained for 90 seconds, followed by the passive return of the body part to an anatomically neutral position (17, 19). The procedure was repeated 3 times within 1-minute intervals.

3.3. Outcome Measures

The outcome measures included PPT, pain intensity, and bilateral active ROM of cervical spine lateral flexion. The first physiotherapist, who was blind to the treatment allocation, recorded the outcomes before treatment (at the beginning of the first session) and after treatment, ie, at the end of the third session (5 minutes after treatment) (10, 20) and in the follow-up. In each session, the order of assessment was randomlay determined, using a table of random numbers. The follow-up was performed 10 days after the first session (1 week after the third session) (18, 21).

3.3.1. PPT

PPT is the minimal amount of pressure where a sense of pressure first changes to pain or discomfort (22). In this study, PPT was measured with a digital algometer (Wagner, Force TenTM FDX model), consisting of a 1 cm-wide disk, pressed vertically on the MTrP. Since this equipment requires constant calibration, it was calibrated regularly through autocalibration by the device. Prior to recording PPT in the identified MTrP, a PPT-familiarization test was performed on the biceps muscle for all volunteers. To provoke pain, continuous pressure was applied at a rate of 1 $kg.cm^2.s^{-1}$ (11, 23, 24) until pressure was associated with pain for the patient (11).

3.3.2. VAS

VAS was used to evaluate pain intensity. VAS is a 10-cm horizontal line with 2 extremes: no pain (0) and worst imaginable pain (10) (25). The volunteers were introduced to VAS, and continuous pressure was applied on the MTrP at a rate of 1 $kg.cm^2.s^{-1}$ until reaching 2.5 kg/cm^2 using the algometer. The participants were asked to place a vertical mark on the VAS line (11, 24). All patients were asked to lay down in a prone position, and the neck was placed in a neutral position during PPT and VAS evaluations (24).

3.3.3. Active ROM of Lateral Flexion

The active ROMs of left lateral flexion (LLF) and right lateral flexion (RLF) were measured in the cervical spine with a universal goniometer. The goniometer axis was placed on the spinous process of the seventh cervical vertebra, and the fixed arm was placed vertical to the floor. The subject was instructed to laterally bend the neck to the maximum degree possible and align the moving arm with the midline of the cervical spine (26). All outcome measures were assessed 3 times within 30-second intervals, and the average values were used for data analysis (20).

3.4. Statistical Analysis

Before statistical analysis, the collected data were coded; therefore, the analysis process was blinded. Normal distribution of each variable was assessed by means of Kolmogorov–Smirnov test ($P > 0.05$). The mean scores and standard deviations (SDs) were calculated for each variable in the first, third, and follow-up sessions. Within-sessions changes were assessed in each group with repeated measures ANOVA test. Also, post-hoc comparison was performed with Bonferroni test. Intergroup differences were assessed with independent t test. All analyses were performed, using SPSS version 15. P-value less than 0.05 was considered statistically significant (confidence level, 95%).

4. Results

A total of 47 patients were recruited in this study, while only 30 were considered eligible (15 cases per group) (Figure 1). The majority of the patients were right-handed with trigger points in the right upper trapezius muscle. The demographic characteristics of the participants are listed in Table 1. The mean (± SD) age of the participants was 21.37 (1.40) years, the mean (SD) weight was 57.67 (6.61) kg, and the mean (SD) height was 162.50 (5.38) cm. Overall, 27 (70%) participants were right-handed with MTrPs in the right upper trapezius muscle. No adverse events were observed during or after treatments. All the participants were included in the analysis, and there were no missing data.

Table 1. The Baseline Characteristics of the Participants

Variables	Exp (n = 15)	Con (n = 15)	P Value
Age, ye	21.67 ± 1.49	21.07 ± 1.28	0.24
Weight, kg	57.00 ± 6.39 (6.3)	58.33 ± 6.99	0.059
Height, cm	161.80 ± 5.57	163.20 ± 5.29	0.48
BMI, kg/m²	21.77 ± 1.83	21.87 ± 2.11	0.89

Abbreviations: BMI, body mass index; Con, control group; Exp, experimental group.

The results of Kolmogorov–Smirnov test showed normal distribution of the variables in both groups ($P > 0.05$).

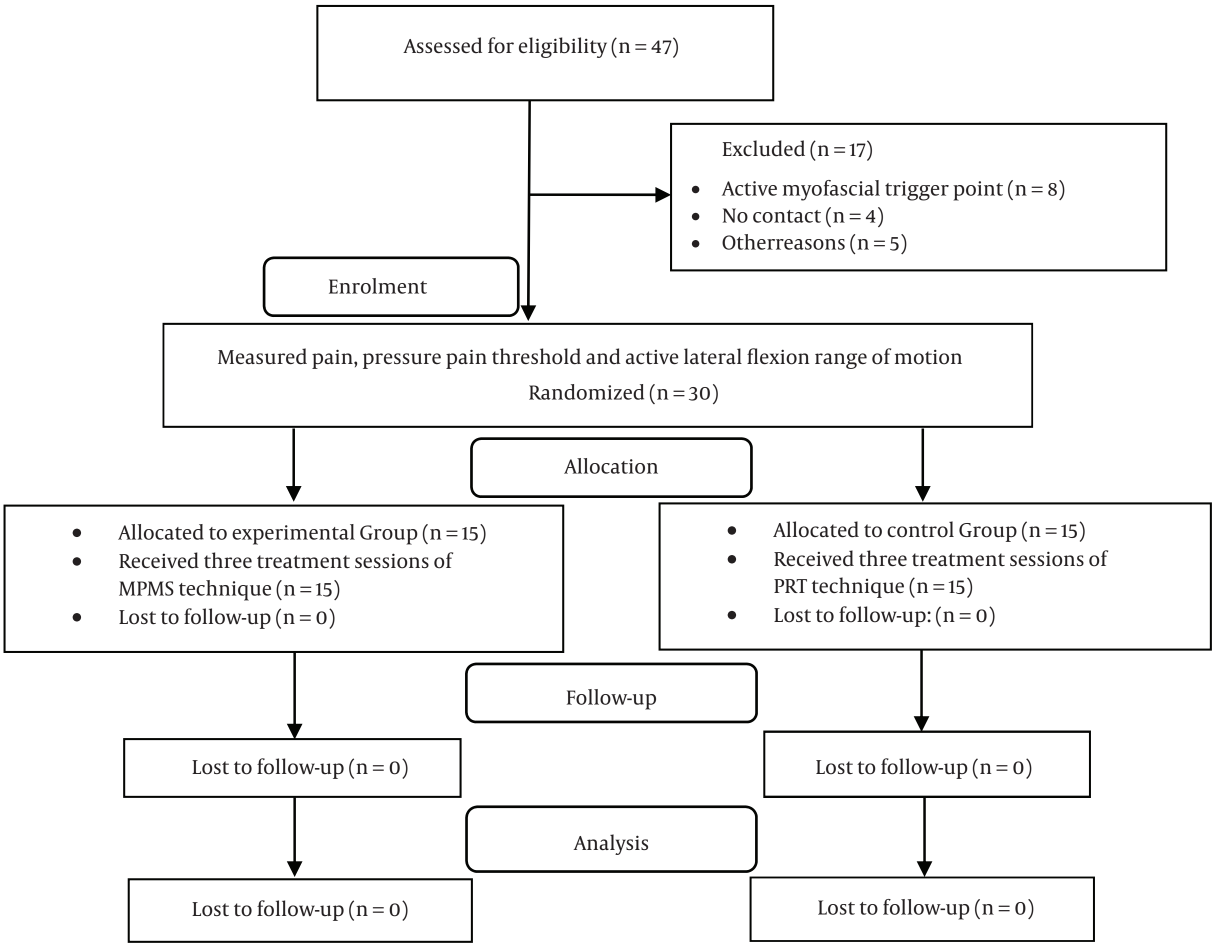

Figure 1. The Chart

At baseline, no significant differences were found in terms of age, height, weight, BMI, PPT, VAS scores, RLF, or LLF between the groups ($P > 0.05$). Therefore, both groups were comparable in all aspects at baseline.

In the follow-up session, the results of repeated measures ANOVA indicated a significant increase in the mean PPT in the experimental group (0.87; P = 0.000). The mean PPT also increased in the control group, although it was not statistically significant (0.40; P = 0.74). In both groups, the mean VAS scores decreased significantly in the follow-up session (MPMS, -1.8, P = 0.002; PRT, -1.1, P = 0.022).

RLF increased in the experimental (2.7; P = 0.012) and control (1.9; P = 0.090) groups. In addition, LLF increased in both groups during the sessions, although it was not statistically significant (MPMS, 1.9, P = 0.254; PRT, 0.73, P = 0.436). The collected data and treatment outcomes are presented in Table 2. The results of independent t test revealed no significant differences in PPT, VAS scores, RLF, or LLF between the groups (Figures 2 - 5).

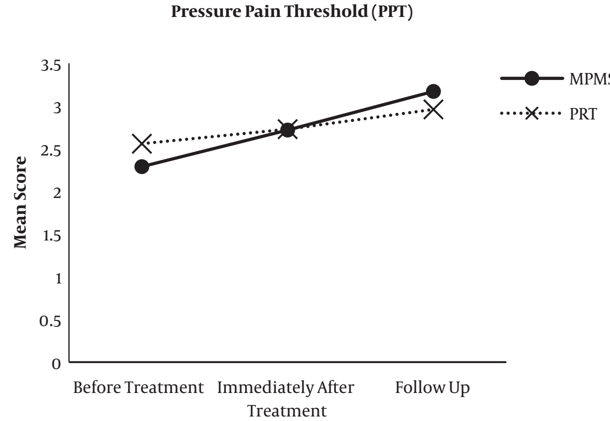

Figure 2. Trend in the Mean Scores of Pressure Pain Threshold (PPT)

Table 2. Treatment Outcomes[a]

Outcomes	Groups		P Value
	MPMS	PRT (Control)	
Pressure pain threshold (PPT)			
Before treatment	2.29 ± 0.78	2.56 ± 0.89	0.38
After treatment	2.72 ± 0.72	2.73 ± 0.78	0.95
Follow-up	3.17 ± 0.66	2.96 ± 0.52	0.36
Visual analogue scale (VAS)			
Before treatment	4.79 ± 1.80	4.39 ± 1.59	0.52
After treatment	4.55 ± 1.81	4.22 ± 1.99	0.64
Follow-up	2.90 ± 2.06	3.23 ± 1.71	0.64
Right lateral flexion (RLF)			
Before treatment	38.95 ± 3.73	38.04 ± 6.22	0.63
After treatment	39.28 ± 4.27	37.84 ± 5.80	0.44
Follow-up	41.66 ± 3.69	40.01 ± 5.86	0.36
Left lateral flexion (LLF)			
Before treatment	37.57 ± 4.81	38.66 ± 5.50	0.56
After treatment	37.9 ± 5.42	38.90 ± 4.74	0.59
Follow-up	39.48 ± 5.61	39.39 ± 4.56	0.96

[a]Values are expressed as mean ± standard deviation.

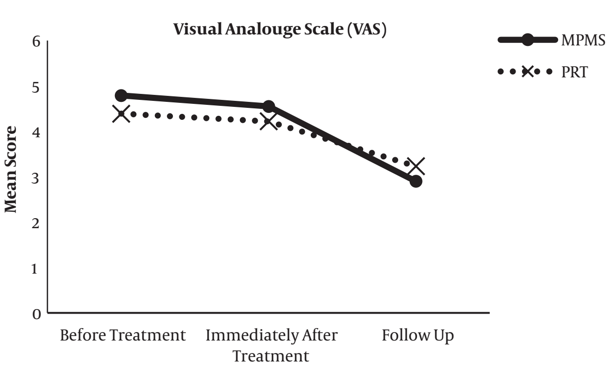

Figure 3. Trend in the Mean Scores of Visual Analogue Scale (VAS)

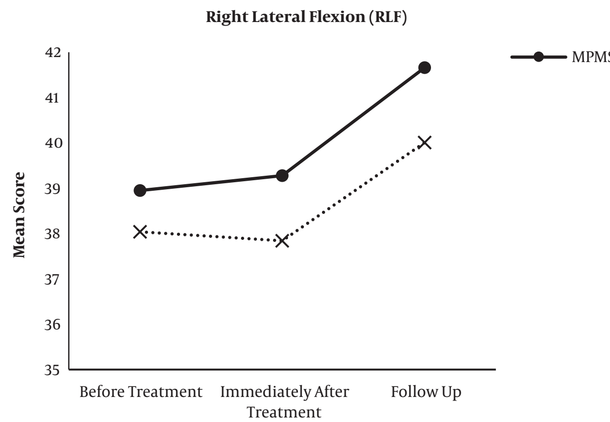

Figure 4. Trend in the Mean Scores of Right Lateral Flexion (RLF)

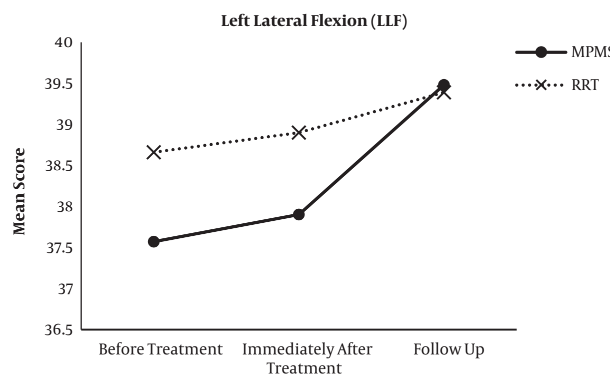

Figure 5. Trend in the Mean Scores of Left Lateral Flexion (LLF)

5. Discussion

The results of this study showed that both MPMS and PRT could reduce MTrP sensitivity and increase ROM among subjects with latent MTrPs in the upper trapezius muscle. The mean intergroup changes were not significantly different. The control group experienced a significant decline in pain and improvement in the active RLF. PPT and active LLF also increased, although it was not statistically significant.

In previous studies, PRT has been applied for the treatment of MTrPs and other disorders. Alagesan et al. indicated that 7 consecutive treatment sessions of PRT decreased pain and significantly increased the active ROM of lateral flexion, in contrast with the present study (17). The observed discrepancy may be due to the longer duration of treatment and use of additional methods (such as exercise and heat) in the mentioned study. Kumaresan et al. also reported a significant decrease in pain and an increase in ROM after 7 treatment sessions with PRT (27).

Mohammadi Kojidi et al. investigated the effects of PRT versus active soft tissue therapy on pain and ROM in women with latent MTrPs. The participants received 3 treatment sessions within 1-day intervals. Similar to the present study, VAS scores decreased, while the active ROM of contralateral flexion increased insignificantly. In contrast to the present study, PPT improvement was statistically significant in the mentioned research (18). In another study, Mohammadi Kojidi investigated the effects of PRT on the latent MTrPs of upper trapezius among computer users. The results regarding the significant improvement of PPT confirm the findings of the present study (10).

Additionally, Renu Pattanshetty et al. compared the immediate effects of myofascial release technique, PRT, and passive stretching on pain responses, ankle dorsiflexion, and plantar flexion in chronic plantar fasciitis after a single treatment session. Although all groups showed a significant decrease in pain, similar to the present study, ROM improvement in the PRT group was less significant than other treatments (6). Moreover, Doley et al. investigated the effect of PRT and deep transverse friction massage on the gluteus medius trigger points. The participants received treatment on alternate days for 3 days. Both groups showed a significant improvement in PPT, whereas the massage resulted in more improvement in PPT, compared to PRT (28).

Although the physiological mechanisms explaining the effects of PRT are still largely theoretical, proprioception and nociceptive theories are the most commonly discussed mechanisms describing the therapeutic effects of PRT. The analgesic effects of this technique can be explained by the nociceptive hypothesis. According to this hypothesis, placing patients in a position of ease may relax the injured tissues and lead to the local perfusion of fluids such as blood and lymph. This arterial filling can result in the removal of sensitizing inflammatory mediators, followed by pain relief and ROM improvement (29).

Restricted movement may be due to hyperactivity of the myotatic reflex arc, caused by excessive gamma gain. According to the proprioception theory, movement in the direction of greatest ease reduces the tension on the affected tissues and minimizes stimulation of the affected proprioceptors in PRT. In fact, positioning the muscle in the position of ease for a short period in PRT (90 seconds for general orthopedic patients and 3 minutes for neurologic patients) (1) reduces the gamma gain, thereby allowing the hyperactive reflex arc to return to its original state and increase ROM (30).

In PRT, the involved muscle is placed in a shortened and comfortable position. It seems that muscle shortening by therapists can have similar effects to PRT. The possible mechanism of this modified technique is somehow similar to PRT and can be explained by Korr's model. Moreover, the muscle spindle activity may decrease by placing the affected muscle in a shortened position, which enables the central nervous system to decrease gamma discharge activity and inhibit the facilitated segment of the spinal cord.

Overall, shortening of the extrafusal fibers or placing them in a position of ease decreases the intrafusal and extrafusal fiber disparities and reduces the gamma discharge. This enables the muscle to return to its normal resting length, as the hyperactive muscle spindles cease to fire (31, 32). As mentioned earlier, in the present study, the MPMS group experienced a significant decrease in pain, an increase in PPT, and improvement in active RLF; active LLF also increased, although it was not statistically significant.

The novelty of the present study was investigation of the effects of a new modified manual technique on the latent MTrPs of upper trapezius. As the results indicated, MPMS has beneficial effects on the upper-trapezius MTrPs, which are even more favorable than PRT in some occasions.

5.1. Limitations

The present study had several limitations. In this study, a small sample of female students with latent MTrPs was recruited. Therefore, further studies with a larger sample of both genders and active MTrPs are suggested. Moreover, holding more PRT and MPMS sessions, inclusion of a sham control group, and long-term follow-ups are recommended for future studies.

5.2. Conclusion

According to the results of this randomized controlled trial, PRT and MPMS were both effective techniques in the treatment of latent MTrPs of the upper trapezius. Furthermore, MPMS technique can be introduced as a new and effective technique for the treatment of latent MTrPs. This modified technique can be easily applied to small and superficial muscles. One of the advantages of this technique compared to PRT is the therapist's less fatigue, as there is no need to move the entire limb to achieve the position of greatest comfort.

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Footnotes

Authors' Contribution: Study concept and design: Ameneh Amini and Sakineh Goljaryan; acquisition of data: Ameneh Amini, Sakineh Goljaryan, Seyed Kazem Shakouri, and Elaheh Mohammadimajd; analysis and interpretation of data, Ameneh Amini and Sakineh Goljaryan; drafting of the manuscript: Ameneh Amini, Sakineh Goljaryan, Seyed Kazem Shakouri, and Elaheh Mohammadimajd; critical revision of the manuscript for important intellectual content: Ameneh Amini, Sakineh Goljaryan, Seyed Kazem

Shakouri, and Elaheh Mohammadimajd; statistical analysis: Ameneh Amini and Sakineh Goljaryan; administrative, technical, and material support: Ameneh Amini, Sakineh Goljaryan, and Seyed Kazem Shakouri; study supervision: Ameneh Amini and Sakineh Goljaryan.

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References

1. D'Ambrogio K, Roth G. Positional Release Therapy Assessmenr&Treatment of Musculoskeletal Dysfunction. St. Louis: Mosby; 1997.
2. Chaitow L. Positional Release Techniques. London: Churchill Livingstone Elsevier; 2007.
3. Kelencz CA, Tarini VA, Amorim CF. Trapezius upper portion trigger points treatment purpose in positional release therapy with electromyographic analysis. *N Am J Med Sci.* 2011;**3**(10):451–5. doi: 10.4297/najms.2011.3451. [PubMed: 22363082].
4. Mohamed MN, El Shiwi AMF. Effect of therapeutic exercises with or without positional release technique in treatment of chronic mechanical low back pain patients: a randomized controlled trial. *Egypt J Occup Med.* 2014;**38**(2):125–39.
5. Diwadkar P, Khatri S. Immediate effectiveness of positional release therapy in acute ankle sprain. *Indian J Phys Ther.* 2013;**1**(1):36–40.
6. Pattanshetty RB, Raikar AS. Immediate Effect of Three Soft Tissue Manipulation Techniques on Pain Response and Flexibility in Chronic Plantar Fasciitis: A Randomized Clinical Trial. *Int J Physiother Res.* 2015;**3**(1):875–84. doi: 10.16965/ijpr.2015.101.
7. Simons D, Travell J, Simons L. Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual Volum 1. Upper Half of Body. Baltimore: Williams & Wilkins; 1999.
8. Sciotti VM, Mittak VL, DiMarco L, Ford LM, Plezbert J, Santipadri E, et al. Clinical precision of myofascial trigger point location in the trapezius muscle. *Pain.* 2001;**93**(3):259–66. [PubMed: 11514085].
9. Wade R. Trigger points in the upper trapezius or normal subtrapezial anatomy? *Physiother Can.* 2001;**53**(3):219–22.
10. Mohammadi Kojidi M, Okhovatian F, Rahimi A, Baghban AA, Azimi H. The influence of Positional Release Therapy on the myofascial trigger points of the upper trapezius muscle in computer users. *J Bodyw Mov Ther.* 2016;**20**(4):767–73. doi: 10.1016/j.jbmt.2016.04.006. [PubMed: 27814857].
11. Fernandez-de-las-Penas C, Alonso-Blanco C, Fernandez-Carnero J, Carlos Miangolarra-Page J. The immediate effect of ischemic compression technique and transverse friction massage on tenderness of active and latent myofascial trigger points: a pilot study. *J Bodywork Mov Ther.* 2006;**10**(1):3–9. doi: 10.1016/j.jbmt.2005.05.003.
12. Unalan H, Majlesi J, Aydin FY, Palamar D. Comparison of high-power pain threshold ultrasound therapy with local injection in the treatment of active myofascial trigger points of the upper trapezius muscle. *Arch Phys Med Rehabil.* 2011;**92**(4):657–62. doi: 10.1016/j.apmr.2010.11.030. [PubMed: 21440713].
13. Gemmell H, Allen A. Relative immediate effect of ischaemic compression and activator trigger point therapy on active upper trapezius trigger points: A randomised trial. *Clin Chiropractic.* 2008;**11**(4):175–81. doi: 10.1016/j.clch.2009.01.007.
14. Nambi G, Sharma R, Inbasekaran D, Vaghesiya A, Bhatt U. Difference in effect between ischemic compression and muscle energy technique on upper trepezius myofascial trigger points: Comparative study. *Int J Health Allied Sci.* 2013;**2**(1):17. doi: 10.4103/2278-344x.110570.
15. Hou CR, Tsai LC, Cheng KF, Chung KC, Hong CZ. Immediate effects of various physical therapeutic modalities on cervical myofascial pain and trigger-point sensitivity. *Arch Phys Med Rehabil.* 2002;**83**(10):1406–14. [PubMed: 12370877].
16. Maher RM, Hayes DM, Shinohara M. Quantification of dry needling and posture effects on myofascial trigger points using ultrasound shear-wave elastography. *Arch Phys Med Rehabil.* 2013;**94**(11):2146–50. doi: 10.1016/j.apmr.2013.04.021. [PubMed: 23684553].
17. Alagesan J, Shah U. Effect of Positional Release Therapy and Taping on unilateral Upper Trapezius Tender Points-Randomized Controlled Trial. *Int J Heal Pharm Sci.* 2012;**1**(2):13–7.
18. Kojidi MM, Okhovatian F, Rahimi A, Baghban AA, Azimi H. Comparison Between the Effects of Passive and Active Soft Tissue Therapies on Latent Trigger Points of Upper Trapezius Muscle in Women: Single-Blind, Randomized Clinical Trial. *J Chiropr Med.* 2016;**15**(4):235–42. doi: 10.1016/j.jcm.2016.08.010. [PubMed: 27857631].
19. Nagrale AV, Glynn P, Joshi A, Ramteke G. The efficacy of an integrated neuromuscular inhibition technique on upper trapezius trigger points in subjects with non-specific neck pain: a randomized controlled trial. *J Man Manip Ther.* 2010;**18**(1):37–43. doi: 10.1179/106698110X12595770849605. [PubMed: 21655422].
20. Ruiz-Saez M, Fernandez-de-las-Penas C, Blanco CR, Martinez-Segura R, Garcia-Leon R. Changes in pressure pain sensitivity in latent myofascial trigger points in the upper trapezius muscle after a cervical spine manipulation in pain-free subjects. *J Manipulative Physiol Ther.* 2007;**30**(8):578–83. doi: 10.1016/j.jmpt.2007.07.014. [PubMed: 17996549].
21. Oliveira-Campelo NM, de Melo CA, Alburquerque-Sendin F, Machado JP. Short- and medium-term effects of manual therapy on cervical active range of motion and pressure pain sensitivity in latent myofascial pain of the upper trapezius muscle: a randomized controlled trial. *J Manipulative Physiol Ther.* 2013;**36**(5):300–9. doi: 10.1016/j.jmpt.2013.04.008. [PubMed: 23769263].
22. Fischer AA. Application of pressure algometry in manual medicine. *J Man Med.* 1990;**5**(4):145–50.
23. Gemmell H, Miller P, Nordstrom H. Immediate effect of ischaemic compression and trigger point pressure release on neck pain and upper trapezius trigger points: A randomised controlled trial. *Clin Chiropractic.* 2008;**11**(1):30–6. doi: 10.1016/j.clch.2007.09.001.
24. Sarrafzadeh J, Ahmadi A, Yassin M. The effects of pressure release, phonophoresis of hydrocortisone, and ultrasound on upper trapezius latent myofascial trigger point. *Arch Phys Med Rehabil.* 2012;**93**(1):72–7. doi: 10.1016/j.apmr.2011.08.001. [PubMed: 21982324].
25. Jensen MP, Turner JA, Romano JM, Fisher LD. Comparative reliability and validity of chronic pain intensity measures. *Pain.* 1999;**83**(2):157–62. [PubMed: 10534586].
26. Chaves TC, Nagamine HM, Belli JFC, de Hannai MCT, Bevilaqua-Grossi D, de Oliveira AS. Confiabilidade da fleximetria e goniometria na avaliação da amplitude de movimento cervical em crianças. *Revista Brasileira de Fisioterapia.* 2008;**12**(4):283–9. doi: 10.1590/s1413-35552008000400006.
27. Kumaresan A, Deepthi G, Anandh V, Prathap S. Effectiveness Of Positional Release Therapy In Treatment Of Trapezitis. *IJPHC.* 2012;**1**:71–81.
28. Doley M, Warikoo D, Arunmozhi R. Effect of Positional Release Therapy and Deep Transverse Friction Massage on Gluteus Medius Trigger Point - A Comparative Study. *J Exerc Sci Physiother.* 2013;**9**(1):40. doi: 10.18376//2013/v9i1/67579.
29. Bailey M, Dick L. Nociceptive considerations in treating with counterstrain. *J Am Osteopath Assoc.* 1992;**92**(3):334. [PubMed: 1592658] 337-41.

30. Birmingham TB, Kramer J, Lumsden J, Obright KD, Kramer JF. Effect of a Positional Release Therapy Technique on Hamstring Flexibility. *Physiother Can.* 2004;**56**(03):165. doi: 10.2310/6640.2004.00013.
31. Korr IM. The neural basis of the osteopathic lesion. *J Am Osteopath Assoc.* 1947;**47**(4):191–8. [PubMed: 18910957].
32. Korr IM. Proprioceptors and somatic dysfunction. *J Am Osteopath Assoc.* 1975;**74**(7):638–50. [PubMed: 124754].