Comparison between the Immediate Effect of Manual Pressure Release and Strain/counterstrain Techniques on Latent Trigger Point of Upper Trapezius Muscle

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Objective: This study compare the immediate effect of manual pressure release (MPR) and strain/counterstrain (SCs) techniques on latent trigger point of upper trapezius muscle.

Methods: Sixty-six volunteers (mean age, 24.73±1.63) participated in this study. Subjects underwent a screening process to establish the presence of MTrPs in the upper trapezius muscle as described by Simons et al (Myofascial pain and dysfunction, 1999). Subjects were divided randomly into 3 groups: MPR group, SCs group and a placebo group, which received a sham ultrasound. The outcome measure was the pressure pain threshold (PPT) and visual analogue scale (VAS) on the MTrP in the upper trapezius muscle by an assessor blinded to the treatment allocation of the subject.

Results: The experimental groups showed a trend toward an increase in PPT levels and decrease in VAS after the intervention procedures. Within-group effect sizes were large in the MPR and SCs groups ($d > 1$), and small to medium in the placebo group ($d \sim 0.4$). Comparing between MPR and SCs groups showed significant differences in PPT and VAS changes ($P < 0.05$).

Conclusions: MPR and SCs techniques are superior to sham ultrasound in immediately reducing pain in patients with non-specific neck pain and upper trapezius MTrP, but MPR technique is better than SCs technique.

Key Indexing Terms: *upper trapezius, latent trigger point, manual pressure release, strain counterstrain.*

Introduction

Myofascial trigger points (MTrPs) are claimed to be a common source of musculoskeletal pain in people presenting to manual therapists for treatment. Simons[1] has contended that MTrPs are often inadequately diagnosed and treated due to insufficient training and knowledge of practitioners. MTrPs are claimed to be a source of local and referred pain, and may create additional complaints by reducing joint range of motion and producing autonomic disturbance. Patients with MTrPs can present with complex clinical findings and the underlying cause of MTrPs has been the subject of much speculation.[2]

Travell and Simons[3] clinically define a myofascial trigger point (MTrP) as "a hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band." MTrPs can develop from a number of conditions including: genetics, aging, and performing a strenuous activity.[4] MTrPs can be brought on by macrotrauma or by cumulative microtrauma. Abnormal posture, repetitive motion, or psychological stresses are examples of cumulative microtrauma.[3-5] Formation and presence of a MTrP is correlated with muscle pain, weakness, and movement dysfunction.[3,6-14] There are a variety of modalities purported to relieve or diminish the symptoms associated with MTrPs, including ischemic compression,[3,15,16] massage,[3,18-22] needling,[3,23-31] vapocoolant spray and stretch,[3,15,31,32] electrical stimulation,[33-37] laser therapy,[33,38-40] ultrasound,[41-49] and diathermy.[50]

Sustained manual pressure, referred to in this paper as ‘manual pressure release’ (MPR), and previously referred to as ‘ischemic compression,’ ‘inhibition’, and ‘trigger point pressure release,’ is one of a number of techniques advocated for the treatment of MTrPs. MPR is performed by applying tolerably painful, persistent manual pressure, usually with the thumb or fingertip, against the tissue barrier of a MTrP.[2] There is evidence that the palpable MTrP bands and nodules are a result of localized bulging and shortening of the sarcomeres in a muscle fiber to produce ‘contraction knots’ and ‘contraction discs’.[3,51]

The upper trapezius is probably the muscle most often beset by MTrPs.[52,53] Fischer measured the PPT of eight different muscles with a pressure algometer and determined that the upper trapezius was most sensitive to the pressure of the muscles tested.[54] The two trigger point locations in the upper trapezius commonly refer pain along the posterolateral aspect of the neck, behind the ear to the temple.[2]

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A recent systematic review of manual therapies in treatment of MTrPs concluded that there were few studies analysing treatment of MTrPs using manual therapy.[58] As MTrPs are characterized by restricted range of motion of the affected tissues.[1]

Fernandes-De-Las-Penas et al. (2005) suggested the necessity of including changes on range of motion of the affected tissues after MTrP treatment. Manual therapy is a inexpensive method and could be used in everywhere, without instrument. These treatments don't have any side effects, but we don't know which of manual therapy techniques is more effective.

The aim of the present study is to compare the immediate effects of manual pressure release and strain counterstrain on an upper trapezius latent trigger point. It was hypothesised that the MPR & SCS interventions would elicit reductions in trigger point sensitivity and pain intensity that would not be seen following sham ultrasound.

Methods

This study was a randomised, single-blind, sham controlled clinical trial. The study was conducted at the Physical Therapy Research Center (PTRS) of Shahid Beheshti University of Medical Sciences in the Iran and approval for the study was obtained from the PTRS Research Ethics Sub-Committee. Data collection occurred between October 2010 and June 2011.

The sample size and power calculations were performed with a local software (Tamaño de la Muestra, 1.1, Madrid, Spain). The calculations were based on detecting a 20% difference in pressure pain threshold (PPT) at post intervention data, assuming an SD of 10%, an α level of .05, and a desired power of 80%. These assumptions generated a sample size of at least 20 subjects per group.

The participants

Through local newspaper advertisements, Sixty six female students from Zanjan University, Iran, between the ages of 18-35 years suffering from neck/shoulder pain corresponding with the area covered by the upper Trapezius muscle were recruited. They were healthy individuals, diagnosed with latent MTrPs in the trapezius muscle. Subjects were randomly divided into 3 groups for treating MTrPs: 24 subjects in MPR group; 22 subjects in SCS group; and 20 subjects were in the control group, who received sham ultrasound.

To locate trapezius MTrPs, we followed the exploration diagnostic criteria established by Simons et al (1999):

1. Presence of palpable taut band in a skeletal muscle.

2. Presence of a hypersensitive tender spot in the taut band.

3. Local twitch response provoked by the snapping palpation of the taut band.

4. Reproduction of the typical referred pain pattern of the MTrPs in response to compression.

5. Spontaneous presence of the typical referred pain pattern and/or patient recognition of the referred pain as familiar (Gerwin et al., 1997).

If only the four first criteria were satisfied, the MTrP was considered to be latent. If all of the aforementioned criteria were present, was considered to be active (Simons et al., 1999; Gerwin et al., 1997).

For criteria 4, MTrP pressure tolerance was assessed using a mechanical Force gauge.

The assessor applied continuous pressure with the force gauge at approximately a rate of 1 kg/cm2/s, until it recorded a pressure of 2.5 kg/cm2. Pressure thresholds lower than 3 kg are considered to be abnormally low (Fischer, 1996). If the referred pain evoked by the MTrP was obtained before 2.5 kg/cm2, criteria 4 was seen to be fulfilled.

Subjects were excluded if they exhibited any of the following:

1. Diagnosis of fibromyalgia syndrome
2. History of a whiplash injury,
3. History of cervical spine surgery,
4. Diagnosis of cervical radiculopathy or myelopathy determined by their primary care physician;
5. Having undergone myofascial pain therapy within the past month before the study.

Each subject read a Study Information Sheet and signed an Informed Consent Form before enrolment in the study. The randomization scheme was generated by using the web site Randomization.com <http://www.randomization.com>. To ensure equal numbers in the groups, subjects were randomized in blocks of two. Sealed opaque envelopes were prepared containing the assigned treatment and numbered consecutively. Subjects were allocated to the next available envelope number.

Interventions

Manual pressure release

For manual pressure release technique, the subject laid supine with the cervical spine in a neutral position. Subjects had been encouraged to relax as much as possible. The therapist had identified the latent MTrPs in the upper trapezius muscle by using pincer palpation. The clinician applied non-painful pressure and had slowly increased it by her thumb over the MTrPs until she felt a tissue resistance barrier. This level of pressure was maintained until release of the tissue barrier was felt; then, the pressure was increased until a new barrier was reached. This process was repeated until there was no TrP tension/tenderness or 60 s had elapsed, whichever occurred first.[59,60]

Strain counterstrain

For strain/counter-strain technique, the subject sat on the chair with relaxed upper extremities. The therapist had identified the latent MTrPs in the upper trapezius muscle by using pincer palpation. Once located, the therapist applied gradually increasing pressure to the MTrP until the sensation of pressure became one of pressure and pain. At this time, she was created a new position with less tension resulting in a subjective reduction of pain of up to 75%. In the present study, the position that led to reduce pain, was ipsilateral side-flexion of the cervical spine with slightly contra lateral rotation and upper limb abduction.

This position was maintained for 90 seconds. Finally, the subject was slowly placed to neutral position (Meseguer et al., 2006; Ibanez-Garcia et al., 2009).

Sham ultrasound

A Novin ultrasound (512X model) machine was used.

The subject was informed that pulsed ultrasound was going to be used; they should not feel any sensation of heat or pain. If they did perceive such a sensation they were asked to inform the therapist and the machine would be turned down. Since this was a sham procedure, such adjustment made no actual difference. Ultrasound lotion was applied over the MTrPs and the ultrasound head was moved slowly over the upper trapezius muscle in the region of the MTrPs for 2 min. The machine's integrated timer was used to alert the clinician when 2 min had elapsed.[61,62] Ultrasound was chosen because subjects are not aware of the apparatus being connected or disconnected, allowing them to be used as a control group. This same method has been used in earlier studies (Gemmell et al., 2008).

Pressure Pain Threshold

Pressure pain threshold (PPT) is defined as the minimal amount of pressure where a sense of pressure first changes to pain (Kostopoulos et al., 2008). An algometer (Taivan, model 512X) was used in this study. This device consist of a round rubber disk (area, 1cm) attached to a pressure (force) gauge.

A pressure of 2.5 kg/cm2 was applied on MTrPs. The VAS was used to evaluate a possible change in pain intensity. Each participant was instructed to indicate the intensity of pain by marking a 10-cm horizontal line with 2 extremes: no pain and worst imaginable pain. Subjects were advised to not utilize drugs such as: opioid and non-opioid analgesics, anti-inflammatory drugs and anti-depressants.

Subjects received the treatments, as described for each group, after which the same measurements were performed. Examiner 1 (neurologist) performed the outcome measures, having been blinded to the treatment techniques, while examiner 2 (physical therapist) performed the treatment techniques. In our study, all measurements were made by a 3th year chiropractic student, who had been trained by a chiropractor with 16 years of clinical experience.

Intra-class correlation coefficient (ICC) was used for assessing intra-examiner repeatability of PPT readings taken from the four pre-intervention trials. The intra-rater reliability of pressure algometry has been found to be high on the same day i.e., ICC = 0.87, P<0.0001. It should be mentioned that a 30 seconds resting period time was allowed between each trial.

Analysis of data

Data was analyzed with the SPSS package (version 16). Mean and standard deviations of the values were calculated for each variable. A normal distribution of quantitative data was assessed by means of the Kolmogorov–Smirnov test (P > 0.05). Baseline features were compared between groups using the One way

ANOVA. Within-group differences were assessed with the dependent t-test. Within-group effect sizes were calculated using Cohen’s d coefficient. Inter-group comparisons between both studies groups were also achieved with the independent t-test. The statistical analysis was conducted at a 95% confidence level. The P-values less than 0.05 were considered as statistically significant.

Results:

No significant difference has found for age ($P = 0.61$), weight ($P = 0.73$), height ($P = 0.37$) and BMI ($P = 0.49$) between groups, Moreover, there were no differences between groups for the PPT ($P = 0.55$) or the VAS ($P = 0.33$), so it could be assumed that all study groups were comparable at the start of the study.

The mean changes in both experimental and control groups were compared using an independent t-test, and were found to be significantly different. Between MPR and control group ($p< 0.0001$, $t=22.88$, for PPT and $p<0.0001$, $t= -16.93$ for VAS), between SCS and control group ($p< 0.0001$, $t= 16.33$ for PPT and $p< 0.0001$, $t= -15.42$ for VAS).

The differences in pre-post PPT and VAS were significant between the groups ($p< 0.05$, $t=7.14$, for PPT and $p<0.0001$, $t= -4.22$ for VAS). Table 1 & 2 show within-group effect sizes at each assessment on three study groups.

Effect sizes were calculated using Cohen’s d, and can be interpreted as being large ($d=0.8$), medium ($d=0.5$) and small ($d=0.2$) (Cohen, 1988). Table 3 shows within-group effect sizes at each assessment on three study groups.

Discussion

The present study found that the application of manual pressure release and strain/counter-strain techniques over latent MTrPs in the upper trapezius muscle induced a decrease in pressure pain sensitivity, and pain intensity. Further, the pre-post effect sizes were large in the both intervention groups suggesting a strong clinical effect, whereas the effect size of the control group was small to mediun. Our study is the first one to compare changes on pressure pain sensitivity and pain intensity after the treatment of latent MTrPs in the upper trapezius muscle with MPR and SCS techniques.

Explanations implicating local structures such as muscle spindles (Hubbard, 1996) and end-plates (Borg-Stein and Simons, 2002) have been proposed for tender point identified using myofascial pain syndrome procedures, but it is also likely that peripheral and central pain sensitization may explain some tender point pain (Lewis et al., 2008). Some published papers have previously analyzed the effectiveness of ischemic compression technique in the treatment of either latent or active MTrPs (Hong et al., 1993; Hanten et al., 2000; Fryer and Hodgson, 2005; Fernadez de las Penas et al., 2006). All these studies found that the ischemic compression technique induced an increase in PPT levels over the MTrPs, which is in agreement with our results after the application of either neuromuscular or strain/counter-strain intervention. Atienza-Meseguer et al. (2006) reported that the application of strain/counter-strain technique also produced an increase in PPTs. Previous and current findings provide evidence that the application of compression interventions can be effective for the reduction of pressure pain sensitivity over MTrPs.

Treatment of latent upper trapezius MTrPs with 60s of MPR or 90s SCs decreased significantly the sensitivity of MTrPs. These results have shown that MPR and SCs were effective therapy for MTrPs in the upper trapezius muscle. These findings are consistent with previous reports of Hou et al (2002) who found that MPR decreased the sensitivity of MTrPs.

Simons (2004) proposed an integrated hypothesis of the aetiology of MTrPs, where acute or chronic muscle overload results in trauma to the motor endplate and subsequent release of acetylcholine. Excessive amounts of acetylcholine result in the formation of contraction knots (areas of localized sarcomere shortening), which are in a state of continued contraction and result in local ischaemia and hypoxia. The combination of increased energy demand in the face of loss of energy supply causes the release of sensitizing noxious substances, which are proposed to be responsible for the pain associated with MTrPs. Autonomic effects can modulate the increased acetylcholine release and contribute to the positive feedback cycle (Simons 2004).

Simons (2004) has proposed that appropriate treatment of MTrPs involves lengthening the sarcomeres, which reduces the energy consumption and; sequentially, it cease the release of noxious substances. There are a number of possible mechanisms behind the effectiveness of MPR and SCs.

Simon et al (2002) has proposed these techniques may equalize the length of sarcomeres in the involved MTrP; consequently, decrease the palpable knot and pain.

Hou et al (2002) have suggested the pain reduction in MTrPs following MPR may result from reactive hyperemia in the local area, due to counterirritant effect or a spinal reflex mechanism, probably produce reflex relaxation of the involved muscle. About Strain/counterstrain technique, is thought to achieve its benefits by means of an automatic resetting of muscle spindles which would help to dictate the length and tone into the affected tissues.

Evidence that may indicate central nervous system sensitization, mediated by large-diameter myelinated Ab afferents (Price et al., 1989; Siddall and Cousins, 1998), has recently been found in relation to tender point activity (Lewis et al., 2010). Strain/counterstrain technique, is thought to achieve its benefits by means of an automatic resetting of muscle spindles which would help to dictate the length and tone of the affected tissues (Chaitow, 2001; Jones, 1981). Based on Wong and Schauer-Alvarez., 2004 and current findings, it seems that strain/counterstrain technique might be effective in reducing tenderness and local pain provoked by tender points.

Our results have shown that SCs and MPR was effective therapy for MTrPs in the upper trapezius muscle. In addition, it is not found any publications have compared the effect of these indispensible techniques i.e, MPR and SCs. According to this study, both of intervention group effect sizes were large, but

MPR technique is better than SCs technique, probably its due to differences in measure of therapist pressure, in addition, the clinician applies a pressure over the MTrPs until a tissue resistance barrier is felt in MPR technique, but in SCs treatment method, the clinician increases the pressure on the MTrPs until the sensation of pressure feels, in other word, in MPR technique the measure of pressure is objective, but in SCs technique is subjective.

It should be mentioned that the current study has several limitations. First of all, this study merely examined the immediate effect on both treatment techniques. Second, the participants in this study were asymptomatic and may not be typical of the population presenting to manual therapists for treatment. Finally, according to previous researches SCs technique cause an increasing in range of motion, so, future studies can compare effect of MPR and SCs techniques on range of cervical lateral flexion.

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Tables:

Table 1Clinical pre-intervention data for each group at the beginning of the study

	Manual Pressure Release	Strain/Counterstrain	Control	P-value
Pressure Pain Threshold	3.23±0.80	3.06±0.82	3.30±0.53	0.55
Visual Analogue Scale	6.17±0.63	5.86±0.64	6.00±0.79	0.33

Values are expressed as mean ± S.D.

Table 2 Pre-post values of each group

	Manual Pressure Release	Strain/Counterstrain	Control
	Pre-Post	Pre-Post	Pre-Post

Pressure Pain Threshold	3.23±0.80;4.53±0.87	3.06±0.82; 3.94±0.73	3.30±0.53;3.39±0.56
Pain Intensity 2.5kg/cm2	6.17±0.63;3.25±0.67	5.86±0.64; 4.05±0.65	6.00±0.79;5.70±1.03

Values are expressed as mean ± S.D.

Table 3 Effect Sizes

	PPT	VAS
Manual Pressure Release	1.55	4.53
Strain/Counterstrain	1.01	2.94
Control	0.35	0.33