Journal of Bodywork & Movement Therapies xxx (2017) 1–5

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Randomized controlled trial

Instrument-assisted soft tissue mobilization increases myofascial trigger point pain threshold

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ARTICLE INFO

Article history:
Received 29 July 2017
Received in revised form
17 October 2017
Accepted 24 October 2017

Keywords:
IASTM
Instrument-assisted treatment
MTrP
Trigger points

ABSTRACT

Background: A myofascial trigger point (MTrP) has been defined as a hyperirritable, palpable nodule in a skeletal muscle. The signs and symptoms of a MTrP include muscle pain, weakness, and dysfunction. MTrPs are common problems associated with soft tissue pathology. Having an intervention to decrease MTrP pain can be clinically valuable.

Purpose: To determine if a series of six instrument-assisted soft tissue mobilization (IASTM) treatments rendered over three weeks would influence the pressure pain threshold (PPT) of a myofascial trigger point (MTrP).

Methods: Randomized, control trial of healthy individuals (n = 29) with MTrPs in the upper trapezius muscle. The intervention was six IASTM treatments rendered over three weeks. Each treatment included 1 min of sweeping with the GT-1/HG-2 (handle bar), 1 min of swivel with the knob of the GT-1/HG-2 directly over the MTrP, 2 min of fanning with the GT-4/HG-8 (convex single bevel), and concluded with 1 min of sweeping with GT-1/HG-2.

The outcome measure used a dolorimeter to compare PPT before and after three weeks in both the treatment and control groups.

Results: Paired *t*-test for PPT pre-test and post-test of the control and treatment groups were $p = 0.42159$ and $p = 0.00003$, respectively. A one-way ANOVA of the control and IASTM groups revealed a statistically significant difference ($p < 0.0001$). The power calculation was greater than 0.99.

Conclusions: A 5-min intervention using three IASTM techniques can effectively increase the PPT of a MTrP in six treatments over a three-week period of time.

1. Introduction

The quest to understand myofascial trigger points (MTrPs) began over one hundred years ago (Simons and Dommerholt, 2005). A MTrP has been defined as a hyperirritable, palpable nodule in a skeletal muscle (Travell and Simons, 1998). The signs and symptoms of a MTrP include muscle pain, weakness, and dysfunction (Travell and Simons, 1998; Hong and Simons, 1998; Mense, 1993, 1996; Simons, 1996). Shah et al. (2005) identified a histochemical milieu of the potential source of the local and referred pain of a MTrP. Proton [H+] concentrations, bradykinin, calcitonin gene-related peptide, substance P, tumor necrosis factor-α, Interleukin-1β, serotonin, and norepinephrine were found to all be significantly higher in MTrPs than in normal, pain-free muscle. Travell and Simons (1998) have long recognized the influence of abnormal posture, repetitive motion, and psychological stress on the perpetuation of MTrPs. Numerous researchers have sought viable interventions to mitigate the pain and dysfunction associated with MTrPs. These modalities include vapocoolant spray and stretch (Travell and Simons, 1998; Hong and Simons, 1998; Mense, 1991, 1993, 1996; Simons, 1996), massage (Travell and Simons, 1998; Portillo-Soto et al., 2014; Ebel and Wisham, 1952; Pemberton, 1939), strain-counterstrain (Ibáñez-García et al., 2009), ischemic/manual compression (Fryer and Hodgson, 2005; Gulick et al., 2011), needling (Jaeger and Skootsky, 1987; Lewit, 1979; Melzack, 1981; Melzack et al., 1977), ultrasound (Gam et al., 1998; Gulick et al., 2001; Srbely et al., 2008; Williams et al., 1987; Draper et al., 2010), electrical stimulation (Hooker, 1998), laser therapy (Cheng, 1987; Laakso et al., 1967), taping (Gulick et al., 2015), and instrument-assisted soft tissue mobilization (Gulick, 2014).

Instrument-assisted soft tissue mobilization (IASTM) uses special instruments with beveled edges to assist the clinician in the

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https://doi.org/10.1016/j.jbmt.2017.10.012
1360-8592/

evaluation and mobilization of soft tissue (Looney et al., 2011). Instruments are used in a multidirectional stroking fashion applied to the skin at 30°–60° angles to detect soft tissue irregularities via the undulation of the tools (Howitt et al., 2006; Sevier et al., 1995). IASTM have been purported to enhance proliferation of extracellular matrix fibroblasts, improve ion transport, and decrease cell matrix adhesions (Howitt et al., 2006; Gehlsen et al., 1999; Hammer and Pfefer, 2005; Loghmani and Warden, 2009). Thus, IASTM has been suggested as an intervention for pathology such as chronic fibrosis, lateral epicondylitis, carpal tunnel syndrome, trigger thumb, and plantarfascitis (Howitt et al., 2006; Sevier et al., 1995; Leahy, 1995; Melham et al., 1998).

However, the effects of IASTM on MTrPs are lacking. This study is a continuation of a line of MTrP research. A prior study (Gulick, 2014) was the first randomized controlled study exploring this clinical protocol. Identification of some methodological errors has resulted in a continued effort to refine the process. Phase I involved two MTrPs (1 treatment, 1 control) in the same person and resulted in an increase in the pressure pain threshold (PPT) of both MTrPs. Phase II modified the protocol by using only one MTrP in each person with a control and treatment group. Again, both MTrPs resulted in an increase in the PPT. In reviewing the methodology of both phases, it appeared the frequent use of the dolorimeter to assess pain threshold may have actually been providing repeated compression to both the treatment and control groups. Ischemic compression has been shown to be an effective treatment technique (Fryer and Hodgson, 2005; Gulick et al., 2011). Thus, phase III resulted in yet another change. Two groups were established (1 treatment, 1 control) but the assessment tool (dolorimeter) was only used at the beginning and end of the intervention/data collection. So the purpose of this study was to determine if a series of six IASTM treatments rendered over three weeks will influence the PPT of a MTrP. The hypothesis was that six IASTM techniques will increase the PPT of MTrPs in the upper back of healthy individuals.

2. Methods

2.1. Participants

Healthy participants (n = 36) over the age of 18 were recruited by a posted flyer. When the potential participant contacted the research assistant, s/he was asked if there are "knots" (i.e. MTrP) in the neck region and if he/she was receiving any treatment to this area. If the individual could potentially meet the inclusion criteria, the research assistant scheduled an initial session with the researcher. Each participant provided written informed consent (document approved by the University Institutional Review Board for the protection of human subjects). Each participant was asked if s/he had any of the following exclusion criteria: sensory problems in the upper or midback regions, heart/circulation problems, cancer, diabetes mellitus, tuberculosis, or any shoulder, neck, or upper/midback surgeries. The upper/midback region was also inspected for wounds, lesions, and infections. It was confirmed that each participant was free of current upper quarter injury and was not being treated for any injury in this area (including medication). As per the inclusion criteria, palpation of the upper/midback region sought to identify palpable trigger points.

2.2. Instruments

An algometer/dolorimeter (JTECH Medical, Midvale, UT) with a 1-cm diameter tip was used to measure pressure sensitivity (in grams) of each myofascial trigger point. Steinbroker was the first to adapt a push-pull gauge called the "palpometer" to quantify articular tenderness. McCarty et al. (1965) developed a similar instrument, the "dolorimeter," which was used in the evaluation of anti-inflammatory therapy. A pilot study (n = pressure pain threshold 20) to assess the test-retest correlation of this instrument in assessing pain pressure threshold revealed an r = 0.91–0.95. JTECH dolorimeter performs autocalibration and guarantees 99% force accuracy (JTECH, 2017).

2.3. Procedure

Once accepted into the study, self-reported age, height, weight, and gender were recorded on the data collection form. Each participant was seated in a chair with his/her forearms resting on a treatment table. The participant was asked to rest his/her forehead on the forearms. The researcher who palpated for the MTrPs had over 30 years of experience in manual, orthopedic physical therapy practice. Based on the study by Myburgh et al. (2008) on the reproducibility of manual palpation for identification of MTrPs, the upper trapezius muscle was used. They reported clinicians should simplify the process of MTrP identification by using pain on palpation, a jump sign, and pain referral. They also stated that attempting to differentiate latent and active MTrP confuse rather than clarify the diagnostic process. Therefore, no distinction was made between active and latent trigger points in this study. The MTrP pressure pain threshold (PPT) was assessed using the JTECH dolorimeter (pre-test). The dolorimeter was placed on the MTrP and increased pressure was slowly applied over at least 5 s by the same investigator each time until the participant reported that the pressure reached the threshold of discomfort (Fig. 1). Participants were told to identify when the pressure began to reach an uncomfortable level. Each participant served as his/her control, regardless of how "uncomfortable" was interpreted. PPT was assessed three times and recorded on the data form. The mean value was used for data analysis.

Participants were randomly assigned (coin toss) to the control or intervention group. Those in the control group were assessed on the initial day and then three weeks later (post-test) only. No treatment was rendered to the control group. Those in the intervention group participated in six IASTM sessions over a three week period (at least two days between sessions). The instruments utilized were stainless stain devices machined into various shapes (Hawk Grips, 2017; Graston, 2017). Emollient was applied to the treatment area to prevent skin irritation. Each session included 1 min of sweeping (Fig. 2 - longitudinal strokes performed parallel to the muscle fibers similar to an effleurage stroke) with the GT-1/HG-2 (single bevel handle bar), 1 min of swivel (Fig. 3 – pivoting/

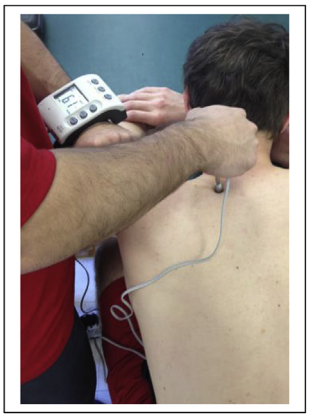

Fig. 1. JTECH technique for the assessment of myofascial trigger point pain threshold.

Please cite this article in press as: Gulick, D.T., Instrument-assisted soft tissue mobilization increases myofascial trigger point pain threshold, Journal of Bodywork & Movement Therapies (2017), https://doi.org/10.1016/j.jbmt.2017.10.012