Cover Page

Positional Release Therapy and Therapeutic Massage Reduce Muscle Trigger and Tender Points

NCT #: Not yet assigned

Todays date: 1/14/2021

Study protocol and statistical analysis plan

INTRODUCTION

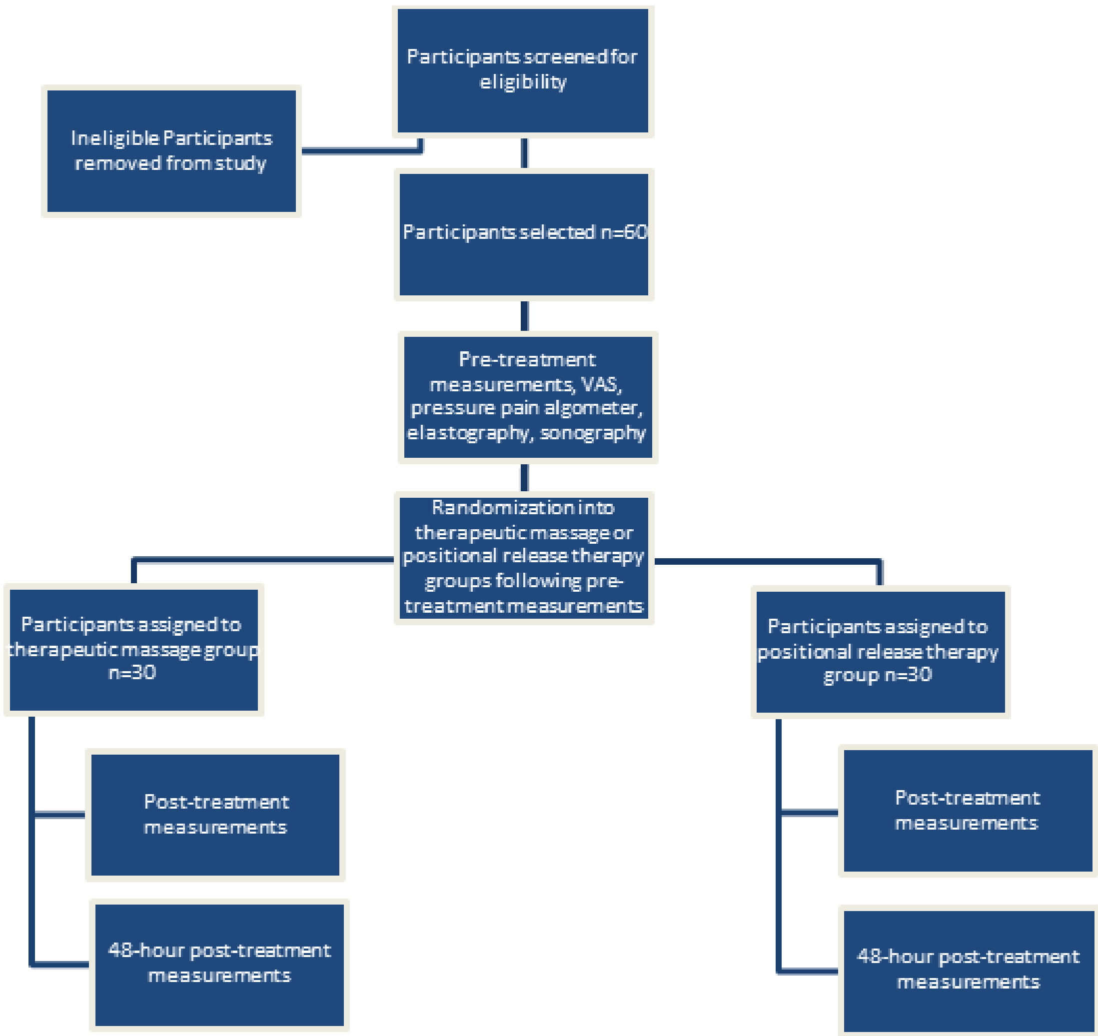
Myofascial pain is a common disorder affecting individuals across the general population and in specific populations, such as athletes, resulting in compromised function, performance, and productivity (Muller et al., 2014). It has been associated with many pain conditions including tension-type headache, spine disorder, and neck and shoulder pain (Muller et al., 2014; Simons & Travell, 1981). Myofascial pain characteristically results from hyperirritable nodules of muscle (trigger points or tender points) associated with pain in affected regions of the body (Jafri, 2014). These areas within the muscle are subjected to continued contraction of muscle fibers due to "too much" calcium resulting in compromised oxygenation of the muscle tissue (Dommerholt et al., 2006). These hyperirritable nodules often occur in fatigued muscles that are subjected to imbalanced postural positions, such as the forward head and rounded shoulders postures (JG & SH, 1983). It can also occur from repetitive movements commonly seen in athletics, and individuals performing manual work (Borg-Stein & Simons, 2002).

Positional release therapy (PRT) and therapeutic massage (TM) are methods used to treat trigger or tender points (D'Ambrogio & Roth, 1997; Knight & Draper, 2013; Wong, 2012). Separate studies on each method have shown efficacy in reducing pain (Aboodarda et al., 2015; Mohammadi Kojidi et al., 2016) muscle tightness (Kelencz et al., 2011) and improving joint mobility (D'Ambrogio & Roth, 1997). PRT is a manual therapeutic technique that first locates tender points within a muscle. Once identified, the practitioner places the muscle in a passively shortened position, while applying slight pressure (D'Ambrogio & Roth, 1997). TM involves the manipulation of soft tissue using techniques such as effleurage and petrissage, to restore blood flow and oxygenation of the muscle tissue (Tessier, 2005; Yang et al., 2012).

Various methods have previously been used to find and assess severity of tender or trigger points. Among those commonly used are the pressure pain algometer with pressure pain threshold (PPT), range of motion electromyography and visual analog scales (VAS) (Aboodarda et al., 2015; Buttagat et al., 2012; Draper, 2015; Ghanbari et al., 2012; Kelencz et al., 2011; Nagrale et al., 2010; Simons & Travell, 1981; Sweety et al., 2014; Wong, 2012). Some studies have also utilized B-mode (two-dimensional) ultrasound imaging (US) to locate, define, trace, and quantify myofascial trigger points after palpation providing a useful means of quantification (Cojocaru MC, 2015; Kumbhare DA, 2016; Muller et al., 2014). Shear wave elastography ultrasound (SWE) has been used to calculate the elastic modulus (tissue stiffness) of muscle reliably, (Brandenburg et al., 2014; Eby et al., 2013; Gennisson et al., 2010; Kumbhare DA, 2016; Muller et al., 2014), but has not been used quantify changes within trigger points following treatment.

Objectives

The purpose of our study was to quantify the effectiveness of PRT or TM at reducing pain, trigger point tenderness, and muscle stiffness in the upper trapezius muscle by using a combination of the visual analog scale, PPT, B-mode US and SWE to assess changes within triggers points.



METHODS

Participants

We recruited 60 healthy Participants, 24 males and 36 females, (age=27.1±8.8 years, wt=75.2±17.9 kg, ht= 172.8±9.7 cm) to participate in the study. Many of the participants participated on a University dance team. Participants admitted into the study were required to have upper trapezius pain, during palpation, of at least 10 mm on the 100mm visual analog scale and muscle tightness with an accompanying trigger point in their upper trapezius. Participants who had suffered an acute injury to their upper trapezius in the last 6 days, were undergoing current treatment for their upper trapezius, or were unable to lie on their stomach for an extended amount of time were removed from the study.

The study was approved by the university's Institutional Review Board (IRB#17411) before participant recruitment. All participants provided written informed consent before individual data collection began.

Instruments

We used a GE LOGIC S8 ultrasound machine (4MDMedical, Lakewood, NJ) with the 9L soundhead to measure muscle thickness and stiffness. Muscle thickness was measured using B-mode ultrasound and SWE measured stiffness of the tissue.

In order to quantify subjective perception of pain we used PPT algometer (Jtech Medical Commander Echo pressure algometer, Jtech Medical, Midvale, UT) with a .5 cm^2 applicator tip along with the 100 mm visual analog scale.

Procedures

Figure 1 outlines study procedures. During the first visit participants underwent screening for presence of inclusion and exclusion criteria as well as palpation for trigger points, following guidelines by Simons, Travell and Speicher (Simons & Travell, 1981; Speicher, 2016). Each side was examined and pain produced during palpation was measured with previously published methods using the VAS (Crichton, 2001). The side that was to be treated was determined by the higher VAS score. Trigger point location, found through palpation, was marked so that all measurements were taken in the same location. All baseline measurements were taken according to the methods listed below. The participants were then randomly assigned into one of two treatment groups, one being positional release therapy, the other therapeutic massage.

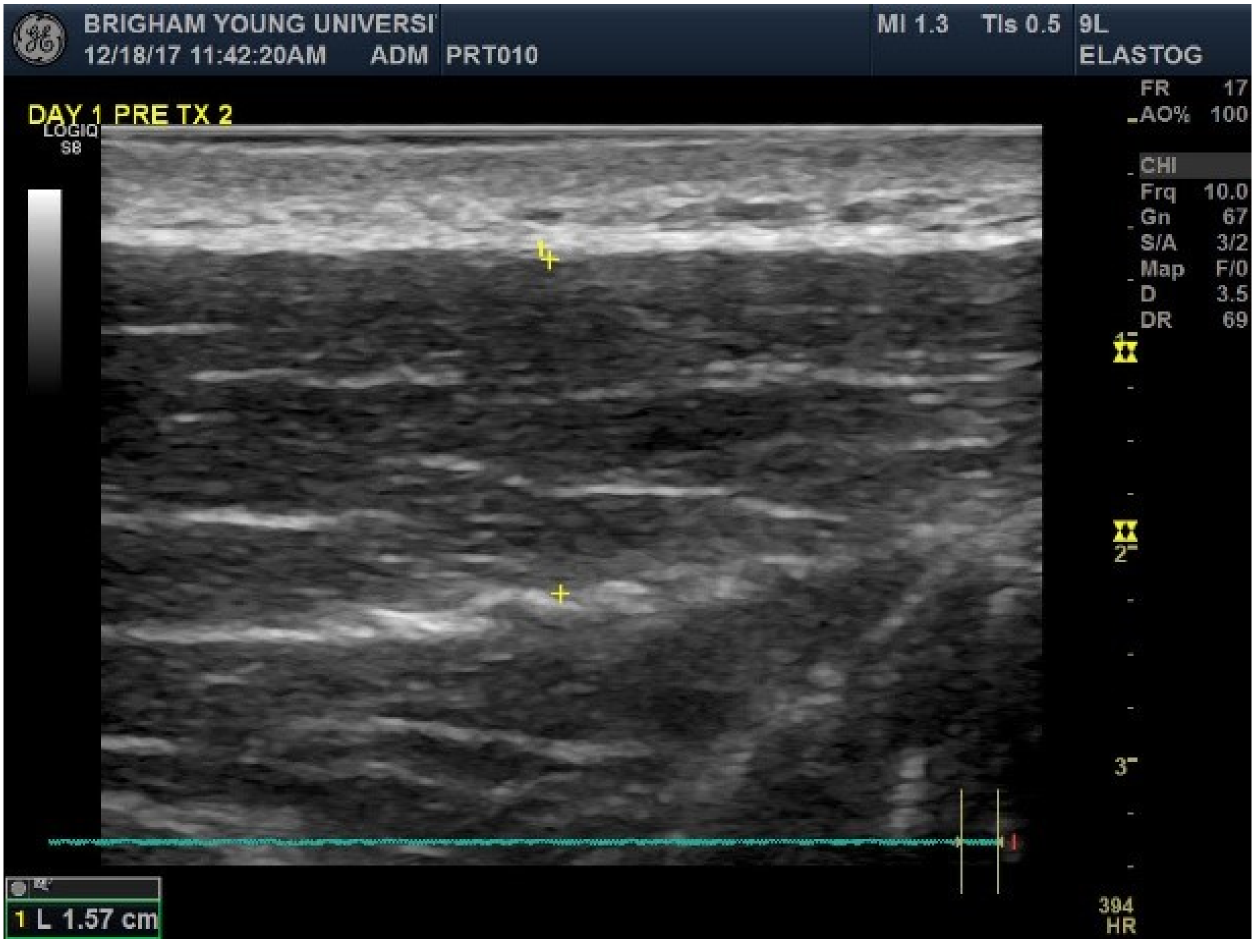
The same order of measurement was used for all participants since we felt that pressure from the PPT algometer could act as a treatment and influence the visual analog scale or elastography measures. Measurements were taken at rest with the participant in prone position, with their arms at their sides for all measurement series, before and after treatment.

Pain Pressure Threshold

Pain pressure threshold was determined by a digital pressure algometer on the same point identified during screening. The area was measured once by pressing perpendicularly into the trigger point until the subject declared it to be painful. The peak force measured was then recorded in kg.

Ultrasound and Elastography

The ultrasound machine with a 9L sound head was used to measure two different variables of muscle tension; 1) muscle thickness (B-mode) and tissue stiffness via SWE over the same spot found and marked during screening. Using B-mode on the ultrasound machine, two images aligned with the muscle fibers obtain were taken to obtain muscle thickness. Internal software was used to measure muscle thickness and the 2 images were averaged and recorded in cm. The elastography measure used a 3 cm^2 box positioned over the area containing the trigger point. Nine sample circles of .5cm dimeter were set within the box side by side in rows in order to cover as much of the box as possible (shown in figure 1). (source?) Each circle registered a strain modulus reading in kPa. The average of the 9 sample circles was used to represent the stiffness of the muscle in the data analysis.



Treatment groups

Therapeutic Massage

Participants in the TM treatment group received a timed massage for 5 minutes by the same experienced research. A combination of effleurage and petrissage techniques were used in an organized pattern. Treatment started with effleurage (1-1.5 minutes) and proceeded to petrissage (2.5 to 3 minutes) again followed by effleurage (1 minute) over the marked area of the trigger point, but also in some surrounding areas. The pressure applied by the researcher progressed throughout the massage into the petrissage phase as tolerated by the participant and pressure was then reduced during the final effleurage phase. After the treatment was completed, the same dependent variable measurements were taken.

Positional Release Therapy

Participants in the PRT group received three successive treatments or releases in the marked area. The researcher located the marked trigger point and while maintaining contact, a light pressure with the clinician's fingertip was applied creating slight dimpling of the skin and blanching of the clinician's fingernail bed. Following palpation, the researcher moved the participant's shoulder into passive abduction and scapular upward rotation and retraction until a position of comfort was achieved with no pain reported by the participant, as directed by Speicher, "Clinical Guide to Positional Release Therapy" (Speicher, 2016) (Figure 3). The participant was instructed to remain completely relaxed during the 90 second treatment. After the recommended 90 seconds had passed the limb was returned to the starting position. This was repeated immediately 2 more times in tender points immediately adjacent to the first one, as recommended by Speicher (Speicher, 2016). Following treatment, the same dependent variable measurements were taken.

<u>Posttreatment measurements</u>

Each participant returned 48 hours post treatment, where dependent measurements were taken. Participants were also given an activity survey to record the number of hours they exercised between the last session and the current session to note any abnormalities or increase in normal exercise. The mark made from the first session, over the examined trigger point, was still visible at the second visit for all participants and was used to determine the location for performing dependent measurements.

Statistical Analysis

A mixed-models analysis of variance was performed for each of the dependent variables (VAS, US, elastography, and PPT). The covariates considered in the analysis were the participants' sex, side of treatment, height, weight, and age. A step-wise regression was used to determine significant covariates for each of the dependent variables. Following the step-wise regression the primary variables of interest, treatment and time of measurement were added along with their interaction for each of the dependent variables. Post hoc t-tests were used to evaluate differences in the measurements. All analyses were performed using SAS, version 9.4 (Chapel Hill, North Carolina) and alpha was set at $p<0.05$.

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