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Positional Release Therapy Versus Therapeutic Massage in Reducing Muscle Trigger and Tender Points

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Positional Release Therapy Versus Therapeutic Massage
in Reducing Muscle Trigger and Tender Points

Amber Hancock Bethers

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Science

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ABSTRACT

Positional Release Therapy Versus Therapeutic Massage in Reducing Muscle Trigger and Tender Points

Amber Hancock Bethers
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Master of Science

Objective: To determine the difference in effectiveness of positional release therapy (PRT) compared with therapeutic massage (TM) in treating trigger and tender points in the upper trapezius muscle.

Background: Trigger points in the upper trapezius muscle are common and can be painful. Therapeutic massage is a more traditional treatment method for this condition while PRT is relatively new.

Design and Setting: A randomized-group design was used to examine the differences between the 2 treatments for reducing pain and muscle tension.

Subjects: Sixty healthy subjects (males = 24, females = 36; age = 27.1 ± 8.8 years; wt = 75.2 ± 17.9 kg; ht = 172.8 ± 9.7 cm) presenting with upper trapezius pain and a trigger point. Subjects were randomly assigned to the TM group or the PRT group.

Measurements: Presence of upper trapezius trigger points was found via palpation by a clinician. Level of pain was measured by a visual analog scale (VAS) and pain pressure threshold (PPT) was assessed by a pressure algometer. Muscle thickness was measured by B-mode ultrasound (US) and muscle tension was measured by shear-wave elastography (SWE). Subjects were measured pretreatment and posttreatment and 48 hours later.

Results: All measurements showed significant improvements for both treatments. Positional release therapy was more effective ($p = 0.05$) at reducing pain at day 2 and was able to maintain the pain loss. The SWE and US showed no difference between the treatment groups. There was no significant difference in PPT, but PRT PPT increased each visit while TM dropped significantly at day 2 ($p = .003$).

Conclusion: Both treatments showed a significant ability to reduce pain and acutely decrease muscle stiffness (as measured by SWE) but there were few differences between the treatments. However, there appeared to be a slight benefit for pain reduction with PRT up to 2 days posttreatment.

Keywords: therapeutic massage, positional release therapy, elastography, ultrasound, trigger point

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INTRODUCTION

Positional release therapy (PRT) and therapeutic massage (TM) are common methods for treating trigger or tender points in patients' muscles.¹⁻³ Separate studies on each have shown them to be effective in reducing pain⁴⁻¹³ and muscle tightness.^{3,5-9,14-16} However, research directly comparing the effectiveness of the 2 treatments is lacking.

Initial research to demonstrate the effectiveness of PRT has used several methods to quantify the effect of the treatment. These include: a numerical rating scale,^{4,14} pressure algometer with pain pressure threshold (PPT),^{3-5,15} range of motion (ROM),^{3,6,16} electromyography,⁷ and visual analog scales (VAS).⁸ Positional release therapy has been compared to therapeutic exercises,^{6,16} passive stretching,⁶ muscle energy,^{3,8} medication therapy,⁴ and sham treatments,^{6,7,16} all resulting in PRT being more effective overall.

Studies utilizing TM have also shown that it can be an effective way to treat muscle dysfunction. Therapeutic massage studies have also used a variety of different methods to quantify its effectiveness, including VAS,^{10-13,17} pressure algometer,^{5,10,18} pain scales,^{5,10,13,17,19} anxiety charts,^{10,17} PPT,^{10,18} performance recovery,^{12,20} ROM,^{12,17,21,22} and muscle tension.^{10,12,19} Researchers have reported that TM was shown to be more effective than ultrasound,¹⁰ heat packs,¹⁰ a control of no treatment,^{12,21-23} and relaxation techniques.^{17,19}

Myofascial trigger points (MTrPs) are hyperirritable nodules of knotted muscle and are found in taut bands of muscular tissue.²⁴ Their existence contributes to the tone, or stiffness, of the skeletal muscle, causing active and passive tension.^{24,25} Tender points are sensitive areas of the body, most often found around MTrPs, and become less tender as MTrPs are treated and overall tissue stiffness is reduced.²⁴

Studies testing the effectiveness of PRT and TM have used two common methods of measuring tenderness and/or pain. The pressure algometer is used to measure tenderness and find a PPT. The use of PPT is considered a reliable measurement tool.^{5,10,18} Visual analog scales are also used for pain measurements and researchers have found them to be a reliable measure of chronic and acute pain.^{26,27} Bijur et al, looked at the reliability of VAS for acute pain and reported an intraclass correlation to be .97 and a Bland-Altman analysis showed that 50% of the paired measurements were within 2 mm of one another and 90% were within 9 mm.²⁶

Prior studies have utilized B-mode Ultrasound (US) to locate, define, and trace MTrPs²⁸⁻³⁰ after palpation. Shear-wave elastography (SWE) was then used to calculate the elastic modulus (tissue stiffness).^{25,28,30} Shear-wave elastography sends waves more parallel than other methods and has produced reliable measures of muscle stiffness.^{25,31,32} Although it has not been used in previous studies to show treatment effect, after our own pilot testing, we decided to also use muscle thickness, measured by B-mode ultrasound, to help characterize the muscle tissue in the region of the MTrP.

The purpose of our study was to determine if PRT or TM is more effective at reducing pain, trigger point tenderness, and muscle stiffness in the upper trapezius muscle. By directly comparing the 2 therapeutic treatments using diagnostic ultrasound and elastography we were able to quantify muscle tissue stiffness beyond the more subjective PPT or VAS measures. Since the 2 treatment methods have been untested in comparison, our study presents new information for muscle response to PRT and TM. These results may help us determine more effective methods for the treatment of tender and trigger points.

METHODS

Participants

We recruited 60 healthy subjects (males = 24, females = 36; age = 27.1 ± 8.8 years; wt = 75.2 ± 17.9 kg; ht = 172.8 ± 9.7 cm) to participate in the study. Subjects who had suffered an acute injury to their upper trapezius in the last 6 days, were undergoing current treatment for their upper trapezius, or unable to lie on their stomach for an extended amount of time were eliminated from the study. Subjects admitted into the study were required to have upper trapezius pain of at least 10 mm on the VAS scale and muscle tightness with an accompanying trigger point in their upper trapezius.

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

Instruments

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

For subjective pain data, we used PPT and a VAS for perception of pain. We used the Jtech Medical Commander Echo pressure algometer (Jtech Medical, Midvale, UT) with a $.5 \text{ cm}^2$ applicator tip on the subjects' upper trapezius at the site of the identified trigger point for PPT.

Procedures

During the first visit, the each subject reviewed and signed an institutionally approved IRB consent form. During the same visit, each subject also underwent screening for presence of inclusion and exclusion criterion. This included a preparticipation questionnaire about their

upper trapezius pain and palpation for a trigger point, following guidelines from Simons, Travell and Speicher.^{15,24,33} Each side was examined and pain produced during palpation was recorded with a VAS.

After the subject had been admitted into the study, the side that the treatment was administered to was determined by the higher VAS score obtained during the screening process. The pretreatment measurements were then performed for our variables of interest (VAS, elastography and ultrasound, and PPT measurements). The same order of measurement was used for all subjects since we felt that pressure from the PPT could act as a treatment and influence the VAS or elastography measures. Trigger point location on the subject was marked so that all measurements were taken in the same location. Measurements were taken at rest before and after treatment. Subjects were previously randomized to treatment type with 30 subjects in each treatment group. Each subject was prone with their arms at their sides for all measurement series.

Visual Analog Scale

A VAS, as seen below, was presented while the researcher palpated each subject. The VAS was 10 cm (100 mm) long and was used once before and once after treatment as well as on the second visit (Figure 1). The subject marked a vertical line on the VAS the distance that they felt represented their level of tenderness and pain, the left side of the line being the lowest (No Pain) and the right being the highest (Pain as Bad as It Could Possibly Be), when palpated by the researcher. The amount marked was recorded in mm.

Ultrasound and Elastography

The ultrasound machine was used to measure two different variables of muscle tension—muscle thickness and tissue stiffness (via elastography)—over the same spots found and marked during screening. A 9L sound head was used to for all measurements. In B-mode, 2 images were

taken to measure muscle thickness, using features on the machine, with the 2 findings averaged and recorded in cm. The elastography measure used a 3 cm² box positioned over the area containing the trigger point. Nine sample circles of .5 cm diameters were set within the box side by side in rows in order to cover as much of the box as possible. Each circle registered a strain modulus reading in kilopascal (kPa). The average of the 9 sample circles were used to represent the stiffness of the muscle in the data analysis.

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.

Treatment Groups

Therapeutic Massage. Each subject in the TM treatment group received massage for 5 minutes. The techniques of effleurage and petrissage were used as much as possible over the marked area of the trigger point, but also in some surrounding areas. These specific techniques were chosen based on muscle location and ease of treatment application. After the treatment was completed, the same measurements as before were taken in a similar manner.

Positional Release Therapy. Each subject in the PRT group received 3 releases in the marked area. The researcher located the same trigger point as before and, while maintaining contact with it, moved the subject's shoulder into passive abduction and scapular upward rotation and retraction until a position of comfort was achieved, as directed by Speicher in, "Clinical Guide to Positional Release Therapy"²⁴ (Figure 2). The subject was instructed to remain completely relaxed during the treatment. After the recommended 90 seconds had passed, or until

the researcher felt the muscle fasciculation stop, the subject was returned to the previous prone position. This was repeated immediately 2 more times. After the treatment was complete, the same measurements were taken in a similar fashion.

Posttreatment Measurements

Each subject returned 48 hours after treatment for posttreatment measurements. The same 4 measurements taken during the previous visit were taken again. Each subject was 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.

STATISTICAL ANALYSIS

A mixed models ANCOVA was performed for each of the dependent variables (VAS, US, elastography, and PPT). A step-wise regression was used to determine significant covariates for each of the dependent variables. These covariates were then used in the respective mixed-models analysis for each dependent variable. The covariates considered were the subjects' gender, side of treatment, height, weight, and age. After selection of significant covariates, the primary variables of interest, treatment and time of measurement, were added along with their interaction. Each subject was measured at pretreatment, posttreatment, and 2 days posttreatment. The correlation in the data was accounted for by doing the mixed models analysis. Post hoc *t* tests were used to evaluate differences in the measurements. All analyses were performed using SAS, version 9.4 (Chapel Hill, NC) and alpha was set at $p < 0.05$.

RESULTS

The purpose of our study was to determine if PRT or TM is more effective at reducing pain, trigger point tenderness, and muscle stiffness. We used VAS, PPT, US and elastography to measure the treatment effects. Results for each of the respective variables are described below.

Visual Analog Scale

Using gender as a significant covariate, there was a within-group treatment effect with both groups showing a significant decrease in reported pain at posttreatment and day 2 ($p < .0001$). The PRT and TM groups were not significantly different at pretest ($p = 0.95$), or posttreatment ($p = 0.40$), but were significantly different at the day 2 measure ($p = 0.05$) (Figure 3).

Pain Pressure Threshold

Using gender as a significant covariate, there were no significant within-group differences for PRT at posttreatment ($p = 0.89$) or day 2 measurements ($p = 0.27$). There were no significant within-group differences for the TM group at posttreatment ($p = 0.60$), but there was a significant decrease at day 2 ($p = 0.003$), as well as between pretreatment and day 2 ($p = 0.01$). There were no significant differences between PRT and TM at pretreatment ($p = 0.38$), posttreatment ($p = 0.31$) or day 2 ($p = 0.65$) (Figure 4).

Elastography

Using weight, age, and gender as significant covariates, there was a within-group treatment effect with both groups showing a significant decrease in average kPa at posttreatment ($p = 0.002$). Positional release therapy had no significant difference on day 2 ($p = 0.08$), nor did TM ($p = 0.32$). Although each treatment's average kPa increased at day 2 measurements, the TM group maintained a significant decrease in kPa compared to baseline ($p = 0.03$). There was no significant difference between the 2 groups at pretreatment ($p = 0.21$), posttreatment ($p = 0.22$) or day 2 ($p = 0.47$) (Figure 5).

Ultrasound

Using gender and weight as significant covariates, there was a within-group treatment effect with both groups showing a significant increase in muscle thickness at posttreatment (PRT $p = < .0001$, TM $p = 0.01$). Positional release therapy had a significant increase at day 2 compared to baseline ($p < .001$) while TM did not ($p = 0.41$). Between posttreatment and day 2 PRT had a significant decrease ($p = 0.02$) while the TM group had no significant difference ($p = 0.4$). There was a significant difference between PRT and TM groups posttreatment ($p = 0.049$). However, there was no significant difference at pretreatment (0.97) or day 2 ($p = 0.21$) (Figure 6).

DISCUSSION

The purpose of our study was to determine if PRT or TM is more effective at reducing pain, trigger point tenderness, and muscle stiffness in the upper trapezius muscle. Both treatments showed a significant ability to reduce pain and improve structural characteristics as measured by muscle thickness and elastography. However, there were limited differences between treatment groups. Generally, there were no differences between treatment groups, except there was a possible lasting effect from PRT for pain.

In our study, we used 2 measurements for pain: VAS and PPT. Both PRT and TM were effective in reducing pain reported on a VAS, as seen in previous studies.^{3-5,8,10,14} On average, PRT had a greater decrease in VAS (28.9 to 9.1) than TM (28.9 to 12.0). In addition, PRT was able to maintain the decrease in perceived pain while TM actually increased between visits. This was somewhat consistent with findings by Ghanbari et al's research showing that the use of PRT for tension-type headaches reduced the pain for longer durations than medication provided.⁴ Another study also reported that pain scores continually dropped between sessions after

application of PRT to the upper trapezius,⁷ while Nagrale et al showed improvement in pain was seen 2 and 4 weeks after treatment with PRT.⁸ In our study, therapeutic massage did not have a lasting effect on pain reduction, which is supported by Butttagat's findings that over the course of 3 weeks and several treatments, VAS scores remained relatively the same.¹⁰

There was no real significance between the 2 groups for increasing the PPT score but each was successful at increasing PPT after treatment, as seen in previous studies.^{3-5,15} Our results for the PPT also support PRT application resulting in lasting pain relief. For the PPT, an increase indicates a subject can tolerate more force before reporting feeling pain. Although not statistically significant, at each visit the PRT group increased the average PPT score resulting in higher pretreatment scores than at day 2, supporting the results of our VAS scores as well as results of previous studies.^{3,4,15} The TM group, on the other hand, significantly decreased their average PPT at day 2, indicating a lower tolerance for pain. While unexpected, this finding is supported by Aboodarda et al, which reported (after massage application to the calf) an increase in PPT scores, however, testing after 15 min of rest led to a significant decrease in PPT.⁵ They proposed that the reasoning for this might be that pressure from massage stops the pain cycle through mechanoreceptors and proprioceptors, producing an analgesic effect which wears off after time.^{5,11,13} The overall result of pain measurements in this study indicated that subjects treated with PRT experienced a significant decrease in pain that is maintained longer than subjects treated with TM.

While there was no significant difference between the 2 treatments, our decreasing elastography measurements supported previous research stating that PRT^{7,9} and TM^{10,12,19} are effective at reducing chronic muscle stiffness. Both PRT and TM had significant decreases in tissue stiffness posttreatment. Each treatment's muscle stiffness measurement increased between

posttreatment and day 2. This might be due to the subjects using their trapezius muscles for activities of daily living or exercise, leading to a return of tissue stiffness. In one study, they tested elbow flexor stiffness by measuring static torque and elbow range of motion before and after subjects underwent eccentric exercises. They found that immediately after exercise and 4 days after, tissue stiffness had increased significantly.³⁴ Another explanation for our findings might be that subjects received only 1 treatment and that a return of muscle stiffness was inevitable.

Ultrasound imaging was used to measure muscle thickness. Both treatment groups had a significant increase in muscle thickness posttreatment. The PRT group's average muscle thickness decreased at day 2, but it was still thicker than pretreatment. The TM group, on the other hand, decreased their average muscle thickness back to their pretreatment average. Our results did not match the findings from the elastography measurements. We expected that as the muscle relaxed, or became less stiff, the thinner it would become. This is supported by a study using ultrasound to measure muscle thickness of several muscles (tibialis anterior, biceps brachii, brachialis, transversus abdominis, obliquus internus abdominis, and obliquus externus abdominis) that found muscle thickness increased the more the muscle was contracted (not the more it was relaxed).³⁵ We are not sure why the differences between our elastography and ultrasound findings existed. However, there are a few possible reasons that our results showed muscle thickness increasing instead of decreasing. Performing PRT on a MTrP increases blood flow through decompression of neurovascular structures, which could lead to an increase in muscle thickness.^{1,24} Therapeutic massage has similar effects in that it increases blood flow to the area as well.^{36,37} The mechanical pressure from massage can also create microdamage to the muscle, initiating the inflammatory response which could also increase muscle thickness.¹³

Limitations

Our study had limitations. We used healthy individuals with no acute upper trapezius injury but current pain and a trigger point in order to compare the effectiveness of PRT and TM. Whether or not our results could be applied to those with chronic trapezius tightness or MTrP sensitivity is unknown. We only looked at the upper trapezius muscle, however we assume that treatment of MTrPs would be similar in other muscles. We also assume that a single pressure algometer measurement did not have a treatmentlike effect on MTrP sensitivity or activity.

Future Research

While this is the first study directly comparing PRT and TM, more research is needed to fully determine the effects of the treatments in different populations (ie, chronic muscle tension, after acute injury, those with abnormal holding positions such as ballroom dancers). Studies researching the effects of PRT and TM over the course of several weeks or repeated treatments could help support our findings that PRT may be more effective at reducing and maintaining pain reduction. More information is needed to see if muscle thickness, as measured by US, relates to elastography measurements of muscle stiffness. As in the study by Hodges et al, using the US to include measures of muscle fascicle length and angle could help define muscle tightness characteristics.³⁵ However, due to the structure and size of the upper trapezius, our field of interest was small enough that such measurements were not possible in our study, but may be useful when assessing other muscles both during contraction and after treatments of PRT or TM.

CONCLUSION

Both treatments showed a significant ability to reduce pain and acutely decrease muscle stiffness (as measured by SWE). In general, PRT and TM were both successful at decreasing MTrP sensitivity and stiffness. However, there appeared to be a slight benefit for pain reduction

with PRT up to 2 days posttreatment. More research is needed to supplement these findings and further compare the treatments.

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Visual Analog Scale

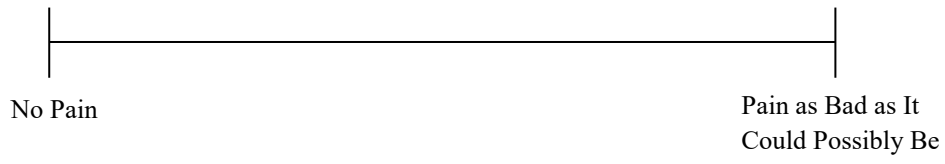


Figure 1: Visual Analog Scale



Figure 2: Positional release therapy technique for upper trapezius

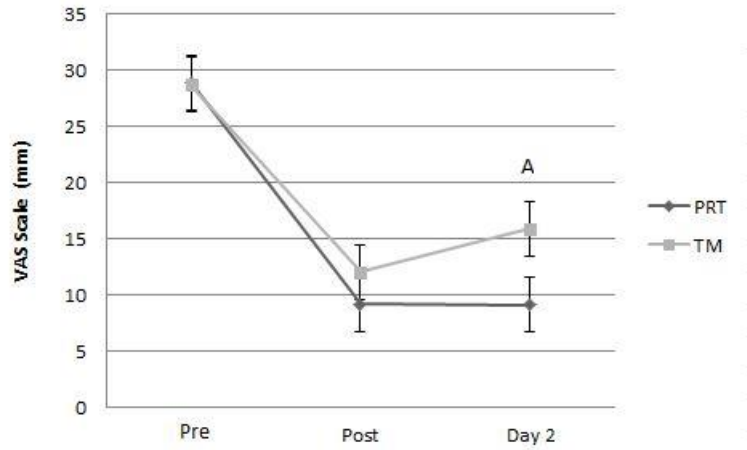


Figure 3: Graphic representation of the significant groups (positional release therapy and therapeutic massage) by test (pretreatment, posttreatment, and day 2) interaction for VAS score in rating pain.

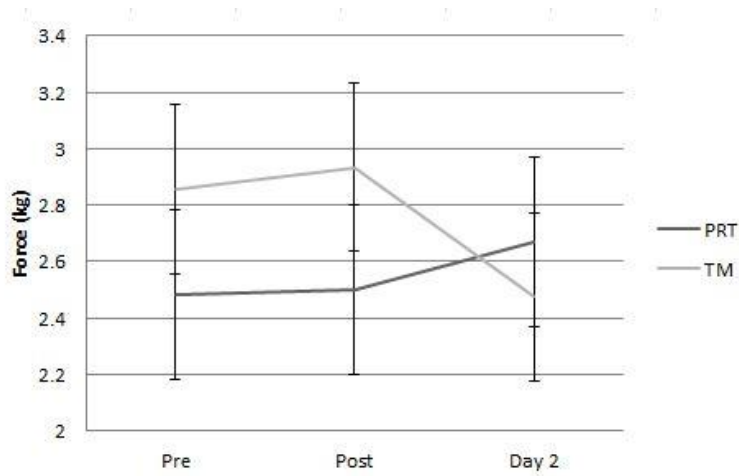


Figure 4: Graphic representation of the significant groups (positional release therapy and therapeutic massage) by test (pretreatment, posttreatment, and day 2) interaction for pain pressure threshold.

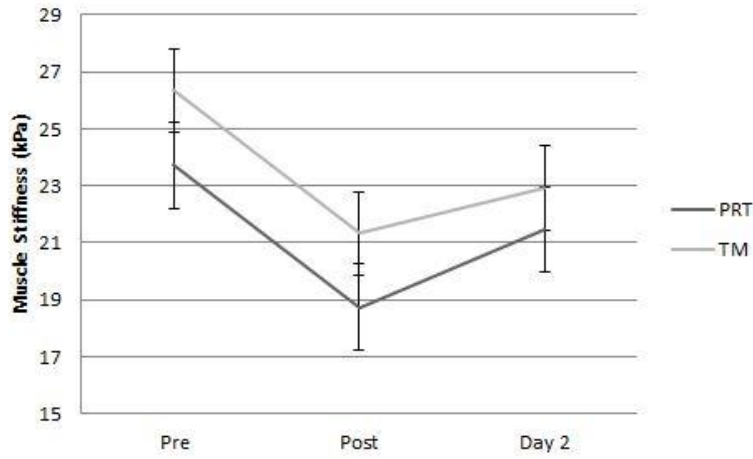


Figure 5: Graphic representation of the significant groups (positional release therapy and therapeutic massage) by test (pretreatment, posttreatment, and day 2) interaction for elastography.

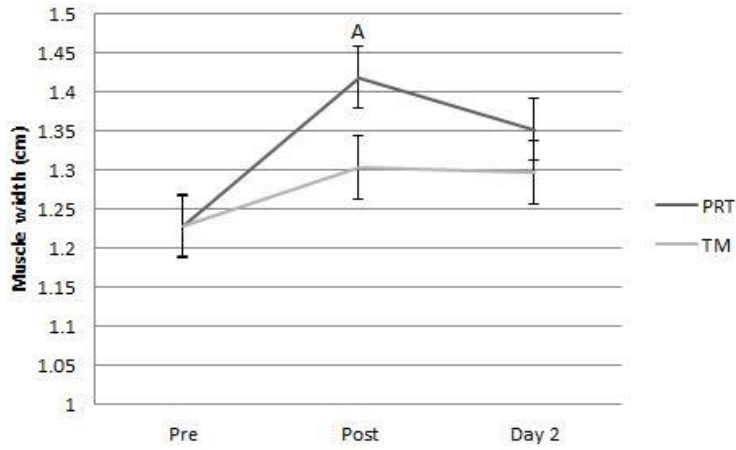


Figure 6: Graphic representation of the significant groups (Positional release therapy and therapeutic massage) by test (pretreatment, posttreatment, and day 2) interaction for ultrasound imaging for muscle thickness.