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A Comparison of Myofascial Release and Ultrasound in the Treatment of Musculoskeletal Pain

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A COMPARISON OF MYOFASCIAL RELEASE AND ULTRASOUND IN THE TREATMENT OF MUSCULOSKELETAL PAIN

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To

my husband Trenton, a lover - in the true sense

of the word - to mankind and me;

and to Britney just for being my real goal in life;

and to the profession of Physical Therapy.

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ABSTRACT

A COMPARISON OF MYOFASCIAL RELEASE AND ULTRASOUND IN THE TREATMENT OF MUSCULOSKELETAL PAIN

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The purpose of this study was to evaluate the effectiveness of myofascial release (MFR) compared to ultrasound (US) in treating musculoskeletal pain. Thirty-three subjects with a mean age of 38 years were admitted to the study. Twenty-eight of the subjects were randomly placed into either the myofascial release or the ultrasound treatment group, and five of the subjects were placed into a treatment group based on referral by a physician. Each subject received 10 treatments. Data in the form of number of trigger points, active range-of-motion of the affected joint, pain scale measurement, and a Treatment Response Questionnaire score, were collected.

The t value for between group pre trigger point number supported statistical significance. The t value for between group post trigger point number supported no statistical significance. The t values for within group changes in trigger point supported no statistical significance. The Mann-Whitney U value supported that the

MFR group outranked the US group 47 percent when ranking the percent change in trigger point number from pre to post treatment at a .05 level of significance. The Kruskal-Wallis H value for percent change in trigger point from pre to post treatment supported that MFR subjects appeared to make greater improvement than the US subjects at a .05 level of significance.

The Mann-Whitney U value supported that the MFR group outranked the US group 79 percent when ranking the percent change in pain scale measurement from pre to post treatment at a .05 level of significance. Kruskal-Wallis H value for percent change in pain scale measurement from pre to post treatment supported that MFR subjects appeared to make a greater improvement than the US subjects at a .05 level of significance.

The Mann-Whitney U value supported that the MFR group outranked the US group 46 percent when ranking the change in range-of-motion from pre to post treatment at a .05 level of significance. Confidence interval calculations showed that between group pre range-of-motion means and between group post range-of-motion means are not statistically significant at .05 level of significance. The difference in change of range-of-motion between the treatment groups is statistically significant at .05 level of significance in favor of the MFR group. The mean percent change in range-of-motion within each group is markedly different from each other, but standard deviations

are substantially large to question whether the results support one treatment over the other.

The Mann-Whitney U value supported that the MFR group outranked answers in the US group 55 times at a .05 level of significance. Kruskal-Wallis ANOVA determined that 5 of the 10 questions on the Treatment Response Questionnaire showed significance of .05 or lower. The chi-square value for each significant question showed a statistically significant relationship between the responses given by the MFR group and the responses given by the US group at a .05 level of significance.

INTRODUCTION

Fascia is an elastocollagenous connective tissue in which muscles, nerves, blood vessels, lymph vessels and bones lie.[1] Connective tissue is found in the interstitial tissues of all organs, and forms the membranes through which osmotic processes of cell nutrition and elimination take place.[1] Fascia courses all the way to the cellular level to separate, support, and protect structures and thus may inhibit cellular metabolism if injured or distorted.[1]

Fascia plays an important role in the normal function of the body and may be the cause of disease if altered from normal alignment.[1,2] Bonica reports that interruptions in the normal coursing of fascia can be manifested as symptoms of pain, muscle spasm, limitation of range-of-motion, vasomotor changes, sweating, and weakness.[3] Travell states that while myofascial trigger points can be caused by chronic visceral disease or emotional stimuli, a myofascial trigger area can provoke conditions such as a cardiac ectopic rhythm and may be the reason for the pain associated with disc syndrome after surgery has been done to excise the bulging disc.[4] Also, alterations of the fascia due to postural imbalance, gravitational pull, inflammatory processes, and trauma may be causes of physiological malfunction.[1]

Myofascial pain and dysfunction are commonly overlooked by examiners.[5] A patient may be experiencing musculoskeletal pain patterns related to fascia but because

the pain does not follow a dermatomal reference zone or because various diagnostic test results are negative, patients are left untreated. Due to continual pain or discomfort, the patient seeks a second opinion only to be informed that the source of this bizarre pain pattern is emotional.

Bonica writes that the identification of myofascial pain syndromes is supported when the pain distribution is not dermatomal nor following peripheral nerve distribution, when movement augments the pain, and usually when no sensory nor reflex changes are noted.[3] In myofascial conditions, Travell explains that neurological deficits are not observed unless a muscle that contains a trigger point compresses a peripheral nerve, and then inconsistent sensory and motor testing will result.[4] Travell supports the diagnosis of myofascial problems through the identification of trigger points. Trigger points are "small hyper-irritable regions in muscles from which impulses bombard the central nervous system and can give rise to referred pain".[5] Active trigger points meet the criteria of being tender to palpation, producing a "jump response" upon palpation, and displaying weakness in the muscle containing the trigger point upon active contraction.[3-6] Bonica defines myofascial trigger points as "hypersensitive regions in muscle or connective tissue".[3] Another explanation of trigger point is "a sign or symptom which remains unnoticed by the patient that must

be evoked by a stimulus".[7] The stimulation used to locate trigger points can be palpation or ultrasound and high voltage galvanic stimulation.[8]

The patient response to location of a trigger point is a localized deep tenderness in a palpably firm band of muscle with a low threshold to deep pain.[9] Nielsen describes the area of the stimulated trigger point to which pain is referred as a reference zone.[7] Within the reference zone of pain, it has been found that a vasodilatation may occur as the trigger points are stimulated or treated.[9] The vasodilatation may be due to the release of fascia the capillary beds are coursing through, thus causing a freeing of vessels and allowing a free flow of blood.[1,9] To re-emphasize the fascial relation to circulation and to accentuate to the examiner the possible vasomotor responses a patient may experience with trigger point stimulation, clinicians should be aware that "manipulation of soft tissue and corrective posture techniques are of utmost importance in maintaining adequate venous drainage."[1]

As described in the literature, myofascial pain treatments placed emphasis on manual mobilization of fascial structures[3-6,10-15] and on ultrasonic heating of the fascial structures.[15,16] Travell reports that stretching of the myofascial trigger point is an adequate method to treat painful trigger points.[10] Sola and Kuitert have cited that heat and deep friction massage aid the

treatment of myofascial trigger points after a local injection of saline.[13] Griffin and Karselis state that treatment with ultrasound will alter connective tissue structures such as fascia so as to increase range-of-motion, increase tendon extensibility, and relax skeletal muscle.[15]

Myofascial release is noninvasive manual stretching and manipulation of fascial trigger points. In this study, trigger points will be located by palpation. Trigger points are identified when the patient describes a sharp sensation of pain when the soft tissue is palpated. Travell explains that the sharp feeling of pain is a result from palpation of a band of fibers which have been injured.[4] Simmons writes that massage and thumb pressure can decrease the irritation caused by a trigger point.[14]

This study assumes that specific injury to the musculoskeletal system can cause a fascial disarrangement and cause myofascial trigger points which can be located with palpation. Upon injury to a muscle, the body protects itself from aggravating the injured area by splinting the site with muscle spasm. Simmons reports that if the muscle sarcoplasmic reticulim is injured, it will release calcium and the calcium will act together with adenosine triphosphate to provoke local contractile activity.[5] Because of the sustained muscle contraction, and because fascia hardens with trauma,[5] the actin and myocin fibers will become shortened. Thus, a disarrangement in the

fascia can occur and cause an active trigger point resulting in immediate pain.[4]

With this background in mind, the purpose of this study was to examine whether myofascial release techniques consisting of cutaneous fascial stretching, unwinding, deep pressure to trigger points, cranial base release, and thoracic inlet, respiratory, and pelvic diaphragm release are more effective than ultrasound therapy to treat musculoskeletal pain.

The hypothesis for this study is that myofascial release when compared to ultrasound will result in greater pain relief, measured by pre and post treatment analog pain scales, decrease number of trigger points in the affected soft tissue examined by palpation, increase active range-of-motion of the involved joint, measured by pre and post goniometric measurements, and provide a greater subjective measure of patient improvement for overall patient effects, measured by a Treatment Response Questionnaire.

METHODS

Subjects

Patients with the complaint of pain resulting from musculoskeletal injury were selected for this study. A patient was admitted to the study only if he met the following criteria: 1. trigger points can be located with palpation; 2. patient has muscle shortening resulting in active range-of-motion limitation not caused by bony

blockage; 3. patient demonstrates from evaluation and questioning no history of connective tissue disease, rheumatoid arthritis, central nervous system damage, mental illness, malignancy, or unhealed fractures; and 4. patient is between 20 and 50 years old.

Thirty-three patients meeting the above criteria were admitted to the study. There were 13 men and 20 women. The mean age was 38 years with a range of 22 to 50 years. After an explanation of the study was given, a consent form was signed by each subject. All patient conditions were evaluated by the same physical therapist. Twenty-eight patients were randomly placed in treatment Group A (myofascial release) or in treatment Group B (ultrasound). Five of the 33 patients were specifically referred to physical therapy for myofascial release or ultrasound. These subjects were placed into their referred groups without regard to random assignment. Data were collected upon relief of all pain symptoms or after the patient had experienced 10 treatments, whichever came first. Each patient's physical therapy was completed within a four week period.

Procedure

In the evaluation of each patient's condition, the following data were recorded: 1. the active range-of-motion of the joint with the most limitation caused by musculoskeletal pain; and 2. the number of trigger points

found upon palpation of the area in which the patient complained of pain. The number of trigger points, within a measured area, producing a sharp pain upon palpation was recorded by the researcher and a second physical therapist. The two numbers were averaged for data purposes. This second trigger point palpation by another therapist was done to increase the consistency of measurement of the trigger point number being used for statistical analysis. Trigger point palpation was done by the same physical therapists throughout the study. The patient then marked a horizontal pain scale to indicate pain perception at the time of the initial evaluation.[17]

Patients placed in the MFR treatment group received 20 minutes of myofascial release. Myofascial release is noninvasive passive stretching of restricted fascia. Fascial techniques used in this study include gentle cutaneous fascial stretching, relieving fascial mal-alignment by active assist joint movement (unwinding), deep pressure stretching applied specifically to active and latent trigger points, gentle separation of the atlas from the occiput when patient symptoms are specific for spinal musculoskeletal involvement (cranial base release), and re-alignment of transversely oriented fascia (thoracic inlet, respiratory, and pelvic diaphragm releases) when these transverse planes are affected by musculoskeletal symptomology.

Patients placed in the US treatment group received a 7

minute ultrasound at 1.7 W/cm^2 per 25 square inch area. This intensity was chosen because through experience in treating trigger points with ultrasound an increase in patient discomfort was reported with intensities beyond 1.7 W/cm^2. The Mettler ultrasound machine was used for each treatment and was calibrated prior to beginning the study.

After each therapy session, the patient was instructed to continue with his usual daily routine as tolerated. No special instructions were given except to patients suffering with low back pain. These patients were instructed not to lift objects greater than 10 pounds, not to flex spine forward, or rotate spine, and to bent the knees not the back when picking objects off the floor.

Once the patient had relief of all pain, or the patient had completed 10 treatments, physical therapy was stopped and the patient's condition re-evaluated. The physical therapist re-evaluated the patient's condition and recorded the active range-of-motion most limited in the initial evaluation, and the number of trigger points activated with palpation in the pained area. Again the number of trigger points was recorded by the researcher and a second physical therapist, and these numbers were averaged. Each patient was asked to mark a horizontal pain scale describing the pain perception after therapy ended. Each patient also completed a Treatment Response Questionnaire consisting of 10 questions related to progress toward becoming pain free, overall improvement,

freedom of joint movement, and ability to perform daily living activities. The Treatment Response Questionnaire was designed so that responses were given on a point scale of improvement from one (0% improvement) to five (100% improvement). Prior to giving a patient this questionnaire, it was reviewed by four typical patients not admitted to the study and by four physical therapists to assure that each question was understandable and that each question was an adequate measure of progress. See table 1 for a summary of the research procedure.

This research procedure was approved by The Human Subject Review Committee of Community Health Professions and Physical Therapy, Old Dominion University.

Data Analysis

Statistical analysis included calculation of a Mann-Whitney U value to determine if were are statistically significant differences of mean rank for percent changes in range-of-motion, trigger point number, and pain scale measurement. The Mann-Whitney U Test also calculated mean rank values for each group's change in range-of-motion, change in trigger point number, and change in pain scale measurement to determine the direction of level of significance at .05 level of significance. A Mann-Whitney U value was also calculated to determine the frequency of patient response toward 'most improvement' on the Treatment Response Questionnaire between treatment groups.

Kruskal-Wallis H values were computed to determine if percent change in trigger point number and percent change in pain scale measurements were statistically significant at .05 level of significance. Kruskal-Wallis was also used to determine which questions in the Treatment Response Questionnaire are statistically significant at a .05 level.

The t values were calculated for between group pre trigger point number, between group post trigger point number, and within group change in trigger point to determine if there was a statistical significance at a .05 level.

Confidence intervals were calculated to address whether between group pre range-of-motion measurements and between group post range-of-motion measurements are statistically significant at .05 level of significance.[18] Confidence limits for change in range-of-motion were calculated to determine if there are statistically significant differences between group means at .05 level of significance.[18]

Chi-square values were calculated to show the frequency of patient responses given for each significant question on the Treatment Response Questionnaire, and to determine if there is a statistically significant relationship between the responses given by the MFR group and the responses given by the US group at .05 level of significance.

RESULTS

The t-test was used to address the hypothesis: MFR will provide a greater decrease in trigger point number from pre to post treatment when compared to US. The t value for between group pre trigger point number (2.63), is larger than the tabled value of 2.06. The t value for between group post trigger point number (0.76), is less than the tabled value of 2.06. This means that there is a statistical significant difference between group pre trigger point values. There is no statistical significant difference between group post trigger point values. The within US group t value is 0.09 for change in trigger point number. The within MFR group t value is 1.94 for change in trigger point number. Neither the MFR group change in trigger point number nor the US group change in trigger point number is significant at the .05 level. See Table 2 for the t value, degrees of freedom, and the level of significance for each treatment group change in trigger point number. The t test does not support the hypothesis.

Because the results of the t test supported that the MFR subjects and the US subjects were two independent samples prior to the application of treatment, the Mann-Whitney U value was calculated to address the hypothesis: MFR will provide a greater decrease in the number of trigger points from pre to post treatment when compared to US. The U value of 47 is smaller than the tabled value of 89. This means that the MFR group outranked the US group

47 percent when ranking the percent change in trigger point number from pre to post treatment. The mean rank of percent change in trigger points from pre to post treatment for the MFR group is 23. The mean rank of percent change in trigger points from pre to post treatment for US is 12. These computations for percent change in the number of trigger points between groups support the hypothesis in that a statistically significant difference is present between treatment group means at .05 level of significance. See figures 1 and 2 for raw data bar graph display.

Kruskal-Wallis one-way analysis of variance was computed to address standard deviations for means between groups and within groups on percent change in trigger point number from pre to post treatment, and to determine if there was statistical significance between group change in trigger point. The mean trigger point number palpated prior to MFR intervention was 24.7, with a standard deviation of 21.2. The mean trigger point number palpated post MFR was 14.0, with a standard deviation of 18.7. The mean trigger point number palpated prior to US intervention was 10.7, with a standard deviation of 5.8. Mean trigger point number post US application was 10.3, with a standard deviation of 6.9. There is a decrease of 10.7 in the trigger point means from pre to post MFR treatment, and a decrease of 0.4 in the trigger point means from pre to post US treatment. See Table 3 for the minimum and maximum changes in trigger point number which could occur from pre

to post treatment within each treatment group. The Kruskal-Wallis H value for percent change in trigger point number from pre to post treatment was 6.12. Because this value is larger than the tabled value of 3.84 there is statistical significance at a .05 level. It appears that MFR results were better than ultrasound results in change in trigger point because the sum of the rankings for MFR (T=203.34) was lower than the sum of the rankings for US (T=357.66). See table 4 computation values specific to Kruskal-Wallis H values. These results support the hypothesis.

The Mann-Whitney U value was calculated to address the hypothesis: MFR will provide greater pain relief as measured by an analog scale when compared to US. The U value of 79 is smaller than the tabled value of 89. This means that the MFR group outranked the US group 79 percent when ranking the percent change in the pain scale measurement from pre to post treatment. The mean rank of percent change in pain from pre treatment to post treatment for the MFR group is 20.6. The mean rank of percent change in pain from pre to post treatment for the US group is 13.7. These computations for change in pain scale measurement within groups supported the hypothesis for a statistically significant difference between treatment group means at .05 level of significance. See figures 3 and 4 for raw data bar graph display.

Kruskal-Wallis one-way analysis of variance was

computed to address the hypothesis: MFR will provide greater pain relief as measured by an analog scale when compared to US. The mean pre pain scale measurement for US is 6.2 cm, with a standard deviation of 1.8 cm. The mean pre pain scale measurement for MFR is 6.9 cm, with a standard deviation of 2.0 cm. The mean post pain scale measurement for US is 5.06 cm, with a standard deviation of 2.4 cm. The mean post pain scale measurement for MFR is 3.8 cm, with a standard deviation of 3.0 cm. This shows a decrease of 1.1 cm in the pain scale measurement means from pre to post US treatment and a decrease of 3.1 cm in the pain scale measurement means from pre to post MFR treatment. See Table 5 for minimum and maximum pain scale values from pre treatment to post treatment for both groups. The Kruskal-Wallis H value for between group change in pain scale measurement from pre to post treatment is 8.30. This value exceeds the tabled value of 3.84 at .05 level of significance. It appears that MFR results were better than ultrasound results in change in pain scale measurement because the sum of the rankings for MFR (T=192.00) was lower than the sum of the rankings for US (T=369.00). See table 6 computation values specific to Kruskal-Wallis H values. These results support the hypothesis.

The Mann-Whitney U value was calculated to address the hypothesis: MFR will provide a greater increase in range-of-motion as measured with a goniometer pre treatment and

post treatment when compared to US. The U value of 46 is smaller than the tabled value of 89. This means that the MFR group outranked the US group 46 percent when ranking the percent change in range-of-motion from pre to post treatment. The mean rank of percent change in range-of-motion from pre to post treatment for the MFR group is 23. The mean rank of percent change in range-of-motion from pre to post treatment for the US group is 12. These computations for change in range-of-motion support the hypothesis and suggest a statistically significant difference between treatment group means at .05 level of significance. See figures 5 and 6 for raw data bar graph display.

Confidence intervals were calculated to address whether or not between group pre range-of-motion measurements and between group post range-of-motion measurements are statistically different.[18] The range of values for pre range-of-motion measurement from the lower confidence limit (-0.42) to the upper confidence limit (0.66) includes zero. This means that the obtained difference between means could have been due to chance, and therefore the difference between pre range-of-motion means is not statistically significant at .05 level of significance.[18] The range of values for post range-of-motion measurements from the lower confidence limit (-0.41) to the upper confidence limit (0.58) includes zero. This means that the obtained differences between means could

have been due to chance, and therefore the difference between post range-of-motion means is not statistically significant at .05 level of significance.[18]

The mean rank of change in range-of-motion for each treatment group was calculated to figure the confidence limit for the difference between two means from unmatched groups. The mean rank for change in range-of-motion for MFR is 22.6, with a standard deviation of 4.1. The mean rank for change in range-of-motion for US is 11.7, with a standard deviation of 2.5. The confidence limits for the difference between the change in range-of-motion from unmatched groups are upper = 13.3 and lower = 8.5. This range of values does not include zero. The difference in change of range-of-motion between the treatment groups is statistically significant at .05 level of significance.[18] This difference between the means can be expected to occur again in favor of the MFR treatment because the confidence limits are statistically significant, and because the mean rank for change in range-of-motion is higher for MFR as opposed to US.[18] See Table 7 for data involved in calculating the confidence limits for the difference between two means from unmatched groups. The confidence limit computations for change in range-of-motion between groups support the hypothesis.

Standard deviations were computed from the mean percent change in range-of-motion from pre to post treatment. Measurement of variation within the MFR group

revealed a mean percent change in range-of-motion of 78.3 percent, with a standard deviation of 60.8. All of the 16 patients in the MFR group experienced an increase in range-of-motion post treatment. Change in range-of-motion was 2.9 percent to 170.0 percent for the MFR group. The percent change in range-of-motion for the US group revealed a mean of 15.8 percent, with a standard deviation of 26.8 percent. Of the 17 patients in the US group, 10 experienced an increase in change of range-of-motion post treatment. Change in range-of-motion was 1.2 percent to 60.0 percent for the 10 patients in the US group. The remaining seven patients in the US group experienced a decrease in change of range-of-motion post treatment. Percent change in range-of-motion was 2.9 percent to 16.7 percent for the remaining seven patients in the US group. See Table 8 for a summary of these results. Although the mean percent change in range-of-motion between groups was markedly different, the standard deviations from each mean were too disperse to identify any difference between group change in range-of-motion measurements. The hypothesis is not supported.

The Mann-Whitney U value was calculated to address the hypothesis: MFR will provide greater subjective patient improvement as measured by the Treatment Response Questionnaire when compared to US. The U value of 55 is smaller than the tabled value of 89. This means that the MFR group outranked answers in the US group 55 times. The

mean rank of responses for the MFR group is 22 on a scale of 1 to 50. The mean rank of responses for the US group is 12 on a scale of 1 to 50. These computations supported the hypothesis and suggested a statistically significant difference between group means at .05 level of significance.

Kruskal-Wallis one-way analysis of variance was computed to determine which questions in the Treatment Response Questionnaire are statistically significant. Five of the 10 questions showed significance of .05 or lower. This means that there are significant differences in the ranks of the responses given by each group for 5 of the 10 questions at .05 level of significance. These questions were one, four, five, six, and nine and addressed improvement to changes in pain, changes in movement, and improvement in ability to perform daily activities. See Table 9 for level of significance for each statistically significant question and degrees of freedom. The remaining five questions were eliminated from statistical computation because of not meeting the .05 level of significance.

Chi-square was calculated to investigate if frequencies of responses for each significant question were different, and to test the hypothesis of MFR will provide greater subjective patient improvement as measured by the Treatment Response Questionnaire when compared to US. See Table 10 for chi-square values and frequency data for each significant question. The chi-square value for each

question supported that there is a statistically significant relationship between the responses given by the MFR group and the responses given by the US group at .05 level of significance.

DISCUSSION

Although 85 percent of the subjects were randomly placed into a treatment group, a normal distribution of patients cannot be assumed because of sampling size. Sampling size could have been increased if the criteria to enter the study had not been so stringent. However, better control was maintained by eliminating extraneous variables that may have been introduced by patient's conditions outside the criteria for admission to the study.

A statistically significant difference between mean percent change in the number of trigger points from pre to post treatment is supported by the Mann-Whitney U test. The Kruskal-Wallis H value for percent change in trigger point from pre to post treatment supported that MFR subjects appeared to make greater progress than US subjects. The t-test for trigger point data supported no statistical significance for within group change in trigger point at a .05 level. The MFR group change in trigger point number was significant at a 0.10 level opposed to the US group change in trigger point number at a 0.50 level of significance. Refer to table 3 for summary of these results. In the clinical setting, clinicians may wish to

consider the substantial difference in change in trigger point number for MFR versus US in making treatment decisions.

All of the MFR subjects had a decrease in the number of trigger points from pre to post treatment. Five of the US subjects had an increase in the number of trigger points and two remained the same (Figs. 1 & 2). With the US subjects who did make a change in the number of trigger points toward improvement, there was a mean decrease of only 0.20 with US, opposed to a mean decrease of 10.7 with MFR.

The Mann-Whitney U Test supported that there is a statistical significance between mean percent change of the pain scale measurement from pre to post treatment at .05 level of significance. This statistical significance is in favor of the MFR group because there is a greater mean rank of percent change in the pain scale measurement for MFR (20.6) compared to US (13.7). The Kruskal-Wallis H value appeared to show a greater change toward improvement from pre to post treatment in the MFR group at .05 level of significance.

Confidence limit calculation for range-of-motion data showed that there is no statistical differnce between group pre range-of-motion scores and between group post range-of-motion scores. This is expected because the subjects in one treatment group were unmatched from the other treatment group. Confidence intervals supported a statistical

significance for within group changes in range-of-motion. This indicates that the changes in range-of-motion would probably occur at .05 level of significance with both US and MFR if the study was reproduced. But is one treatment more significant over the other in the treatment of musculoskeletal pain? The confidence interval (13.3 to 8.5) calculated from the mean rank values of US (11.7) and MFR (22.6) does not include zero. This means that there is less than five percent probability that a difference as large as the obtained 4.8 (13.3 minus 8.5) point advantage for the MFR group could have resulted from chance variation between the groups.[18] There is a high probability that the MFR subjects would display greater change in range-of-motion at 95 percent confidence if this study was performed again.

The standard deviations computed were too dispersed about the mean to suggest statistical significance for change in range-of-motion measurements. The fact that some patients in the US group experienced an increase in change of range-of-motion while others experienced a decrease in change of range-of-motion, caused the standard deviation to be greater than the mean percent change of range-of-motion. See raw data display of measurements for each group in Figures 5 and 6.

Both the Mann-Whitney U Test and chi-square computations supported a statistically significant relationship between the responses given by the MFR group

compared to the US group. The mean rank of responses for the MFR group fell at the middle of a 50 point scale. This suggested that MFR subject mean responses averaged "moderate improvement". The mean rank of responses for the US group fell at the lower to middle end of a 50 point scale. This suggested that US subject mean responses averaged "minimal to moderate improvement".

Overall subjective changes from pre to post treatment were more satisfying for the MFR subjects. This may be partially due to the amount of attention given to each subject by the physical therapist. MFR subjects were given 20 minutes of the therapist's time as opposed to 7 minutes of the therapist's time for the US subjects.

Further research is suggested in comparing MFR to another manipulatory physical therapy treatment rather than a non-manipulatory treatment such as US.

CONCLUSION

In this investigation, it was found that patients from both treatment groups had increased in active range-of-motion, decreased in trigger point number, and decreased in pain. This finding supported individual patient successes in both treatment groups. Changes showing no progress are also present within both treatment groups. Positive and negative changes in treatment results can be directly seen by looking at the bar graphs in figures one through six. The results of this study supported that mean differences

in between group pain scale measurement, and mean differences in between group change in range-of-motion are statistically significant in favor of the MFR treatment.

This study by no means emphasizes a sole use of myofascial release nor ultrasound in patient treatment, but comparisons of modalities must occur to offer support to clinicians as to their successfulness.

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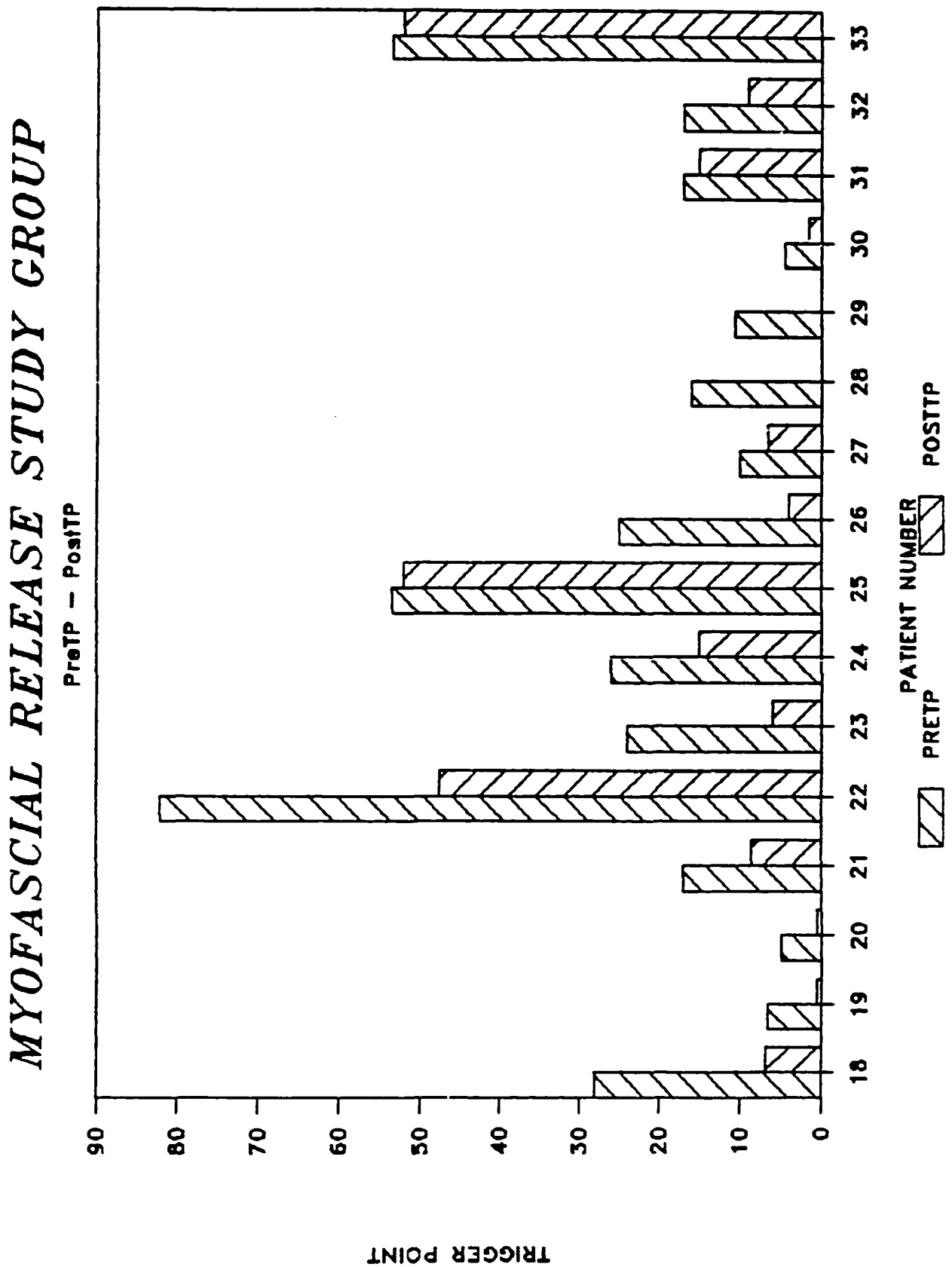

Figure 1 - Pre to Post Trigger Point Changes for Myofascial Release

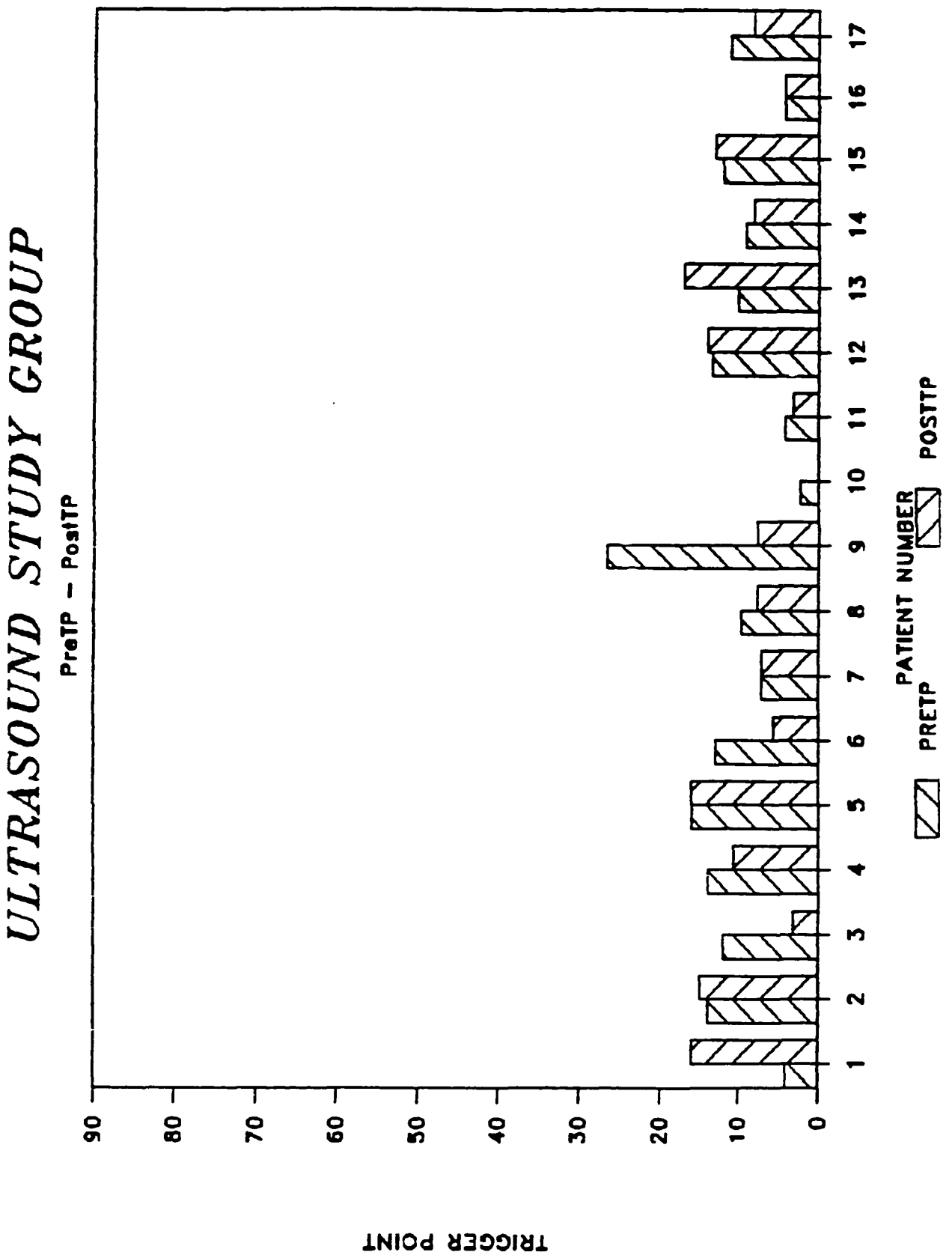

Figure 2 - Pre to Post Trigger Point Changes for Ultrasound

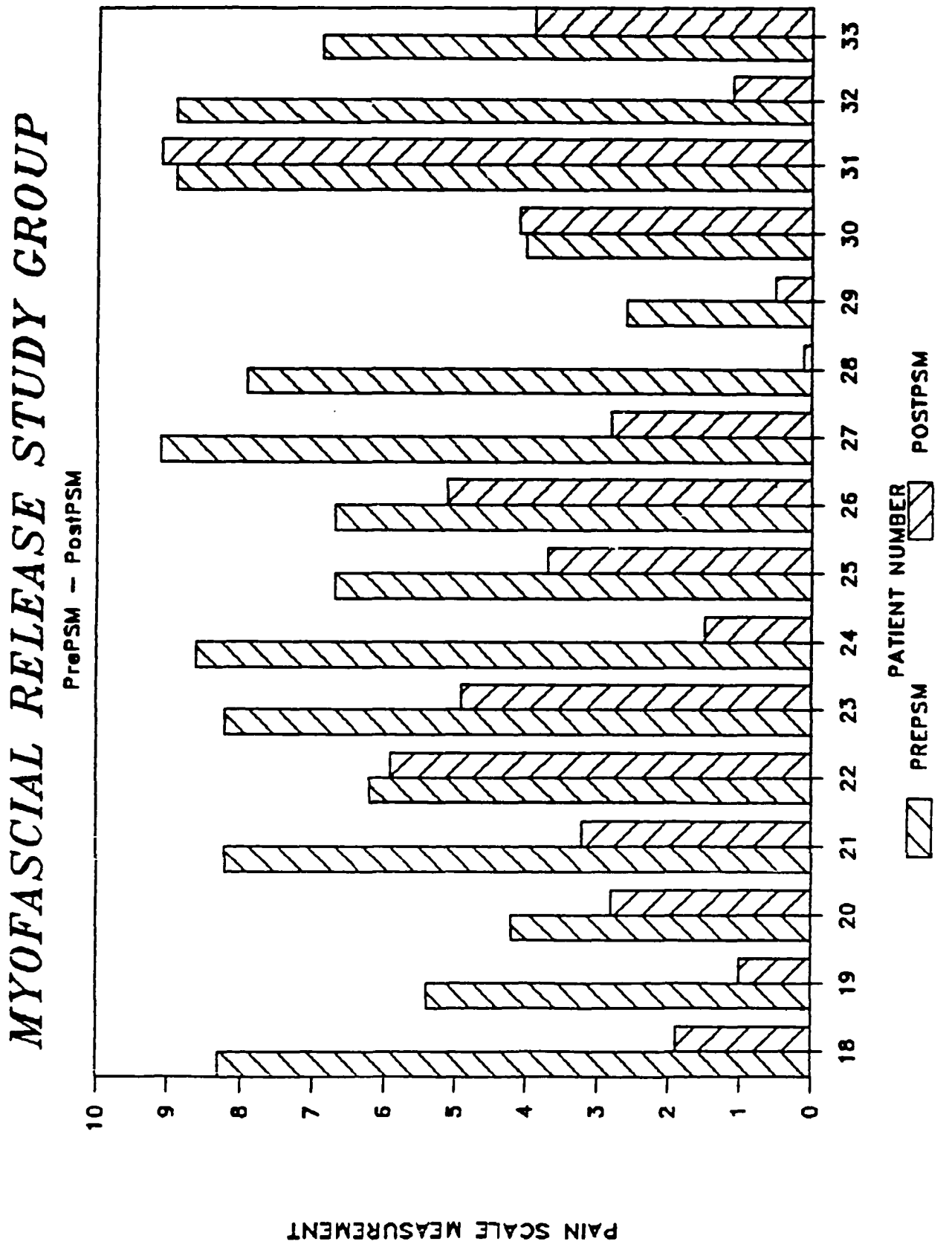

Figure 3 - Pre to Post Pain Scale Measurement Changes for Myofascial Release

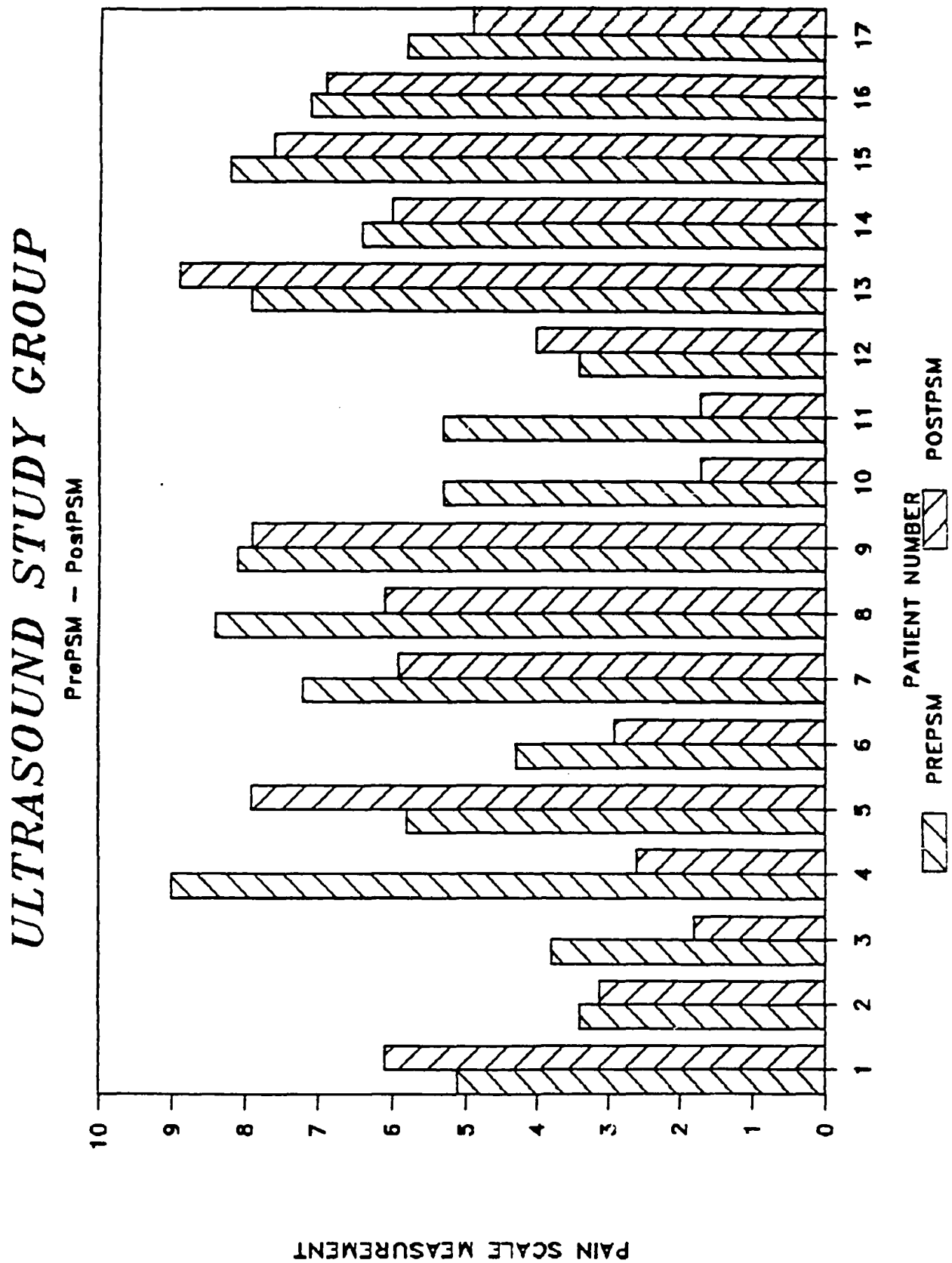

Figure 4 - Pre to Post Pain Scale Measurement Changes for Ultrasound

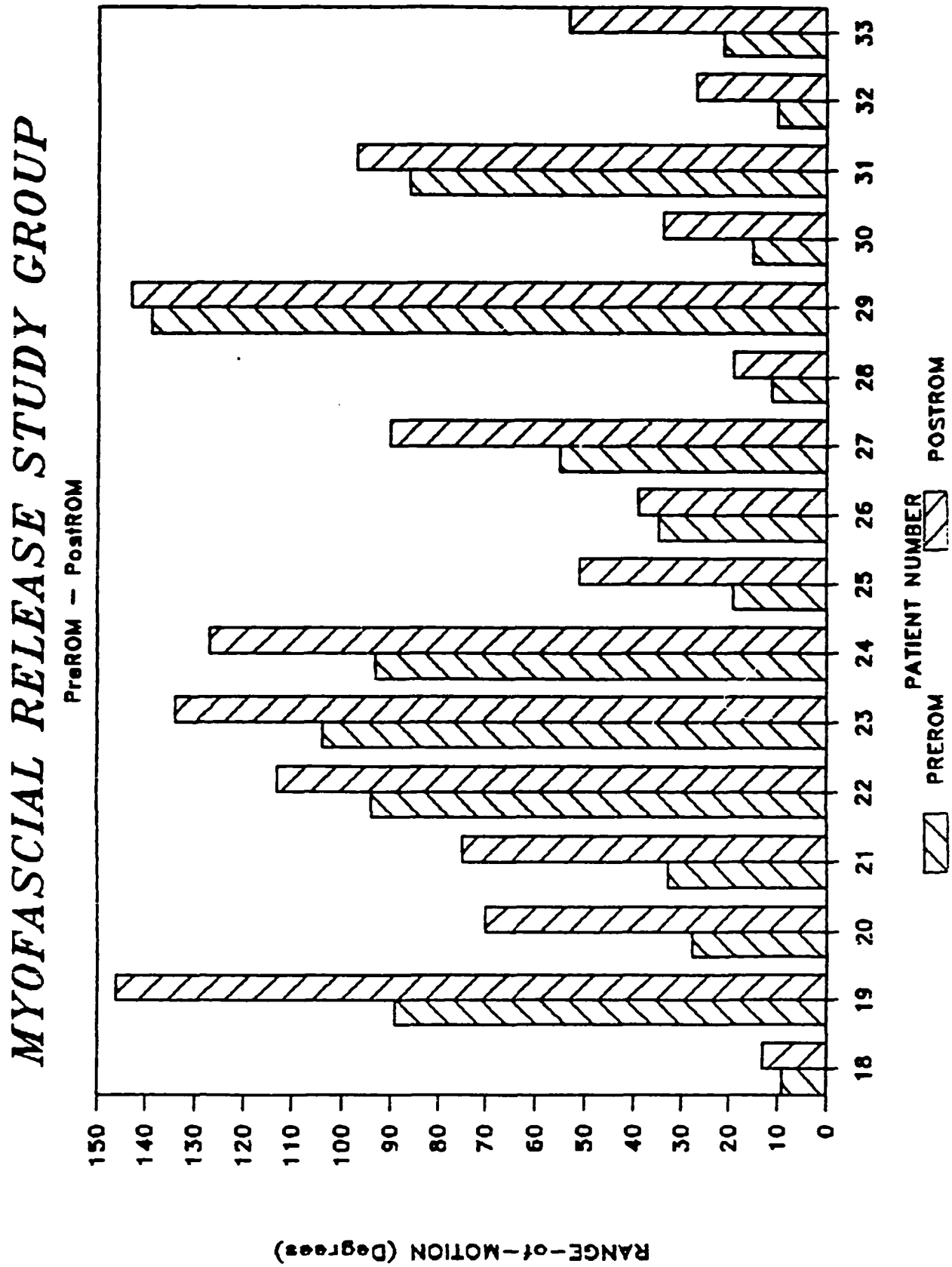

Figure 5 - Pre to Post Range-of-Motion Changes for Myofascial Release

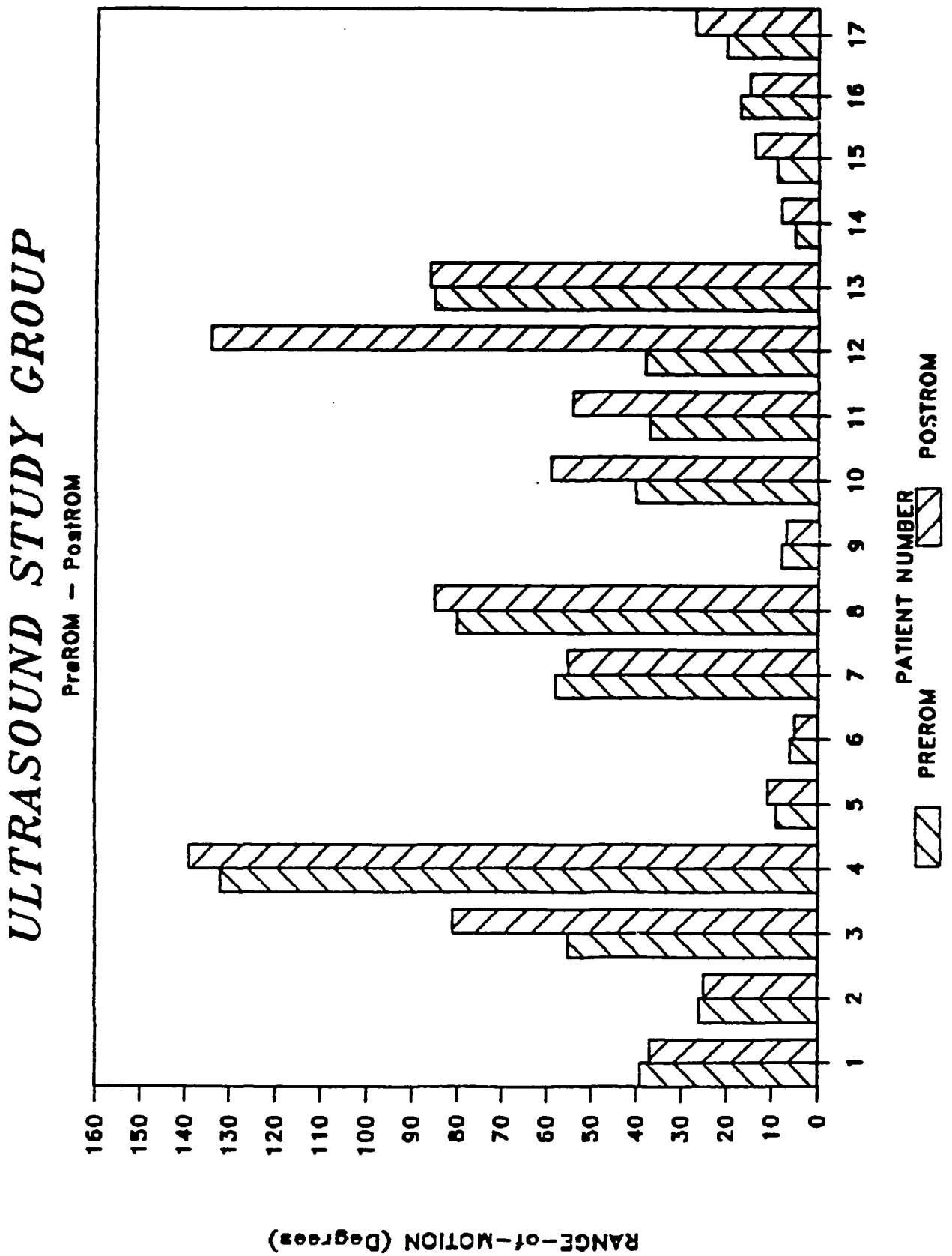

Figure 6 - Pre to Post Range-of-Motion Changes for Ultrasound

SUMMARY OF PROCEDURES

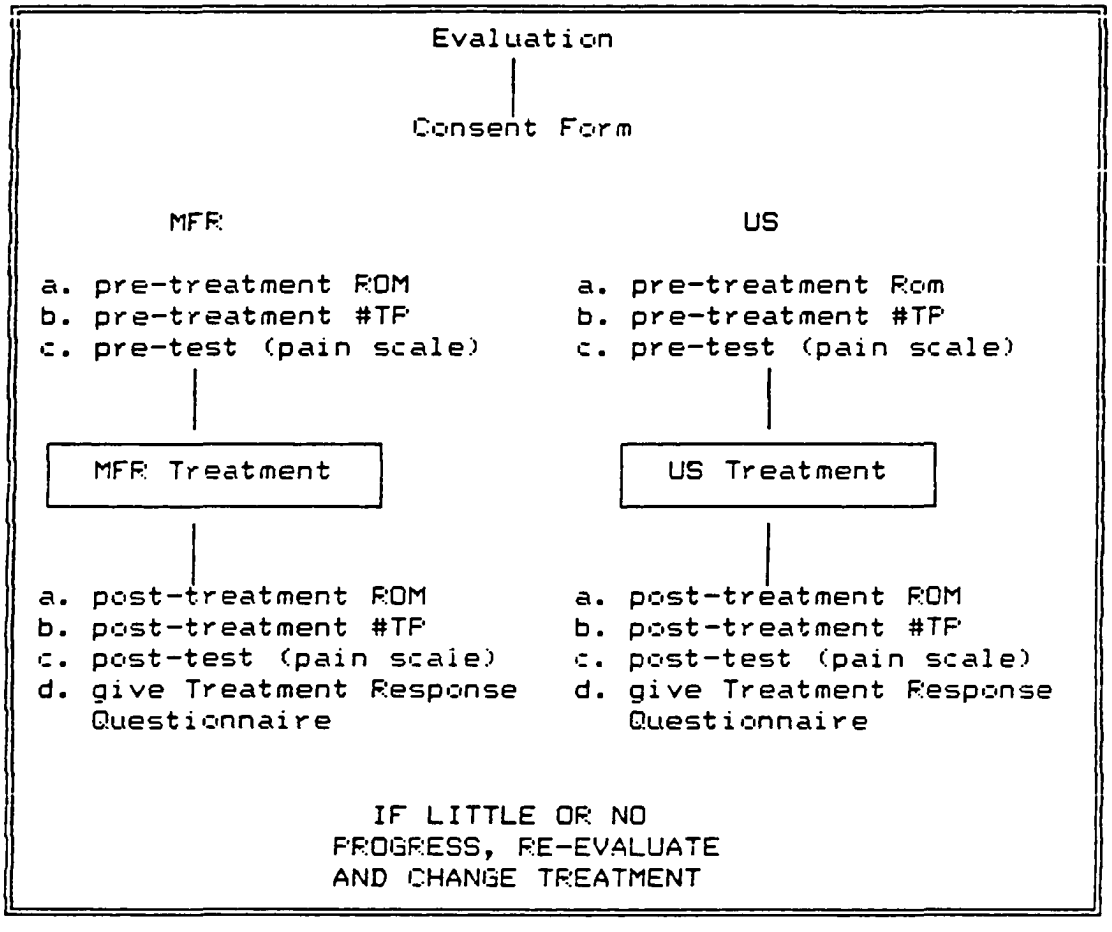

Table 1

t-TEST CALCULATIONS FOR TRIGGER POINT MEASUREMENTS

	MYOFASCIAL Pre => Post	ULTRASOUND Pre => Post
t VALUE	1.94	0.09
D.F.	29	32
LEVEL OF SIG.	0.10	0.50

Table 2

KRUSKAL-WALLIS CALCULATIONS FOR TRIGGER POINT MEASUREMENTS

	MYOFASCIAL		ULTRASOUND	
	Pre	Post	Pre	Post
N	16	16	17	17
MEAN	24.7	14.0	10.7	10.5
STD DEV	21.2	18.7	5.8	6.[illegible]
MIN	4.5	0.0	2.0	0.0
MAX	82.0	52.0	26.5	27.5

Table 3

KRUSKAL-WALLIS CALCULATIONS FOR
CHANGE IN TRIGGER POINT NUMBER

	MYOFASCIAL	ULTRASOUND
T	203.34	357.66
H_{CALC}	6.12	
H_{TABLE}	3.84	

Table 4

KRUSKAL-WALLIS CALCULATIONS FOR PAIN SCALE MEASUREMENTS

	MYOFASCIAL		ULTRASOUND	
	Pre	Post	Pre	Post
N	16	16	17	17
MEAN	6.9	3.8	6.1	5.1
STD DEV	2.0	2.0	1.8	2.4
MIN	2.6	0.1	3.4	1.7
MAX	9.1	10.0	9.0	8.9

Table 5

KRUSKAL-WALLIS CALCULATIONS FOR
CHANGE IN PAIN SCALE MEASUREMENT

	MYOFASCIAL	ULTRASOUND
T	192.00	369.00
H_{CALC}	8.30	
H_{TABLE}	3.84	

Table 6

INPUT DATA FOR CALCULATING CONFIDENCE LIMITS FOR THE DIFFERENCE BETWEEN CHANGE IN RANGE-OF-MOTION MEANS FROM UNMATCHED GROUPS

	Mean of Change in ROM	STD. DEV.	N	t-value for .05 LOS
US-group	$\bar{X}_{US} = 11.7$	$s_{US} = 2.50$	17	2.04
MFR-group	$\bar{X}_{MFR} = 22.6$	$s_{MFR} = 4.13$	16	2.04

Table 7

STANDARD DEVIATION CALCULATIONS FOR
MEAN PERCENT CHANGE IN RANGE-OF-MOTION

	MYOFASCIAL % Change Pre=>Post	ULTRASOUND % Change Pre=>Post
N	16	17
MEAN	78.3	15.8
STD DEV	60.8	26.8
MIN	+2.9	-16.7 *
MAX	+170.0	+60.0 **

* 7 of the 17 patients experienced a decrease
** 10 of the 17 patients experienced an increase

Table 8

PATIENT RESPONSE QUESTIONNAIRE:
SIGNIFICANT QUESTION DATA

	Q1	Q4	Q5	Q6	Q9
D.F.	3.0	3.0	4.0	3.0	4.0
LEVEL OF SIG.	0.02	0.01	0.003	0.0004	0.005

Table 9

CHI-SQUARE VALUES AND FREQUENCY DATA
FOR SIGNIFICANT QUESTIONS

QUESTION	Yes, no pain now	Much less pain	Pain mod. reduce	A little less pain	Pain same as before
1. Do you feel your pain is less after going through 10 physical therapy treatments? CHI-SQUARE 9.59	MFR 0	MFR 8	MFR 4	MFR 4	MFR 0
	US 0	US 5	US 0	US 9	US 3
	100%	75%	50%	25%	0%
4. How much improvement in movement have you experienced? CHI-SQUARE 10.91	MFR 0	MFR 8	MFR 6	MFR 2	MFR 0
	US 0	US 1	US 8	US 3	US 5
	100% improv.	Much improv.	Mod. improv.	Min. improv.	No improv.
5. Are you able to perform your activities of daily living better? CHI-SQUARE 15.85	MFR 0	MFR 5	MFR 10	MFR 1	MFR 0
	US 1	US 5	US 1	US 7	US 3

Table 10
(continued)

CHI-SQUARE VALUES AND FREQUENCY DATA
FOR SIGNIFICANT QUESTIONS

6. Do you feel physical therapy has helped your condition?	Yes, Total recov.	Has helped a lot	Helped mod. amount	Helped little amount	Not at all
	MFR 0	MFR 9	MFR 7	MFR 0	MFR 0
CHI-SQUARE 18.41	US 0	US 4	US 1	US 10	US 2
9. Are you feeling better about getting back to normal now that you have completed 10 physical therapy sessions?	Yes	Much better	Mod. better	Little better	No
	MFR 3	MFR 6	MFR 6	MFR 1	MFR 0
CHI-SQUARE 14.92	US 1	US 3	US 1	US 10	US 2

Table 10

APPENDIX

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Procedure for Research Participation

The physical therapist has evaluated you and has concluded that you meet the criteria to be included in a research study. Both myofascial release treatment and ultrasound treatment have been clinically found to decrease pain and function but conclusive research has not been done concerning the most effective treatment for your painful condition. Thus, the purpose of this study is to help determine the most effective physical therapy to aid in the treatment of your pain and limitation.

If you sign the consent form to be included in this study, you will be randomly placed in treatment group A consisting of passive stretching called myofascial release, or treatment group B consisting of a deep heat called ultrasound. You will be asked to mark a pain scale describing the intensity of your pain. Then you will be placed through physical therapy sessions until your pain has completely subsided or you have reached a maximum of ten treatments. Next, you will be asked to complete a subjective rating scale consisting of ten randomly arranged questions. You will also be asked to again mark a pain scale describing the intensity of your pain at the end of your therapy. Lastly, the same physical therapist will re-evaluate your condition and document data specific for the research.

Please relay any questions concerning the above procedure to your physical therapist. You are not obligated to participate in this research. If you agree to participate, you will be informed of the outcome of this study if you desire. This research procedure has been evaluated and approved by the Old Dominion University Human Subjects Review Committee of the Department of Community Health Professions and by the Administration of Louise Obici Memorial Hospital.

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INFORMED CONSENT FORM

Project Name:_____

Investigator(s)_____

DATE:_____

This is to certify that I,_____, hereby agree to participate as a volunteer in a scientific investigation as a part of the educational and research program of Old Dominion University, under the supervision of _____.
(Faculty Person/Principal Investigator)

The investigation and the nature of my participation have been described and explained to me, and I understand the explanation. (See attached one page abstract.) I understand that I am one of _____ individuals participating in this research project. I further understand that I may withdraw from the project at any time, without penalty or prejudice.

I have been afforded an opportunity to ask questions concerning the purpose of this project and all such questions have been answered to my satisfaction. I understand that should I have additional questions in the future about this project or the manner in which it is conducted, I may contact _____ at _____.
(Faculty Person/Principal Investigator) (Telephone Number)

I understand that I am free to withhold any answer to specific items or questions in any questionnaire submitted to me for this project. I understand that any data or answers to questions will remain confidential with regard to my identity. I further understand that no data which can be identified with me will be released to persons outside the research team without the team first obtaining my written permission.

I acknowledge that I was informed about any possible risks to my health and well being that may be associated with my participation in this research (see attached abstract). I understand that no medical or psychological assistance will be made available to me by either Old Dominion University or any member of the research team as a result of any physicial or emotional harm I may experience as a result of this research project.

I acknowledge that I have been advised of how I may obtain a copy of the results of this research project and that upon my making such a result, a copy will be provided without charge.

I have been informed that I have the right to contact the Old Dominion University Institutional Review Board for the Protection of Human Subjects should I wish to express any opinions regarding the conduct of this study.

_____ Date:_____
Signature of Volunteer

TABLE 1

Treatment Group "A" Data: Myofascial Release

BEFORE TREATMENT				AFTER TREATMENT						
Patient's Name	Number of Trigger Pts. Palpated and Body Part (see body chart)	AROM of Most Limited Range	Pain Scale Measurement	Number Treat. Used	Number Trigger Points	% ↓ or ↑ and # change	AROM of prev. most lim. range	% AROM ↑ or ↓ and # of degrees	Pain Scale Meas.	% Pain Meas. ↓ or ↑ and num. change

TABLE 2

Treatment Group "B" Data: Ultrasound

BEFORE TREATMENT				AFTER TREATMENT						
Patient's Name	Number of Trigger Pts. Palpated and Body Part (see body chart)	AROM of Most Limited Range	Pain Scale Measurement	Number Treat. Used	Number Trigger Points	% ↓ or ↑ and # change	AROM of prev. most lim. range	% AROM ↑ or ↓ and # of degrees	Pain Scale Meas.	% Pain Meas. ↓ or ↑ and num. change

VISUAL PAIN SCALE

Instructions: Mark on the scale below the usual level of your pain.

NO PAIN _____ PAIN AS BAD AS IT COULD BE

1 10

PATIENT RESPONSE QUESTIONNAIRE

ADL = Activities of Daily Living

1. Do you feel your pain is less after going through 10 physical therapy treatments?

Yes - no pain at all	Much less pain	Pain moderately ↓ed	A little less pain	No-pain feels the same as before

2. Do you feel your overall condition has improved after 10 physical therapy sessions?

Total Recovery	Much Improvement	Moderate Improvement	Minimal Improv.	No Improvement

3. Are you able to move more freely after 10 physical physical therapy sessions?

No ↑ in freedom of movement	Minimal ↑ in movement	Moderate ↑ in movement	Much Improvement	Am back to norma improvement

4. How much improvement in movement have you experienced?

0%	25%	50%	75%	100%

5. Are you able to perform your ADL better?

No Improvement in performing ADL	Minimal Improv.	Moderate Improvement	Much Improvement	Can perform ADL with no problems

6. Do you feel physical therapy has helped your condition?

Am totally Recovered	Has helped a lot	Has helped a mod. amount	Has helped a little bit	No-Not at all

7. How much improvement in pain have you experienced?

0%	25%	50%	75%	100%

8. Are you in more comfort when functioning through ADL ?

No-Not At All	A little ↑ in comfort	Moderate ↑ in comfort	Much More Comfort	Yes-No discomfor At All

9. Are you feeling better about getting back to normal now that you have experienced 10 physical therapy sessions?

Definately Yes	Much Better	Feeling a moderate amount better	A little bit better	Definately No Feel I don't have a good chance to get better

10. I am able to perform (major movement complaint)_____

100% better	75% better	50% better	25% better	0% better

LOUISE OBICI MEMORIAL HOSPITAL · SUFFOLK, VIRGINIA 23434

MEMORANDUM

TO: Gary W. Smith, Director of Rehabilitative Services

FROM: D. Bishop, R.P.T. D. Bishop, RPT

DATE: March 25, 1985

RE: Initiation and Completion of an Experimental Research Study

I would like to undertake an experimental study involving LOMH patients suffering with myofascial pain. Conclusive research has not been done concerning the most effective treatment for myofascial syndromes. Thus, the purpose of this study is to help determine the most operative physical therapy to aid in the treatment of myofascial pain and limitation.

The procedure for research participation will be as follows:

a) Patient will be evaluated by the physical therapist to determine if the subject meets the criteria listed below:
   1) trigger points can be located with palpation
   2) ~~it has been less than two weeks post the initial onset~~ of pain
   3) patient has muscle tension shortening resulting in some active range of motion limitation not caused by bony blockage
   4) patient denies a history of connective tissue disease, rheumatoid arthritis, central nervous system damage, mental illness, malignancy, and unhealed fractures
   5) patient is between 20-50 years old
b) Written explanation of research study in layman's vocabulary presented to patient
c) Patient signs consent form to be kept on file
d) Patient randomly placed in treatment group "A" consisting of myofascial release or treatment group "B" consisting of ultrasound
e) Therapist will document objective data such as number of trigger points and specific joint range of motion
f) Patient marks a pain scale denoting the patient's perceptive level of pain prior to physical therapy
g) Patient placed through treatment until he is better or until he has reached ten complete treatments
h) Patient marks a pain scale denoting the patient's perception of pain after physical therapy

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i) Patient also asked to answer a questionnaire concerning his perception of progress in decreasing his pain and increasing his function
j) Therapist will document objective data such as number of trigger points and specific joint range of motion
k) If patient has made little or no progress with his designated physical therapy, then a re-evaluation will take place and treatment will change to better aid the patient's pain and limitation

This study has been provoked because of recognizing that myofascial conditions appear to be mal-treated, because previous research has not be completed concerning myofascial release and ultrasound in treating myofascial conditions, and because experimental research will aid in the completion of my masters.

Upon completion of my work, attempts will be made to get this experimental research published at which time Louise Obici Memorial Hospital, Old Dominion University and I will be recognized.

This study has been evaluated and approved by the Old Dominion University Subjects Review Committee.

DB:sh

pc:
Robert R. Everett
Richard Linneberger

LOUISE OBICI MEMORIAL HOSPITAL · SUFFOLK, VIRGINIA 23434

MEMORANDUM

TO: Dr. Douglas Kells
Medical Director of Physical Therapy, President of Medical Staff

FROM: D. Bishop, R.P.T.

DATE: April 16, 1985

RE: Initiation and Completion of an Experimental Research Study

I would like to undertake a research study involving LOMH patients suffering with possible myofascial pain. Conclusive research has not been done concerning the most effective treatment for myofascial syndromes. Thus, the purpose of this study is to help determine the most effective physical therapy to aid in the treatment of myofascial pain and limitation.

The procedure for research participation will be as follows:

a) Therapist has on file an "Evaluate and Treat" referral from the patient's doctor
b) Patient will be evaluated by the physical therapist to determine if the subject meets the criteria listed below:
   1) trigger points can be located with palpation
   2) it has ~~been less than four weeks post the initial onset~~ of pain
   3) patient has some active range of motion limitation not caused by bony blockage
   4) patient denies a history of connective tissue disease, rheumatoid arthritis, central nervous system damage, mental illness, malignancy, and unhealed fractures
   5) patient is between 20-50 years old
c) Written explanation of research study in layman's vocabulary presented to patient
d) Patient signs consent form to be kept on file
e) Patient randomly placed in treatment group "A" consisting of myofascial release or treatment group "B" consisting of ultrasound
f) Therapist will document objective data such as number of trigger points and specific joint range of motion
g) Patient marks a pain scale grading his perception of pain prior to physical therapy

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h) To be consistent with the research protocol, the patient is given physical therapy until the patient and physical therapist feel he has reach maximal recovery or until the patient has completed 10 treatments. If after 10 treatments the patient has not recovered from his pain and limitation, he will be re-evaluated by the physical therapist and treatment will be altered. The doctor will be notified of any changes in the patient's therapy.

i) Patient marks a pain scale grading his perception of pain after physical therapy.

j) Patient asked to answer a questionnaire concerning his perception of progress in decreasing his pain and increasing his function

k) Therapist will document objective data such as number of trigger points and specific active joint range of motion

Although ultrasound and myofascial release (a noninvasive manual stretching and manipulation of fascial trigger points) have each been found to be clinically successful physical therapy modalities, there has been no conclusive research completed supporting the most competent method to treat myofascial condition. This research will help physicians and physical therapist better determine the most effective therapy to aid a patient suffering from myofascial pain and limitation.

If your patient meets the designated criteria previously listed, please send the patient to physical therapy with an "Evaluate and Treat" referral. Once 60 subjects are treated suffering from myofascial pain, appropriate statistical analysis will be done to determine the level of significance of the treatment modality found most effective. After completion of this experimental research, attempts will be made to have the results published in the American Physical Therapy Association Journal so that professionals treating patients with myofascial pain and limitations will be more aware of the most effective treatment method: ultrasound versus myofascial release. This study has been evaluated and approved by the Old Dominion University Human Subjects Review Committee of the Department of Community Health Professions and the Administration of Louise Obici Memorial Hospital contingent upon the approval of Physical Therapy's Medical Director, Dr. Douglas Kells.

DB:sh

pc: All Medical Staff