Original Article

Efficacy of Therapeutic Ultrasound vs Myofascial Release in Treating Trigger Points of Myofascial Pain Syndrome: A Comparative Study

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Abstract

Background: Myofascial Pain Syndrome (MPS) is a highly prevalent condition, reported in 85% of patients with chronic pain complaints, and disproportionately affects women (64.3%) compared to men (35.7%). To evaluate treatment efficacy for MPS, a pre-post experimental comparative study was conducted, recruiting 30 subjects diagnosed with myofascial trigger points (MTrPs) who were randomly divided into two groups.Subjects received 12 treatment sessions on alternate days. The Ultrasound group (Group A) was treated with a continuous mode for 5-7 minutes, while the Myofascial Release group (Group B) received manual therapy over the trigger points until the therapist noted a reduction in tissue resistance. Outcome measures used were the Visual Analog Scale (VAS)in terms of pain and Palpable Muscle Spasm Degree (PMSD) in terms of spasm.

Aim of the Study: To compare the efficacy of Therapeutic Ultrasound versusMyofascial release in reducing pain and spasmassociated with Myofascial Pain Syndrome over the trigger point region.

Materials and Methods: This study employed ultrasound application and myofascial release, and subjects were randomly assigned to two groups.Outcome measures used were the Visual Analogue Scale (VAS) subjectively in terms of pain and the Palpable Muscle Spasm Degree (PMSD) objectively in terms of spasm.

Key Results: The pre-mean VAS of Group A was 7.73±0.704, and the post-mean VAS was 2.07±0.594. The pre-mean PMSD was 1.87±0.576, and the post-mean PMSD was 1.00±0.926. For Group B, the pre-mean VAS was 8.33±0.816, and the post-mean VAS was 2.40±0.910. The pre-mean PMSD was 2.13±0.640, and the post-mean PMSD was 0.600±0.910. The "P" value was <0.001. A weekly comparison of the mean VAS level in both groups was 4.60±0.138, with a "P" value of <0.001, which showed significant improvement across all 12 sessions (4 weeks).

Conclusion: This study statistically validated that both Therapeutic Ultrasound and hands-on manual therapy (Myofascial Release) were equally effective in reducing pain and spasm among the student population with active MTrPs. However,

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the clinical assessment suggested that Myofascial Release might be superior, offering more effective pain relief and spasm reduction within a shorter duration, in addition to being cost-effective, non-invasive, and providing immediate ymptomatic relief.

Keywords: Myofascial Pain Syndrome (MPS), Myofascial Trigger Point (MTrP), Ultrasound, Myofascial release, Visual Analog Scale (VAS), Palpable Muscle Spasm Degree (PMSD).

Introduction

Myofascial Pain Syndrome (MPS) is a complex musculoskeletal condition characterised by the presence of trigger points (TrPs) within skeletal muscle and its surrounding fascia. These TrPs are localised, hyper-irritable spots described as palpable, taut bands, nodes, or knots that are tender and painful when pressure is applied.[1] According to the recent surveys, the prevalence of MPS is about 85% in patients complaining of chronic pain.[2] Trigger points are most frequently identified in high-stress muscles such as the trapezius, levator scapulae, scalene, and infraspinatus. They are categorised based on their origin as active trigger Points, which cause pain even when the patient is at rest, contributing significantly to chronic pain complaints, and the Latent Trigger Points, which cause pain or other MPS symptoms only when direct manual pressure is applied. Other types include Primary/ Secondary Trigger Points reflecting their initial cause or development in response to other problems.[3,4]

Patients typically report chronic or acute symptoms, including a dull aching or sharp, stabbing pain, alongside associated issues like stiffness, muscle spasms, and a limited range of movement (ROM) in the affected area.[5]

MPS primarily develops due to chronic overuse or overstress of muscle groups and prolonged maintenance of abnormal or awkward postures.[6] These factors cause certain muscles, particularly the parascapular muscles like the Upper Trapezius, Rhomboids, and Levator Scapulae, to remain in a shortened or contracted state, leading to the formation of the taut band or knot.[7-8]

Diagnosis relies on a physical examination, where the therapist's palpation confirms the presence of the characteristic rope-like nodule, taut band, or irritable point, correlating with the patient's complaints of pain, stiffness, and restricted ROM.

Treatment protocols are divided into two main categories: Invasive and Non-invasive Techniques. Invasive Techniques primarily include dry needling, which involves inserting a thin needle into the trigger point to elicit a twitch response and relieve tension.[9-10]

Non-Invasive Techniques encompasses a wide variety of physiotherapeutic approaches, including Manual therapy techniques and Electrotherapy Modalities. Manual therapy techniques include Myofascial Release (MFR), Spray and Stretch, Ischemic compression, Deep Transverse Friction Massage(DTFM),Multiple trigger point release massagesand Kinesio Taping.[11-13] Electrotherapy modalities include Faradic stimulation, Mechanical Vibration, Ultrasound, Microwaves, Interferential therapy (IFT), Extracorporeal shock wave therapy, Low-level laser therapy, Magnetic coil stimulation, and Transcutaneous Electrical Nerve Stimulation. Other techniques includeThermotherapy (hot packs), Stretching, and strengthening exercises. [14-17]

Therapeutic Ultrasound, uses sound waves to create thermal and non-thermal effects. The thermal effect increases the elasticity of collagen fibres, which helps reduce pain and stiffness by decreasing muscle spasms and improving local blood circulation. It provides controlled deep heat in continuous mode to the targeted muscle/fascia, which is difficult to replicate with superficial heat or manual friction. This heat is crucial for increasing the extensibility of collagen fibres in the muscle and fascia, breaking the pain-spasm-pain cycle, and reducing muscle spasms deep within the trigger point structure.

Non-Thermal Effect of ultrasound, especially in pulsed mode, uses acoustic streaming and cavitation to mechanically stimulate cellular activity. This promotes tissue healing and repair by activating mechanoreceptors in fibroblasts. This is a unique bio-mechanical effect not shared by manual techniques.

These Microcirculatory Effects (thermal and non-thermal) combine to promote vasodilation and increased local blood circulation to the ischemic core of the trigger point, aiding in the washout of metabolic waste products and chemical irritants hypothesised to sustain the trigger point.[18]

Myofascial Release (MFR) is a manual, hands-on technique where sustained, gentle pressure is applied to areas of fascial restriction. The goal is to stretch and release the tightened fascia, allowing the structure to become pliable and soft, thereby reducing pain and improving restricted movement. The therapist locates the taut band, applies sustained, thumb pressure from the origin of the muscle and strokes toward the insertion of the muscle. The key manoeuvre is strumming, where the thumb finger pulls perpendicularly across the muscle fibres over the TrPs.[19]

Despite the wide use of various physiotherapy protocols, such as MWD, IFT, TENS, Ultrasound, and manual techniques like Deep Transverse Friction Massage (DTFM) and Ischemic Compressionto inactivate trigger points, some previous research has been inconclusive regarding functional improvements post-treatment. Crucially, there is a recognised insufficient evidence base comparing the outcomes of manual (like MFR) versus electrotherapeutic (like Ultrasound) approaches for TrPs treatment.

Therefore, the specific objective of this study was to directly evaluate and compare the effectiveness of Therapeutic Ultrasound versus Myofascial Release in managing trigger points located in the Upper Trapezius, Rhomboids, and Levator Scapulae muscles.

The use of Therapeutic Ultrasound (US) as a single modality, rather than in combination with manual techniques, is justified by the fundamental objective of this comparative interventional study to isolate and quantify the distinct therapeutic effects of two dissimilar approaches: a mechanical electrotherapy (US) versus a manual therapy (MFR). While clinical practice often combines modalities, such amalgamation renders it difficult to determine the specific contribution of each intervention to patient outcome. By administering US as a standalone treatment, we aim to validate its unique physiological mechanisms,specifically, its controlled deep thermal effect on collagen extensibility and its non-thermal cellular effects (acoustic streaming and cavitation) that promote tissue repair, without the confounding influence of simultaneous manual stimulation. This methodological rigour is essential to address the recognised gaps in the literature and provide evidence-based guidance on the independent efficacy of US for the deactivation of Myofascial Trigger Points.[20-24]

Materials & Methods

The study was conducted in the Department of Physiotherapy. It was a pre- and Post-Experimental Comparative Study. The sample population consisted of college-going students who screened positive for the trigger point. The study included a total of 30 subjects, and the duration wasset for four weeks.

Participants - Eligibility

Inclusive Criteria

Subjects were included if they were aged 18-23 years, reported pain greater than “6” on the VAS, and presented with more than one demonstrable active triggerpoint on palpationin the neck and upper back area(Upper Trapezius, Rhomboids, Levator scapulae).

Exclusive Criteria:

Subjects were excluded if they had cervical radiculopathy, skin allergies, any history of trauma to the upper back and trunk area, or a permanent tattoo in the cervical and shoulder area. Additionally, subjects with a history of high-velocity neck or shoulder injury were excluded.

Materials Used

The materials used includ0ed an Ultrasound machine, ultrasonic gel, and cotton.

Data Collection

Subjects were randomly selected and screened for trigger points.All data were collected after informed consent was obtained from the subjects. The consent also included permission to use their data and photographs for presentation and publication purposes.Physical examination findings were noted in individual case sheets.

Interventions

Procedure

All 30 subjects who met the inclusioncriteria were randomly allocated into two groups: one group receivedTherapeutic Ultrasound,and the other group receivedMyofascial release, respectively.

Group -A

Subjects in Group A received only Ultrasound therapyfor trigger points. The ultrasound was administered at 1MHz frequency, 3 days a week on alternate days for 4 weeks, using a continuous mode with a treatment duration of about 5-7 minutes.It was given to the upper trapezius, levator scapulae, and rhomboids.

Group-B:

Subjects in Group B were treated with the only Myofascial release technique. This technique was applied "3" days a week on alternate days for "4" weeks. The myofascial release was specifically given to the upper trapezius, levator scapulae, and rhomboids.This deep tissue technique targets trigger points (TrPs) and taut bands in the Upper Trapezius, Levator Scapulae and Rhomboid muscles.The therapist locates the taut band, applies sustained, thumb pressure from the origin and strokes toward the insertion of the muscle. The key manoeuvre is strumming,where the thumb finger pulls perpendicularly across the muscle fibres over the TrPs.

Outcome Measures

Measurements were obtained on two occasions: pre-intervention and post-intervention.

Visual Analog Scale (VAS)

The Visual Analogue Scale (VAS) is a psychometric instrument where a patient marks their subjective symptom intensity, such as pain, from "no pain" to "worst possible pain," yielding a score from 0 to 10.

Palpable Muscle Spasm Degree (PMSD)

Grading of PMSD objectively by the therapist palpating over the trigger point area

0 Nospasm

1. Medium-gradespasm
2. Spasmis strongerthanmediumgrade,butdoes notlimitthe jointrangeofmovement
3. Sever espasmlimiting joint range of movement
4. Severes pasm accompanied by postural deviation

Statistical Analysis

The data wereanalysedby using the Statistical Package for the Social Sciences Computer Program(SPSS) software in this study.

Demographic variables(age) were analysed by using descriptive statistics. Paired t-tests were used to compare pre- & post-VAS within each group, while independent t-tests were used for comparison between the groups. All data were expressed as Mean ± Standard deviation, with statistical significance set at $p<0.05$.

Result

Table 1 presents the descriptive statistics for the 30 subjects, indicating a mean age of 20.5 ± 1.72 years, with ages ranging from 18 to 23 years.

Table 1: Demographic Variables (Descriptive Statistics) (N=30)

Variable	Minimum	Maximum	Mean
Age in Years	18	23	20±1.72

Table 2 presents the pre- and post-intervention VAS and PMSD values for Group 1 and Group 2. In Group 1, the pre-intervention mean VAS was 7.73±0.704, decreasing to a post-intervention mean VAS of 2.07±0.594. For Group 2, the pre-intervention mean VAS was 8.33±0.816, decreasing to a post-intervention mean VAS of 2.40±0.910.

Table 2. Clinical Variables Analysis (Outcome Measures Within Group)

GROUPS	Pre-VAS	Post-VAS	Pre-PMSD	Post-PMSD	"p" Value
Group-1	7.73±0.704	2.07±0.594	1.87±0.576	1.00±0.926	<0.001
Group-2	8.33±0.816	2.40±0.910	2.13±0.640	0.600±0.910	<0.001

Regarding PMSD values, Group 1 showed a pre-intervention mean of 1.87±0.576, which decreased to a post-intervention mean of 1.00±0.926. In Group 2, the pre-intervention mean PMSD was 2.13±0.640, decreasing to a post-intervention mean of 0.600±0.910. A p-value of <0.001 was observed for all variables presented in the table.

Table 3 presents the post-intervention changes in VAS and PMSD between the groups. The post-intervention mean VAS was 2.07±0.594 in Group 1 and 2.40±0.910 in Group 2. The post-intervention mean PMSD level was 1.00±0.926 in Group 1 and 0.600±0.910 in Group 2. The p-value for VAS was 0.245, and for PMSDit was 0.243.

Table 3. Between-Group Analysis

VARIABLE	Group-1	Group-2	"P" Value
VAS	2.07±0.594	2.40±0.910	0.245
PMSD	1.00±0.926	0.600±0.910	0.243

Discussion

This experimental comparative study evaluated the effects of Ultrasound and Myofascial release on trigger points in the upper trapezius, levator scapulae, and rhomboids. The primary outcome measures for this study were pain, assessed with VAS, and spasm, measured using the Muscle Spasm Degree (PMSD). This study intentionally included a greater proportion of female participants than male participants for myofascial pain syndrome (MPS) trigger point analysis, recognising the significantly higher prevalence of MPS in women, estimated at 64.3% in women versus35.7% in men, as a primary justification for prioritising the most affected population. This strategic enrollment ratio is further supported by the established finding that women generally exhibit greater pain sensitivity and lower pain tolerance thresholds than men, potentially leading to more pronounced clinical presentations of trigger points. Furthermore, the modulating influence of female sex hormones on pain perception and chronic pain conditions is a key factor, as hormonal fluctuations have been implicated in the development and exacerbation of MPS. Crucially, the practical observations during the initial screening phase of this research validated this approach and predominantly identified women meeting the criteria for MPS trigger points compared to men, ultimately reinforcing the decision to enrol a larger female cohort to ensure the study's findings are robust and clinically relevant to the majority of MPS sufferers.

In one group, to treat the myofascial trigger points, 1MHz Ultrasound was used in a continuous mode for 5-7 minutes per session on 15 patients. Ultrasound is a non-invasive and commonly used modality with both thermal and non-thermal effects. Its thermal effect enhances the flexibility of collagen fibres, which contributes to decreased stiffness, reduced muscle spasms and pain, and improved blood circulation. The non-thermal effects of Ultrasound produce a segmental analgesic effect, and also 1 MHz therapeutic ultrasound improves cell replication by using non-thermal, mechanical effects (like acoustic streaming and cavitation) to activate cellular mechanoreceptors, which stimulate proliferation pathways in fibroblasts and other repair cells for enhanced tissue healing. The study conducted by Kavadar et al. investigated the same dosage and

frequency of Ultrasound on upper trapezius trigger points and found a significant improvement in pain, as measured with VAS and Algometer. Similarly, the studies conducted by Chiarelli et al., Houghton et al., and Mc Milan et al. found that Ultrasound therapy is highly effective in treating pain, promoting tissue healing, and improving overall musculoskeletal function. The current study compared the changes in pain and stiffness as measured by VAS and PMSDbefore and after 12 sessions of Ultrasound treatment on the myofascial trigger points, and found a significant improvement in VASand PMSD within both groups after the intervention.

The second group received the Myofascial release technique on their myofascial trigger points. Myofascial release is a hands-on soft tissue technique that directly applies force to the involved fascia, loosening tightened structures caused by overuse or stress, thereby relieving symptoms.The therapist locates the taut band, applies sustained, thumb pressure from the origin of the muscleand strokes toward the insertion of the muscle. The key manoeuvre is strumming, where the thumb finger pulls perpendicularly across the muscle fibres over the TrPs.

The study conducted by Werenski J et al. found that applying an appropriate myofascial technique can be a very effective therapy for myofascial pain, and it has shown a decrease in pain and an increase in range of motion for the joint acted on by the affected muscle. The study conducted by Zutshi et al. showed that myofascial release shows greater improvement in pain and pressure threshold.

Upon comparing both groups statistically, there was no significant difference, indicating that both treatments were equally effective.

Conclusion

This present study validated and concluded that both Ultrasound and hands-on manual therapy (Myofascial release) were equally effective in reducing pain and spasm statistically in the student population with active Myofascial Trigger Points (MTrPs). But clinically, myofascial release seems to be more effective in pain relief as well as reducing spasm within a short period, while also being cost-effective, non-invasive, and providing symptomatic relief.

The study uses a small and specific student population, which restricts the generalizability of the findings to broader demographics. Despite the statistical significance achieved, the small sample size (30 subjects) limits the statistical power. Furthermore, while two measures were utilised, the reliance on the subjective Visual Analogue Scale (VAS) for pain and the therapist's perceptual judgment for the Palpable Muscle Spasm Degree (PMSD) introduces potential measurement subjectivity and inter-rater variability. Crucially, the lack of any long-term follow-up means the duration of the pain and spasm relief cannot be ascertained, and the inability to blind the therapist to the manual intervention (Myofascial Release) creates a potential performance bias.

To address these shortcomings, future research should prioritise recruiting a larger, more diverse cohort encompassing various age groups and occupations to enhance external validity. To strengthen the findings, future studies should incorporate a true control or sham group to isolate the specific effects of the therapeutic interventions. Utilising more objective outcome measures, such as pressure algometry or surface electromyography (sEMG), is recommended to provide quantifiable data on muscle spasm and pain thresholds, reducing reliance on subjective assessment and finally, implementing a longitudinal follow-up period.

It is necessary to evaluate the sustained efficacy and recurrence rates of MPS after the treatments, alongside a formal cost-effectiveness analysis to quantitatively support the clinical observation that Myofascial Release is cost-effective.

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