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Comparative evaluation of the efficacy of therapeutic exercise versus myofascial trigger point therapy in the treatment of shoulder tendinopathies: a randomised controlled trial

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ABSTRACT

Objective Shoulder pain, primarily due to rotator cuff tendinopathy, significantly impacts function and quality of life, with considerable socioeconomic implications. Physiotherapy myofascial trigger point therapy (MPT) is traditionally used, but therapeutic exercise (TE) has gained attention for its potential administrative and implementation benefits. The aim of this study was to evaluate the efficacy of TE compared with MPT in treating shoulder tendinopathies.

Methods A single-blind randomised controlled trial was conducted comparing TE and MPT. Outcome measures included pain intensity with the Numerical Rating Scale, pressure pain threshold (PPT) and range of motion (ROM), assessed before and after 10 treatment sessions. A total number of 72 participants (TE group n=36 age 49.22±15.29/MTP group n=36 age 49.03±19.12) participated in the study.

Interventions Participants in both groups were evaluated before treatment and after 10 sessions. A total of 10 sessions were conducted over 5 weeks of intervention.

Results Both interventions showed improvements in pain intensity and ROM, with no significant differences between the groups in most measures except PPT, where TE demonstrated a greater decrease in pressure-induced pain.

Conclusion TE could serve as an alternative to manual therapy, offering cost–benefit advantages, especially in administration via telecare and group sessions, highlighting its broader application in physiotherapy.

Trial registration number NCT06241404.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Supraspinatus tendinopathy affects a high percentage of the population and surgery has not shown an improvement over non-invasive techniques.

WHAT THIS STUDY ADDS

⇒ For this reason, our research focuses on the study of two physiotherapy techniques to see which is the most effective.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Therapeutic exercise has been shown to be the most effective option with a clear cost–benefit advantage for the patient.

INTRODUCTION

Shoulder pain affects up to 50% of the population annually[1] and 16%–21% on a persistent basis.[2] It constitutes the third-leading reason for musculoskeletal consultations in primary care.[1 3] Rotator cuff tendinopathy (RCT) is diagnosed in up to two-thirds of these cases,[4] highlighting its prevalence and clinical significance. Moreover, conditions such as RCT tendinitis and tendinosis are among the most common clinical diagnoses,[5] leading to a reduction in functionality, a decrease in health-related quality of life, impaired sleep and work absenteeism.[6] Consequently, RCT represents a significant medical and socioeconomic burden.[1] The link between mechanical overload and RCT tendinopathy is well documented, with the dominant arm more frequently affected.[6] RCT tendinopathy, particularly involving the supraspinatus and infraspinatus muscles, is the most prevalent, often characterised by chronic pain lasting over 3 months, with uncertain prognosis in the long term.[7]

Conservative management includes rest, non-steroidal anti-inflammatory drugs and exercise, with the latter being strongly supported by evidence.[8] In daily clinical practice, physiotherapists often complement exercise with manual therapy to target specific deficiencies associated with RCT tendinopathy.[9] Nevertheless, there is a lack of evidence in the scientific literature for the effectiveness of these interventions.[8]

Manual therapy treatment strategies for shoulder disorders usually include techniques to deactivate myofascial trigger points (MTPs) and eliminate contributing factors, using manual manipulation, cooling, stretching, dry needling and ergonomic advice.[10 11] Other techniques, such as manipulative therapy, extracorporeal shockwaves and dry needling, are also gathering growing evidence about their effectiveness in RCT management.[12–15] The clinical and biological existence of MTPs is well established,[16 17] with palpation as the sole reliable method for clinical diagnosis.[14] Although MTP therapy is seldom mentioned in reviews on shoulder interventions,[18 19] its use in clinical practice is broadly spread.

Therapeutic exercise (TE) encompasses a range of physical activities designed to restore function, improves mobility, reduces pain and prevents further injury. These exercises are tailored to strengthen the rotator cuff muscles, enhance shoulder girdle stability and improve overall joint mechanics. Moreover, the efficacy of TE as a treatment modality is strongly supported by evidence,[8] indicating its role in not only alleviating symptoms but also in addressing the underlying pathophysiological mechanisms of RCT. By focusing on specific exercises, including stretching, strengthening and conditioning protocols, TE aims to optimise shoulder function and facilitate a return to daily activities and sports with minimal discomfort. This approach aligns with the broader goals of rehabilitation, emphasising patient engagement, education and self-management strategies to achieve long-term outcomes.

This study aims to compare the efficacy of TE versus MTP treatment in shoulder tendinopathies.

METHODS

Study design

A single-blind RCT was conducted to determine the efficacy of TE versus myofascial trigger point (MTP) treatment in shoulder tendinopathies. The variables considered were pain intensity, pressure pain threshold (PPT) and range of motion (ROM), measured before the intervention and after 10 treatment sessions. All participants were required to read and sign an informed consent form, detailing general aspects of the pathology, the procedures to be performed, their risks and their benefits.

After the informed consent forms were signed, participants were randomly divided into two groups to avoid biasing the study's results. This process was carried out using two opaque, sealed envelopes into which individually numbered sheets were inserted for random allocation; the groups were completed until reaching a total of 36 participants each. Initial and final assessments were conducted by a physiotherapist blinded to the patient's allocation to the groups. Compliance with the Helsinki Declaration, the Biomedical Law, the Patient Autonomy Law in Data Treatment, and the Organic Law 03/2018, of 5 December, on Personal Data Protection and Guarantee of Digital Rights was recorded.

Patient and public involvement

Study participants were recruited from the physiotherapy clinic FisioSalud Ávila during February to April; these patients had to be referred by a medical specialist in traumatology and rehabilitation, after making a diagnosis through a set of complementary and orthopaedics tests, determining as a clinical judgement tendinopathy of the supraspinatus and/or infraspinatus. The inclusion criteria of the study were (a) patients from 18 to 75 years with a medical diagnosis of shoulder tendinopathy, (b) shoulder pain symptoms lasting longer than 3 months, (c) pain during Jobe's, Patte's and infraspinatus evaluation manoeuvres (highlighting abduction (ABD) and external rotation (ER)). Exclusion criteria were (a) previous shoulder surgery, (b) radiating pain originating from cervical radiculopathy, (c) shoulder pain associated with other diagnoses (adhesive capsulitis, subacromial syndrome, tendon rupture, posterosuperior impingement…) and (d) neurological disorders or systemic diseases which symptoms could interfere with the aim of the study.

Sample size calculation

The sample size calculation was conducted using GPower V.3.1.9.2 software (GPower, University of Dusseldorf, Germany), with a desired effect size of 0.3 (medium). The objective was to determine the minimum sample size required to detect significant differences between the two groups undergoing different treatments with a power of 80% and a type I error (alpha error) of 5%. A sample size of 64 subjects was required. Assuming a 10% of potential losses, a final sample of 72 participants was recruited for random allocation to the 2 groups.

Intervention

Participants in both groups were evaluated before treatment and after 10 sessions. A total of 10 sessions were conducted over 5 weeks of intervention. An expert physiotherapist performed the interventions assigned to each group and another experienced physiotherapist performed the assessments of the different variables and measurements of the treated patients.

Procedure 1

TE group (n=36): Initially, the selection of exercises included in the intervention was based on a shoulder injury unloading exercise programme, according to Ellenbecker and Cools.[20] The programme consisted of 10 exercises, with patients having access to balls and elastic bands for their performance. Participants performed 3 sets of 10 repetitions (20–30 min), pain-free, two or three times per week, for a total of 10 sessions. The programme description is detailed in online supplemental material.

Procedure 2

MTP group (n=36): The intervention involved treating the MTPs identified in the supraspinatus and infraspinatus muscles of the participants. For this purpose, a specific action protocol was followed based on the following steps:

Table 1 Baseline comparison between groups (sociodemographic, descriptive and outcome measures)

Data	Terapeutic exercise group (n=36)	Myofascial Trigger point group (n=36)	P value
Male/female	21/15	16/20	0.23*
Age, years	49.22 (15.29)†	49.03 (19.12)†	0.48‡
BMI, kg/m^2	22.96 (1.78)†	22.96 (1.72)†	0.49‡
Affected side (right/left)	19/17	19/17	1*
Pathology (both/supraespinatus/infraespinatus)	19/15/2	23/13/0	0.28*
NRT_PRE	8 (2)§	8 (2)§	0.5¶
PPT_PRE, mmhg	2.05(1)§	1.6 (1.4)§	>0.01¶
ROM_Flex_Pre, degrees	145.58 (16.82)†	140.97 (22.29)†	0.16‡
ROM_Ext_Pre, degrees	80.72 (3.65)†	79.22 (4.72)†	0.68‡
ROM_Abd_Pre, degrees	150.5 (48)§	150(35)§	0.87¶
ROM_Add_Pre, degrees	28(4)§	26.5 (3)§	0.34¶
ROM_IR_Pre, degrees	57.19 (9.3)†	58.58 (10.6)†	0.27‡
ROM_ER_Pre, degrees	65.22 (8.12)†	66.06 (8.43)†	0.33‡

For all analyses, a p<0.05 (for a confidence level of 95%) was considered as statistically significant.
*X^2 test was applied.
†Data are expressed as mean (SD).
‡Student's t-test for independent samples was performed.
§Data are expressed as median (IQR).
¶Mann-Whitney U test was applied.
Abd, abduction; Add, adduction; ER, external rotation; Ext, extension; Flex, flexion; IR, internal rotation; NRT, Numerical Rating Scale; PPT, pain pressure threshold; ROM, range of motion.

Patients were treated by physiotherapists experienced in MTP and myofascial pain treatment. The physiotherapist performed palpation of the muscles to be treated and observed a palpable tense band which should present a nodule that on pressure should have a rich pain on palpation, referred pain and muscle shortening.[15 21] The treatment began with the deactivation of active MTPs using manual ischaemic compression techniques on the trigger point, followed by passive stretching of the area, and finally, combining it with the application of heat through microwaves for approximately 10 min, as per Simons *et al*,[21] to further deactivate the MTPs, producing a desensitising effect and facilitating muscle stretching.

All these steps were performed in the same session, carried out two or three times a week, until completing the 10 treatment sessions.

Outcome measures

Pain intensity: To measure pain intensity, the Numerical Rating Scale (NRT) was used. The value '0' represents no pain, and at the other end, the value '10' represents the most intense pain imaginable.[22]

PPT of the supraspinatus and the infraspinatus. Measured using a pressure algometer, a device that applies controlled force to the evaluation point, the Wagner FORCE DIAL FDK 60 analogue algometer (Canada). The patient indicates when the pressure becomes painful, and the pressure value is recorded.[23]

ROM of flexion, extension, ABD, adduction (ADD), internal rotation (IR) and ER measured through goniometry.[22]

Statistical analysis

The statistical analysis of this study was performed using IBM SPSS software (SPSS V.24). Initially, the Kolmogorov-Smirnov test was applied to assess normality. Descriptive statistics for all variables were then compiled, and the homogeneity of both intervention groups in the baseline was assessed through a χ^2 test for categorical variables and either t-test for independent samples or Mann-Whitney U test depending on the distribution obtained in the normality tests. Finally, to assess the intra and inter group variations for the parameters recorded prior to the intervention and following 10 sessions, an analysis of variance for repeated measures was used, using the Greenhouse-Geisser correction when sphericity was rejected by the Mauchly test. For effect size estimation, η^2 coefficient was employed. Correlation between variables was explored using Person correlation for data following a normal distribution and Spearman's correlation coefficient for non-normal distributions.

RESULTS

A total number of 72 participants (TE group n=36 age 49.22±15.29/MTP group n=36 age 49.03±19.12) participated in the study. The analysis of the descriptive data at

Table 2 Efficacy of both interventions

Outcomes (n)	Pre Mean (SD)	Post Mean (SD)	Time F (df); p; η^2	Group×time F (df); p; η^2
NRT			F(1)=238.37; **p<0.001**; 0.77	F(1)=0.554; p=0.45; 0.008
TE group (36)	7.56 (1.13)	5.14 (1.15)		
MTP group (36)	7.75 (0.96)	5.56 (1.18)		
PPT			F(1)=22.53; **p<0.001**; 0.24	F(1)=14.79; **p<0.001**; 0.17
TE group (36)	2.45 (0.66)	1.47 (0.76)		
MTP group (36)	1.75 (0.89)	1.64 (0.89)		
ROM Flex			F(1)=95.69 ; **p<0.001**; 0.57	F(1)=0.13; p=0.72; 0.002
TE group (36)	138.86 (17.91)	158.81 (15.28)		
MTP group (36)	135.31 (21.21)	153.83 (17.68)		
ROM Ext			F(1)=76.15; **p<0.001**;0.52	F(1)=0.89; p=0.34; 0.01
TE group (36)	79.78 (3.57)	83.33 (3.37)		
MTP group (36)	77.67 (4.21)	80.53 (4.74)		
ROM Abd			F(1)= 74.35; **p<0.001**; 0.51	F(1)=0.36; p=0.54; 0.005
TE group (36)	133.69 (23.62)	152.64 (21.22)		
MTP group (36)	132.42 (21.34)	154.22 (19.84)		
ROM Add			F(1)=37.68; **p<0.001**;0.35	F(1)=0.004; p=0.95; 0
TE group (36)	27.25 (2.03)	28.61 (1.6)		
MTP group (36)	27.11 (1.78)	28.50 (1.59)		
ROM IR			F(1)=105.1; **p<0.001**; 0.6	F(1)=2.5; p=0.11;0.36
TE group (36)	51.72 (7.79)	62.97 (7.79)		
MTP group (36)	54 (9.36)	62.19 (8.5)		
ROM ER			F(1)= 51.09; **p<0.001**; 0.42	F(1)=0.08; p=0.77; 0.001
TE group (36)	63.25 (8.38)	70.92 (11.1)		
MTP group (36)	62.33 (8.51)	69.42 (8.33)		

Time effect and group×time effect.
Abd, abduction; Add, adduction; Df, degrees of freedom; ER, external rotation; Ext, extension; Flex, flexion; IR, internal rotation; NRT, Numerical Rating Scale; PPT, pain pressure threshold; ROM, range of movement.

baseline did not show statistically significant differences between both groups, except for PPT, as can be shown in table 1.

Regarding the efficacy of both interventions, no statistically significant differences were found between groups in the postinterventions assessment, except for the PPT variable (p<0.001) with a large effect size (η^2=0.17). The values were decreased in postintervention assessment, indicating significantly higher pressure-induced pain in the TE group postintervention. Concerning the time effect, both groups improved significantly in all measured variables as can be seen in the table 2.

Correlations of interest show no statistically significant results except for NRT, which was negatively correlated with ER ROM (p=0.02), tested with Spearman's r correlation coefficient.

DISCUSSION

The results of this study involving NRT are consistent with previous research, such as the study by Dejaco *et al*.[24] These authors reported improvements in the pain intensity scale (Visual Analogue Scale) after a TE intervention with isometric and eccentric exercises 6–12 weeks after intervention, same as Augusto *et al*[25] in their 5-week intervention programme. Some authors, such as Bohm *et al*,[26] suggest that TE programmes longer than 12 weeks are more beneficial for tendon adaptation. Moreover, the prevalence of myofascial trigger points (MTrPs) in various muscles of patients with mild to moderate knee osteoarthritis highlights that pain was poorly correlated with the prevalence of latent and active MTrPs in the hamstring muscles, and disability was moderately correlated with the number of latent MTrPs in the tensor fasciae latae.[27] This emphasises the complexity of pain modulation in tendinopathy and the potential necessity for multifaceted therapeutic approaches. In the light of the results of the present study, congruent with previous scientific literature,[24 25] the benefits of TE shorter programmes have also to be considered. Şenbursa *et al*[28] compared a combination of three groups, comparing a home-based

TE programme versus in-person TE with and without manual therapy intervention. Their results also showed a statistical decrease in pain intensity from before to after treatment in the pain intensity score, with no intergroup differences, as in the present study.

Regarding ROM, Bron *et al*[29] described an MTP intervention involving ischaemic compression, manual stretching and intermittent cold application, which did not significantly alter shoulder ROM in patients with chronic pain (more than 6 months) compared with a control group. These results are discrepant with the present study, which showed improvement in ROM in both groups. The reasons for this discrepancy may be related to the previous ROM of the patients of Bron study, which could be already functionally adequate in chronic patients, due to daily living adaptations through time. TE efficacy in improving ROM in RCT has been reported by several authors using various combinations of exercise types,[24 30] which is coincident with the present study.

As for PPT, Cagnie *et al*[31] showed that a 4-week ischaemic compression treatment significantly improved sensitivity to pressure pain in chronic pain patients. Aksan *et al*[32] noted a significant increase in PPT for all muscles except the supraspinatus, attributed to its relatively small size and deep location. Contrary to these studies, our research found decreased PPT in both groups, with statistical differences between them, showing a larger decrease in TE group. This highlights the complexity of pain modulation in tendinopathy. Müller-Ehrenberg *et al*[33] reported how diagnostic shockwaves can affect pain sensitivity due to different mechanical stimuli. In addition, Tsai *et al*[34] show that the physical characteristics of trigger points, such as size and elasticity, can significantly impact treatment results. Kardes *et al*,[35] in their study, explored how taping techniques, which alter the physical context of trigger points, can also vary pain perceptions. Moreover, the complexity of myofascial pain syndromes, which involve factors like local ischaemia and neurotransmitter release, may explain the diverse effects of MTP therapy.

Clinical implications

The main findings of this study indicate that both groups improved significantly in NRT and ROM values. Regarding intergroup comparison, the results of this study did not show any statistically significant differences in all variables except for PPT, which was decreased in both groups, with lower scores in the TE group. In recent years, chronic musculoskeletal pain has emerged as a significant global health concern, affecting millions of individuals worldwide and imposing a substantial burden on both individuals and society.[36] This condition refers to persistent pain experienced in the bones, joints and tissues of the body for a duration longer than 3 months. Many clinicians have turned to the biopsychosocial model in recent years, recognising that pain is not solely determined by biological factors but is also influenced by psychological, social and environmental factors. Research indicates that telerehabilitation programmes addressing musculoskeletal, cardiac and neurological disorders provide comparable outcomes to traditional, in-person physiotherapy sessions in terms of functional improvement and quality of life enhancements.[37 38] Additionally, TE administered in a group setting not only fosters physical rehabilitation but also confers psychosocial benefits, which are indispensable for the patient's recovery and overall quality of life.[39]

Limitations

This study has some limitations that should be acknowledged, including the study's short duration of 5 weeks, potentially insufficient for observing long-term effects; the exclusive focus on objective measures without considering subjective patient-reported outcomes. These factors suggest the need for further research with extended durations, and the inclusion of subjective outcomes. Furthermore, the results of this study may have to be taken cautiously due to the high average age of participants in this sample, as many factors in older people can interfere in the integrity or condition of the anatomical structure (biochemical, visceral pain…).[40] Further studies could include other measures of pain such as objective questionnaires (SPADI, Penn Shoulder Score) in order to have a more accurate report on patient's level of pain. Finally, the duration of the effects of the intervention was not recorded. Future studies, including a follow-up protocol, would be needed to explore the duration of the obtained benefits. Finally, the possible contribution of biopsychosocial factors to the pain chronification in RCT should be explored

CONCLUSION

The integration of TE in physiotherapy clinical practice, which is traditionally linked to manual therapy interventions, needs to be considered. TE administration, particularly through telecare and group exercise formats, offers a multifaceted approach to patient care that extends beyond physical improvements to include psychosocial benefits and cost savings.

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