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Comparison of Muscle Energy Technique, Myofascial Release, and Combined Techniques for Glenohumeral Internal-Rotation Deficit. An Interventional Study

Comparación de Técnica de Energía Muscular, Liberación Miofascial y Técnicas Combinadas para el Déficit de Rotación Interna Glenohumeral. Un Estudio Intervencionista

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SUMMARY: This study aimed to determine the benefits of a combined technique of muscle energy with and myofascial release more effective than using each in isolation in glenohumeral internal rotator deficits. An interventional study was designed for this study. Thirty-eight patients were diagnosed with painful shoulder syndrome. Patients were randomly allocated into 4 groups where Group A was treated with combined muscle energy and myofascial release; Group B with muscle energy technique; Group C with myofascial release and Group D used as control. The evaluation of the passive joint range of the glenohumeral internal rotation and sociodemographic data for each of the groups were measured, before and after interventions. Despite the use of myofascial release and muscle energy techniques being significantly beneficial in their respective groups, when both were combined; it outcomes were highly successful. A combination therapy treatment applied with the Muscle Energy and Myofascial Release Techniques in patients with painful shoulder syndrome will be more effective in increasing the range of motion of the glenohumeral internal rotation joint than any of the techniques applied individually.

KEY WORDS: Shoulder; Shoulder impingement syndrome; Myofascial release therapy; Range of motion articular.

INTRODUCTION

The shoulder is considered one of the most complex joints as it is the basis for the movements of the entire upper limb. Particularly, the muscles that surround the glenohumeral (GH) junction allow it to have exceptional angular torques for sports activities (Challoumas *et al*., 2017). Also, their synchronic activity produces suitable precision for workers who use the entire upper body (Dallalana *et al*., 2016). Overuse and constant movement of the syn-synergy mechanism between external and internal GH rotators can lead to frequent symptomatology and illness around this joint. While injuries of the supraspinatus muscle (Oñate Miranda & Bureau, 2019), or the proximal biceps brachii tendon are the most commonly reported in shoulder disorders, findings to resolve internal rotator dysfunction have rarely been reported.

The glenohumeral internal-rotation deficit (GIRD) Involves a maladaptive mechanism from muscles and capsular stiffness (Guney *et al*., 2016) in a repetitive movement that goes from an external to an internal rotation during arm throwing (Kibler *et al*., 2012) or overhead shoulder activities (Lintner *et al*., 2007). The GIRD reduces all motor tasks regarding bringing the arm behind the trunk for toileting and putting on a jacket, among others (Aleem *et al*., 2020). Physical therapy based on relieving pain shoulder range of motion (ROM) remains on re-establish peripheral structures of this joint (Longo *et al*., 2020). Nonetheless, therapeutic programs focused mainly on the symptomatology from the external component of the shoulder. So, underestimating restriction from GIR-ROM could increase dysfunction from the more complex arm displacement, where physical diagnosis could

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not have noticed such internal muscles' importance (Aleem *et al*., 2020). Therefore, knowledge about the best treatment method for these internal structures would be considered a part of the entire integrity of shoulder rehabilitation.

Some of the best techniques observed by a literature review, despite shoulder dysfunctions, would be especially twofold: Myofascial Release (MFR) and Muscular Energy Techniques (MET). The first one involves a myofascial massage by the hand of a physiotherapist (Ceca *et al*., 2017). The second one consists of an osteopathic manipulation of the GH joint (Chaitow & Hartman, 2007). Both techniques used much more comprehensive treatment management independently. Although these therapies by themselves have shown practical and positive outcomes, there is a lack of knowledge if both would be utilized mixed. Also, most of such evidence has been worked exclusively on the external component of the muscular shoulder, despite the unknown result of combining such strategies on the GIRD. Therefore, the objective of the present study was to compare the effects of the combined or individual application of muscle energy and myofascial release techniques in the ranges of GIR, in patients with painful shoulder considered a clinical sign present in this type of pathological picture. In addition, we also hypothesized that a combined therapy treatment applied with muscular energy and myofascial Release Techniques in patients with painful shoulder syndrome will be more effective in increasing the range of joint movement of internal GIR than any of the applied techniques individually.

MATERIAL AND METHOD

Design. An interventional study was designed for this purpose based on the TIDieR protocol (Hoffmann *et al*., 2014).

Participants: Thirty-eight subjects were recruited, both men and women between 18-60 years, with a diagnosis of painful shoulder syndrome and GIRD. They were patients from the physiotherapy clinical centre of the local university. To be included in the study, subjects had to have a loss of internal rotation >20° compared to the contralateral shoulder following the protocol of Rose & Noonan (2018). Subjects were excluded when they had a history of surgery or fractures of the shoulder joint complex, radiculopathies, or cervicobrachialgia. All participants signed an informed consent approved by the university ethics committee (CEC UST N° 84/2018).

Thirty-eight individuals were called to participate in this research, finally, there were only 32 with the inclusion criteria. So, they were randomized into 4 groups: three interventional groups and another one as control. Group “A” used a combination of myofascial release and muscle energy. Group “B” was intervened by the muscle energy technique alone. Group "C" used the myofascial release technique, leaving the control group (D) with traditional physical therapy intervention (Fig. 1). Each group was distributed with a completed allocation system (Bailey, 2008).

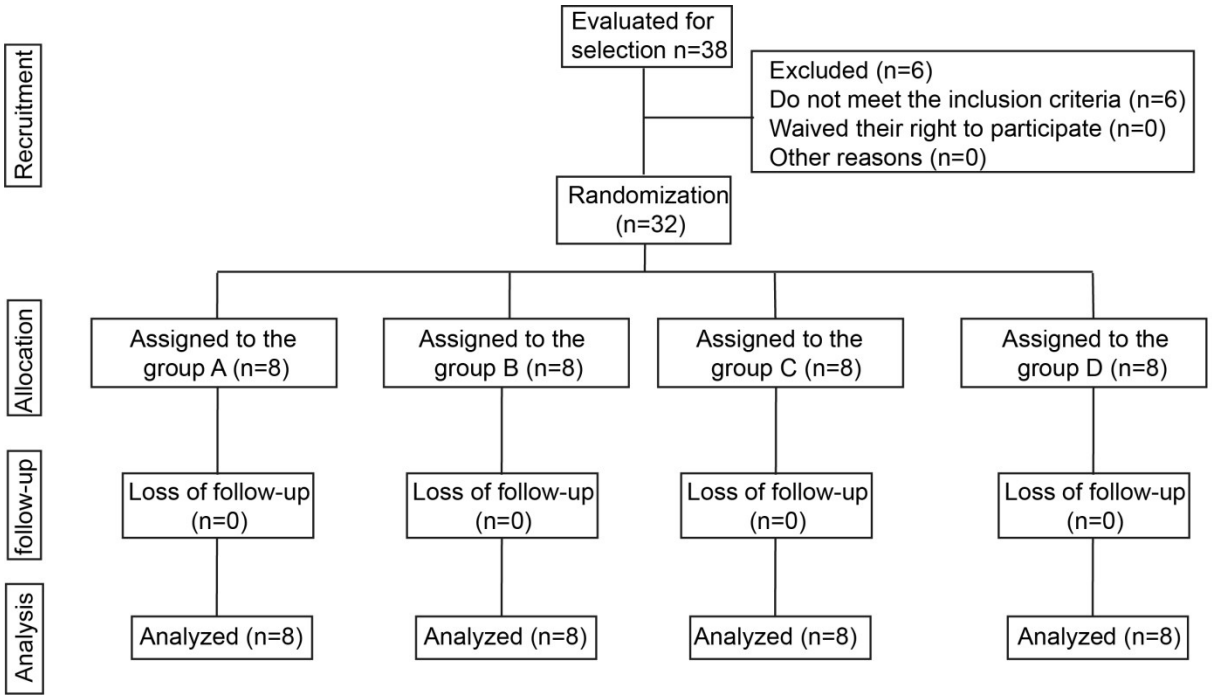

Fig. 1. Flowchart entry and follow-up of study participants according to TIDieR Protocol.

Instruments of measures. An evaluation sheet was used to collect the data, such as sex and age, and to record the results of each variable, in addition, a PASCO Scientific Electrogoniometer "EGM" (PS-2137, PASCO INC., HUD, USA) was used, which records angle, angular velocity, and angular acceleration of a joint, that consists of two potentiometers. Data was sent digitally to a PASPORT interface at a sampling rate of 100 Hz. The PASCO EGM was used in conjunction with an angle sensor (PS-2139) and a USB Link interface (PS-2100A) to connect to the computer by Data Studio software.

Proceedings. The glenohumeral internal rotation range (GIRD) was measured with the PASCO Scientific electrogoniometer on each subject. The protocol for measured GIRD was with the subjects in a supine position and their arm abducted at 90 °, the elbow in flexion at 90 °, with the forearm in pronation and vertical position (Mullaney *et al*., 2010). The reading was taken with the movement of the patient's forearm from its 90 ° neutral vertical position and directing it forward (Tyler *et al*., 2014).

Intervention. An intervention program of eight sessions was applied to all groups, twice a week for 20 minutes each session. All intervention techniques were focused on the supraspinatus, infraspinatus, and teres minor muscles from the rotator cuff of the shoulder with GIRD. Each session began and ended with the measurement of the GIR range using the EGM. In Group A, the intervention started with 7.5 minutes of Ischemic Compression Myofascial Release and then 7.5 minutes of Contraction-Relaxation Muscle Energy (Chaitow & Crenshaw, 2006; Schleip *et al*., 2012). Group B applied the muscle energy technique for the aforementioned muscles for 7.5 minutes according to the protocol of Chaitow (Chaitow & Crenshaw, 2006). Group C was treated by myofascial release from ischemic compression through the protocol observed in Schleip *et al*. (2012). Group D used conservative techniques consisting of physiotherapy and passive and active therapeutic mobilizations in the shoulder joint complex (Neha *et al*., 2017). For each intervention, 5 minutes of rest were used after each technique.

Outcome measures

Primary outcome: It corresponds to the evaluation of the passive joint range of the GIRD for each participant from all groups, before and after interventions.

Secondary outcome: Description of sociodemographic data such as age, sex, weight, height, and muscle mass index, for the 4 groups.

Data analysis. Descriptive statistics were used to report sociodemographic variables. Inferential statistical analysis proceeded with the mean and Standard Deviation (SD) or raw data from secondary outcomes. To verify a similar baseline from initial ROM from all groups, the normality was analyzed by the Shapiro-Wilk test. Homogeneity was verified from initial ROM exams (p=.7). The multiple group analysis was obtained by two-way ANOVA through the group factor (A, B, C, and D) and pre and post-ROM tests. For the post hoc analysis, the Holm-Sidak multiple comparison method was used within and between groups. Any significant difference was indicated when $p < .05$. Finally, the effect size from each intervention, compared with the control one was calculated with the Cohen´d method.

RESULTS

Regarding sociodemographic outcomes, group A had participation of 3 females and 5 males. This group had a mean and SD for the age of 44.5±9.7 years, a weight of 72.2±7.1 kg, and a height of 1.71±0.4 m. For group B, 5 women and 3 men participated. The description of their mean and SD for age was 38.6±4.7 years, weight 71±6.5 kg, and height 1.70±0.2 m. Group C consisted of 4 females and 4 males. Their mean and SD for age was 40.3±9.6 years, weight 76±12.1 kg, and height 1.75±0.7 m. Group B consisted of 3 females and 5 males. Their mean and SD for age was 43.2±4.3 years, weight 78.3±5.4 kg, and height 1.77±0.3 m.

Figure 2 shows the bars of GIR-ROM from media and SD of pre-and post-intervention in each group. Figure 3 shows the "differences" between pre and post-intervention GIR-ROM from all groups. The two ways ANOVA showed a significant difference for the comparison of ROM from factor group ($F(3 , 31)$ 46.2; $p<.001$), as well as from pre and post-test factor ($F(2 , 31)$ 19.1; $p<.001$). The Post Hoc analysis between groups showed a large magnitude difference in group A compared with the other ones (all $p<.05$). Also, inside each group, the Post Hoc revealed significant differences in the mean of GIR-ROM, in Group A, from 38.3±6.1° to 71.8±6.8° (difference of -33.6°, $p<.001$). Group B similarly showed a significant difference between the initial (43.6±9.2°) and final assessment (58.9±11.2°) with a difference of -15.2° ($p<.05$). Group C, showed between pre-and post-intervention of ROM, a significant difference of -11.5° (pre: 38.4±11.7°, post-intervention: 49.9±10.1, $p<.05$). However, the difference between pre (29.7±10.8) and post-intervention (36.1±12.2°) in the GIR-ROM group did not produce significant difference (-6.4°, $p>0.05$) at the end of 6 weeks.

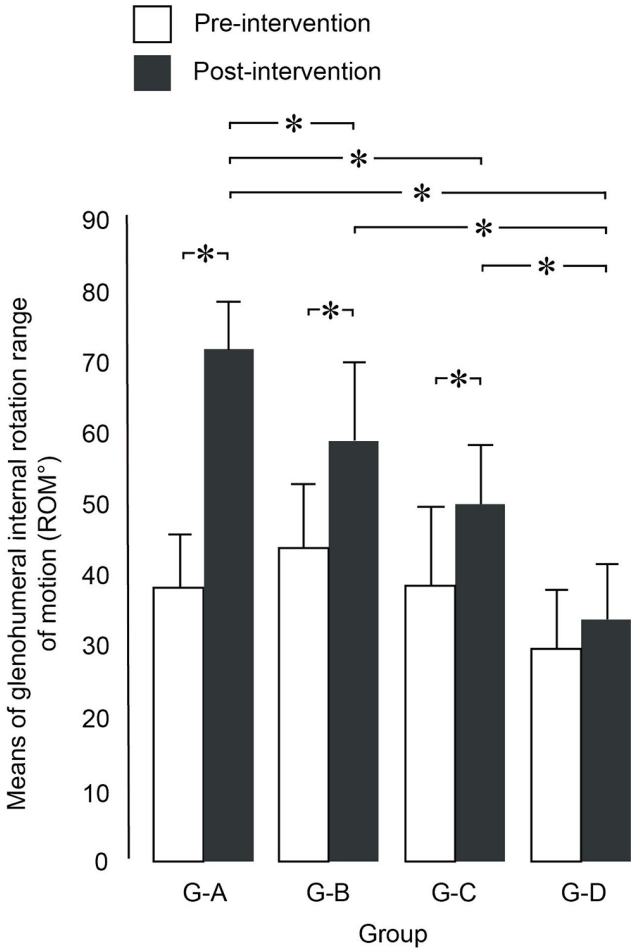

Fig. 2. Mean and standard deviations from pre (white bars) and post (grey bars) intervention of glenohumeral internal rotation range of motion of all groups. G-A= group with mixed MFR & MET intervention. G-B=group with MFR; G-C= group with MET, and G-D= groups with standard physiotherapy.

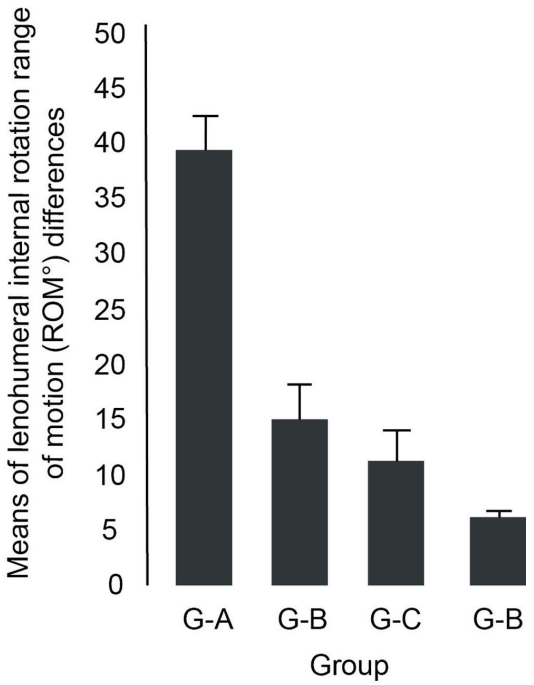

Fig. 3. Mean and standard deviations from the pre and post-intervention differences of glenohumeral internal rotation range of motion of all groups. G-A= group with mixed MFR & MET intervention. G-B=group with MFR; G-C= group with MET, and G-D= groups with standard physiotherapy.

The intergroup analysis from the post hoc test, regarding the outcomes of ROM after the intervention was categorical when combined techniques (Group A) were compared among the others ($p<.001$). Also, the group B (MFR) final ROM was significant difference compared with group C (MET) ($p<.05$). Both techniques showed an increase in ROM compared with the control group (both $p<.05$). Finally, according to Cohen test, Group A performed the highest effect size ($d=3.8$), despite that group B ($d=1.4$) and C ($d=2.6$) demonstrated a great effect size as well.

DISCUSSION

This interventional study compared the use of different techniques to increase GIR- ROM restriction in 32 patients with similar conditions. Although the use of MFR and MET was significantly beneficial in their respective groups, the outcomes were highly successful when both were combined. However, MFR was revealed to be better in ROM increasing, compared with MET. Interestingly, after 6 weeks of intervention, all experimental groups (A, B, and C) showed better results compared to the conventional physical therapy group (C).

If we analyzed both experimental techniques (MFR and MET) separately, classical benefits have been reported by previous results in both, increasing overall ROM of the shoulder, compared with control groups. For instance, positive effects that have been shown by MFR in these patients are related to the results presented by Velázquez-Román (2009) in which an increase in joint width was obtained in normal ranges. In addition, when this group is combined with the MET, improvements were obtained in the range of movement and functionality of the affected shoulder. This further increased the ranks of the Combined Techniques group. These authors concluded that these techniques play an important role in joint stability, range of motion, and motor control when working at the myofascial and muscular levels. Its effects are short-term and its main benefits are muscle relaxation and increased range of motion.

About the group with the MET, a significant increase in the GIR-ROM was observed, as demonstrated by Moore & Sellon (2021), in professional baseball players basing these techniques on a voluntary contraction of the muscle, which stimulates the Golgi tendon organ effectively and generates a reflex inhibition of the antagonist's muscles, producing an increase in the GIR-ROM. Therefore, in the results of the group with the MFR, a significant increase in the GIR-ROM was observed, as was shown in the study of Neha *et al*. (2017), which shows that this technique delivered a favorable response in the release of adhesions and elongation of the fascia, allowing the myofascial tissue to increase in length and relax, thus generating an increased range of motion.

Once we combined MFT with MET, the results in group A were increased by almost twice that both techniques were increased almost twice than those used individually. According to a greater gain of GIR-ROM, just a lack of previous reports has been seen declared such increases (Sata, 2012; Parab & Pattanshetty, 2019). Although those combined benefits from mechanical with neurophysiological theories have been shown, the tendency inside rehabilitation seems to prefer separate forms of treatment. This could be chosen from physiotherapists based on their personal experience with one or the other preference, using manipulation or increases of neural reflex support to release fascias (Rao & Pattanshetty, 2022). However, the goal of functional results that involved ROM restriction was less indicated during the intervention.

Regarding the strengths of this study, it is that an area that has not been fully studied was covered, which is the application of the MR Techniques and the MET in combination, which evidenced positive changes in the study subjects. Another aspect to highlight is the adherence that the subjects maintained to the treatment since they complied with the eight scheduled sessions, another aspect to highlight is that this technique is low cost, since as the main tool you only need the hands of the therapist, in addition to It can be done anywhere, whether it is a consultation, clinic, hospital or even at home. It is not an invasive technique and does not produce negative effects on the patient.

The limitation that this study presented was the small sample (N = 32), especially in the number of participants for each group (N = 8). Another weakness is that the control group has not been more restricted in its therapy, since the conservative treatment received was also significant at the end of the treatment sessions. We consider that these aspects would be it is important to continue researching and improving future studies to deliver an effective, non-invasive, and low-cost treatment for patients with GIRD.

To sum up, a combination therapy treatment applied with the Muscle Energy and Myofascial Release Techniques in patients with GIRD will be more effective in increasing the range of motion of the glenohumeral internal rotation joint than any of the techniques applied individually. It is suggested to continue carrying out more research with a larger sample, and a greater control of the group with conservative treatment, to objectify the clinical effectiveness and compare the effects achieved with other procedures.

FRANCINO, G.; MORENO-REYES, P.; PASTÉN-HIDALGO, W.; CONTRERAS, S.; ESPINOZA, V.; PENA, C. &, JIMÉNEZ, S. Comparación de técnica de energía muscular, liberación miofascial y técnicas combinadas para el déficit de rotación interna glenohumeral. Un estudio intervencionista. *Int. J. Morphol., 42(3)*:735-740, 2024.

RESUMEN: Este estudio tuvo como objetivo determinar los beneficios de una técnica combinada de energía muscular con liberación miofascial más efectiva que usar cada una de manera aislada en los déficits de los músculos rotadores internos glenohumerales. Para este estudio se diseñó un protocolo de intervención. En 38 pacientes se diagnosticó síndrome de hombro doloroso. Los pacientes fueron asignados aleatoriamente a 4 grupos; el grupo A fue tratado con energía muscular combinada y liberación miofascial; Grupo B con técnica de energía muscular; Grupo C con liberación miofascial y Grupo D utilizado como control. Se midió la evaluación del rango articular pasivo de la rotación interna de la articulación glenohumeral y datos sociodemográficos de cada uno de los grupos, antes y después de las intervenciones. A pesar de que el uso de técnicas de liberación miofascial y energía muscular resultó significativamente beneficioso en sus respectivos grupos, cuando ambas se combinaron; Sus resultados fueron muy exitosos. Un tratamiento de terapia combinada aplicado con las Técnicas de Energía Muscular y Liberación Miofascial en pacientes con síndrome de hombro doloroso será más efectivo para aumentar el rango de movimiento de la articulación de rotación interna glenohumeral que cualquiera de las técnicas aplicadas individualmente.

PALABRAS CLAVE: Hombro; Síndrome de pinzamiento del hombro; Terapia de liberación miofascial; Rango de movimiento articular;

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