Patients With Primary Frozen Shoulder Contracture Syndrome: A Case Series Using Manual Therapy and Home Stretching Programmes

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ABSTRACT

BACKGROUND: Although there is no proof to favour one type of manual therapy over another, it has been shown to help patients with frozen shoulder contracture syndrome (FSCS) by reducing pain and improving function. This case series details the immediate and long-term effects of a manual therapy programme and at-home stretching exercises tailored to the individual shoulder mobility limitations and tissue irritability levels of FSCS patients.

CASE DESCRIPTION: A personalized, multimodal manual therapy approach was used to treat eleven patients with primary FSCS. once a week for twelve visits, in addition to one daily, five days a week at-home stretching routines.

At baseline, posttreatment, six months, and nine months, the afflicted shoulder's pain, disability, range of motion (ROM), and muscle strength were evaluated.

OUTCOMES: After treatment, patients reported significantly better shoulder range of motion, strength, and self-reported pain and disability. Furthermore, 4 out of 11 patients exhibited pain. Improvements on the visual analog scale following the intervention that were greater than the minimal clinically important difference (MCID), and eight out of eleven reported reduced pain at six and nine months. Furthermore, Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire scores improved for 7 out of 11 patients, surpassing the MCID both postintervention and at 6 months, and 8 out of 11 patients exceeded the MCID at 9 months.

DISCUSSION: Eleven patients with primary FSCS who received individualized treatment that included stretching exercises and manual therapy techniques while taking tissue irritability into consideration showed clinically significant improvements in shoulder pain and disability, range of motion, or muscle strength.

KEY WORDS: manipulation, mobilization, pain, frozen shoulder, case series.
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INTRODUCTION

A common musculoskeletal condition known as frozen shoulder is characterized by a progressive loss of glenohumeral joint active and passive mobility. Many pathological alterations have been linked to this restriction, such as neovascularity in the rotator interval, reduced joint volume, coracohumeral ligament and anterior-inferior capsule (axillary recess), and rotator interval thickening and fibrosis.

Patients with frozen shoulders have been found to have deficiencies in both external and internal rotational muscle strength in addition to limited range of motion. A more accurate term for the condition has recently been proposed: frozen shoulder contracture syndrome (FSCS), as evidence for capsular adhesions to the humeral head has been disproved.

According to conventional wisdom, the natural history of FSCS is self-limiting and progresses in three stages: painful, stiff, and recovery. Full recovery is expected to occur without medical intervention. This assumption is not always validated, though, as a recent systematic review found that initial gains in shoulder function and range of motion (ROM) slowed down over time, potentially leading to long-term limitations that lasted for several years.

For this condition, a variety of physical therapy interventions, including manual therapy techniques, have been studied. The goals of manual therapy techniques are to improve range of motion and restore the shoulder capsule's normal tissue extensibility. In fact, angular mobilizations, Mulligan's mobilization-with-movement (MWM) techniques, and Maitland techniques—which include high-grade, low-grade, end-range, and midrange passive mobilization techniques—have all been shown in multiple studies to have positive effects on pain and mobility in patients with FSCS. Nonetheless, there is no evidence to favor one type of manual therapy over another, per evidence-based recommendations and clinical practice guidelines. Furthermore, it is yet unknown what the ideal dosage and schedule for manual therapy treatments are.

Previous FSCS research employed manual therapy methods, primarily utilizing a protocol-based approach. It is thought that more of the patient's needs are met by customized strategies. The possible advantages of a customized treatment plan made for each patient with FSCS, however, are unclear.

Guidelines for clinical practice have emphasized how crucial it is to take tissue irritability into account when treating patients with FSCS. Expert consensus has established three tiers of irritability: high, moderate, and low. These tiers are based on the patient's reported level of disability, active and passive mobility behavior, and the degree and frequency of pain. It is advised that clinicians modify their FSCS treatment plans according to the tissue irritability stage in order to modify the direction of mobilization and apply the proper amount of physical stress to the tissue at each stage. It has been suggested that shoulder rotation should take precedence over forcing the shoulder into uncomfortable and constrained flexion ranges in order to restore shoulder mobility in patients with FSCS. In addition to increasing the patient's pain, forced flexion may exacerbate inflammation and damage to the periarticular tissues. This idea states that the specific soft tissue restrictions identified during the assessment of passive shoulder internal and external rotation serve as the basis for manual therapy interventions. As far as we are aware, this biomechanical approach has only ever been documented in case studies; however, the idea of tissue irritability level has never been discussed in relation to the treatment of FSCS patients.

The objective of this case series was to provide a detailed account of the immediate and long-term results following the implementation of a combination of manual therapy techniques targeting the range of motion (ROM) in both internal and external rotation, along with a home stretching exercise program, in patients with Frozen Shoulder Capsulitis (FSCS). The physical therapists' clinical-reasoning approach was primarily guided by the perceived tissue irritability.

CASE DESCRIPTION

Patient:

Between September 2015 and June 2016, the Department of Physical Therapy at the University of Valencia in Spain received referrals from primary care physicians for eleven consecutive patients diagnosed with primary FSCS. These patients were then screened to determine their eligibility.

The criteria for inclusion in the study were as follows: the presence of Frozen Shoulder Capsulitis Syndrome (FSCS) without any connection to a systemic condition or previous injury, a decrease in passive external rotation of more than 50% compared to the unaffected shoulder or less than 45° of external rotation, a loss of range of motion (ROM) of more than 25% in at least two movement planes compared to the unaffected shoulder, and the presence of pain and restricted movement that persisted or worsened for a minimum of one month.

Patients were not included in the study if they had any of the following: prior shoulder surgery; a partial or complete tear of the rotator cuff as seen on ultrasound or MRI; frozen shoulder caused by other factors such as arthritis, stroke, or fracture; calcification as shown on X-ray or ultrasound; issues with the biceps tendon or acromioclavicular joint; or any medical or psychological conditions like cancer, rheumatoid arthritis, or major depression.

Every patient was permitted to maintain their regular medication. Before being included, none of the patients had undergone a corticosteroid injection in their affected shoulder or experienced satisfactory outcomes (improvement in mobility, pain, or function) from previous physical therapy or any treatment administered by their general practitioner. The physical therapy treatment comprised of analgesic modalities such as transcutaneous electrical nerve stimulation and cryotherapy, along with general exercises and manual therapy techniques.

Written consent was obtained from all eligible patients who met the inclusion criteria, ensuring the protection of their rights. The Institutional Review Board at the University of Valencia (Spain) granted approval for this study.

Physical Therapists:

All of the baseline and follow-up assessment measurements were completed by a single physical therapist (E.L.G.), who has 20 years of clinical experience. The outcomes of the previous measurements were hidden from the physical therapist. All manual therapy procedures were carried out by a second physical therapist (M.B.B.), who was blind to the assessment results and board certified in orthopaedic physical therapy with ten years of clinical experience.

The physical therapist (M.B.B.) who carried out the intervention had a three-hour session with one of the authors (E.L.G.) prior to the study to receive specialized training in the use of the interventions. The treating physical therapist was given instructions during this training session to accurately perform all manual therapy techniques, including pilot treatment on two healthy individuals. A treatment booklet detailing the methods and specifics of each intervention included in the study was also given to this physical therapist.

Evaluation Procedure:

Assessments were conducted at three different times: three months after the intervention period (posttreatment), six months after the intervention period (posttreatment), and nine months after the baseline. Every patient answered questions about their medication use and sociodemographic information on a standard medical history questionnaire. Measures of muscle strength, active range of motion and active ROM with overpressure, and shoulder pain and disability were all part of the examination. Open-ended questions were utilized to document adverse effects. Any unfavorable follow-up experience that necessitated further interactions with the healthcare system (physical therapist, general practitioner, or hospital) was considered an adverse effect.

Outcome Measures:

Pain and Incapacity in the Shoulders A 100-mm visual analog scale (VAS), with 0 representing "no pain" and 100 representing "the worst imaginable pain," was used to measure shoulder pain. In this study, the average patient pain during the 24 hours prior to assessment was taken into account for the VAS assessment. For the VAS, the estimated minimal clinically important difference (MCID) is 30 mm.

The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, which can be self-administered, was used to measure shoulder

disability. The DASH is a 30-item assessment that is scored from 1 to 5, with higher scores indicating more severe symptoms. It also includes two optional sections that address the impact of pathology on sports and work. Next, a scale from 0 to 100 (worst score) was created using the total score (30 to 150). The DASH in Spanish has demonstrated strong construct and criterion validity, high internal consistency (Cronbach α =.96), good test-retest reliability (r = 0.96), and excellent treatment responsiveness.19 The DASH has an MCID of 10.2 points.

Shoulder Range of Motion In accordance with earlier recommendations, shoulder range of motion was assessed using a Plurimeter-V gravity inclinometer (Dr. Rippstein, Zurich, Switzerland). The Plurimeter-V measures ROM with a 1° interval13 and has a standard error of measurement ranging from 1.7° to 5.2°.

Patients were measured in a relaxed standing position for shoulder flexion and abduction of the affected shoulder, as well as for active range of motion and active range of motion with overpressure. In order to prevent excessive compensation from the thoracic or lumbar spine, patients were instructed to move their shoulder to its maximum flexion and abduction until they experienced pain or limitation of movement, whichever came first. They were also instructed to maintain their arm in a strict sagital or frontal plane. Two Velcro (VIL Ltd, London, UK) straps were used to secure the inclinometer to the proximal upper arm in order to guarantee constant alignment of the device during shoulder flexion and abduction over the middle deltoid and biceps brachii muscles, respectively. The examiner stabilized the scapula and applied overpressure at the conclusion of active shoulder flexion and abduction to test active range of motion with overpressure.

Furthermore, the Plurimeter-V inclinometer was utilized to measure the scapular upward rotation during shoulder abduction, adhering to the protocol outlined by Watson et al. To measure the degree of scapular upward rotation at the conclusion of shoulder abduction, the inclinometer was manually positioned along the spine to the scapula.

Lastly, in a supine position, active range of motion and active range of motion with overpressure were measured for shoulder external rotation, starting from a position of 0° shoulder abduction and 90° elbow flexion. Patients were first instructed to move the forearm laterally into shoulder external rotation, with the inclinometer attached to the dorsal surface of the distal forearm. The examiner stabilized the anterior aspect of the shoulder and applied overpressure at the conclusion of active shoulder external rotation to test active range of motion with overpressure.

Good validity and reliability have been shown in shoulder range of motion measurements taken while seated with the trunk upright.

Strength of the Shoulder Muscles A manual muscle tester from Lafayette Instrument Company, Lafayette, IN was used to measure the strength of the muscles. It was a portable, handheld dynamometer. Measurements of shoulder strength were taken while seated, utilizing the "make" method. Patients were told to push for six seconds in the desired direction while keeping their trunks in a stable position and applying as much force as they could to the dynamometer.

Patients were positioned in the scapular plane at a 90° elevation to simulate the full-can test position for shoulder flexion. On the dorsal aspect of the distal forearm, the dynamometer was positioned. Patients were positioned with the elbow flexed to 90°, the forearm in its mid-range of motion, between supination and pronation, the shoulder in 0° abduction and medially rotated 45°, and the elbow in its flexion position. Right next to the ulnar styloid process, on the dorsal surface of the distal forearm, was where the dynamometer was positioned. The elbow was flexed to 90°, the shoulder was in 0° abduction, and the forearm was in its midrange range of motion, between supination and pronation, in order to test shoulder internal rotation. On the ventral

surface of the distal forearm, the dynamometer was positioned.

Three repetitions of each muscle strength test were carried out, with a 30-second break in between measurements. The mean was then analyzed. Clinical use of isometric strength testing with a handheld dynamometer has demonstrated satisfactory reliability.

Intervention:

Over the course of 12 weeks, patients received a 12-session treatment program that was delivered in 60-minute sessions that were scheduled once a week. Based on the degree of tissue irritability and particular impairments in shoulder mobility, the intervention program comprised a multimodal approach of manual therapy techniques (e.g., internal/ external passive ROM at different levels of abduction). TABLE 1 shows that different mobilizations were used based on the tissue irritability level: low-grade, low-to-high-grade, or high-grade for high, moderate, and low irritability, respectively. For example, low-grade, passive, oscillatory mobilization manual techniques (e.g., Maitland mobilization grades I–II) and low-intensity, short-duration (1–5 seconds) pain-free stretching exercises (0/10 on a numeric pain-rating scale) were used to decrease muscle guarding and reduce pain in patients with high irritability.

When it comes to shoulder range of motion restrictions, the treating physical therapists were directed in choosing the focus and direction of the manual therapy program by means of internal and external active rotation combined with overpressure testing at varying degrees of shoulder abduction. Furthermore, MWM techniques were used if handbehind-back and/or flexion range of motion were specifically limited (APPENDIX A, accessible at www.jospt.org). For example, a superior/inferior glenohumeral glide was used if a patient showed signs of limitation in external rotation at 90° of abduction.

Joint mobilization (grades I–IV) was applied in five bouts of one minute using passive oscillatory mobilizations (e.g., Maitland mobilizations), and MWM techniques were applied in three sets of ten repetitions. APPENDIX A contains comprehensive descriptions of the manual therapy techniques that make up the treatment program. The methods were ranked in order of decreasing shoulder range of motion.

During the course of treatment, patients undertook once daily, five days a week, at-home stretching exercises customized to their unique shoulder range of motion limitation and tissue irritability level, as detailed in APPENDIX B (accessible at www.jospt. org). Patients were told to modify the length and intensity of the stretching exercises based on how irritable they were. Stretching was done for shorter periods of time and without pain (5 bouts of 1 to 5 seconds) by patients with high irritability, for shorter periods of time and without pain (5 bouts of 5 to 15 seconds) by patients with moderate irritability, and for longer periods of time with some pain or discomfort allowed by patients with low irritability.

The length and date of each at-home stretching session were noted in an individual treatment diary, which was used to track program adherence.

The treating physical therapist evaluated the patient's perceived tissue irritability and shoulder range of motion limitations before the start of each treatment session. As a result, the best manual therapy methods were selected for that particular treatment session, as well as the stretching regimen to be followed at home until the following scheduled appointment.

In following sessions, the degree of tissue irritability and shoulder range of motion limitations were reassessed to determine how to proceed with the treatment. Additionally, the duration and intensity of the manual therapy techniques were continuously adjusted within and between sessions based on the patient's response and level of irritability to ensure that the techniques and the home stretching program were well tolerated**.**

Descriptive statistics were used to analyze data from 11 patients. The VAS and DASH scores, shoulder ROM (abduction, external, and overpressure rotation, flexion, and upward

scapular rotation), and shoulder muscle strength (flexion, internal, and external rotation) were the outcome measures. By deducting scapular upward rotation from the total shoulder abduction range of motion, the glenohumeral contribution to total active shoulder abduction was determined and dubbed "isolated glenohumeral active abduction."

OUTCOMES

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Shoulder Pain and Disability:

Of the 11 patients, 8 showed pain improvements at 6 and 9 months, and 4 showed improvements greater than the MCID on the VAS at the posttreatment evaluation. After treatment, the VAS scores of all patients—with the exception of patient 6—improved. Nine out of eleven patients had maintained or even improved pain at six and nine months.

Nine out of 11 patients exceeded the MCID at nine months, and seven out of eleven patients demonstrated improvements in DASH scores beyond the MCID at posttreatment and six months. After treatment, the DASH scores of all patients—with the exception of patient 2—improved.

Shoulder Range of Motion After treatment, active shoulder flexion and active shoulder flexion with overpressure improved in nine out of eleven patients. At six months, all patients' movements had improved, with the exception of patient 4.

Nine out of eleven patients showed improvements in active shoulder abduction and active shoulder abduction with overpressure. With the exception of patient 2, all patients' active shoulder abduction continued to improve at six months, and at nine months, four patients had somewhat reduced range of motion. With the exception of patient 8, all patients' active shoulder abduction with overpressure continued to improve at six months, and at nine months, five patients had somewhat reduced range of motion.

After treatment, seven patients showed improvement in their active external rotation of the shoulder. The outcomes of the follow-up measurements were similar. After treatment, eight out of eleven patients had greater active shoulder external rotation with overpressure, and nine of them were still improving their range of motion at six and nine months. In every patient, isolated glenohumeral active abduction improved.

Shoulder Muscle Strength:

After treatment, the shoulder flexion strength of eight out of eleven patients had increased. In 9 of 11 patients, this variable was still improving at 6 months. Five of the patients had a minor reduction in shoulder flexion strength at nine months. After treatment, eight patients had stronger internal rotation in their shoulders. Nine out of eleven patients showed sustained changes in this variable over time. Between baseline and six months and nine months posttreatment, there was no increase in shoulder external rotation strength in any patient.

DISCUSSION

Our study detailed a home stretching program and manual therapy as part of a clinical reasoning approach for patients with FSCS. Eleven patients with primary FSCS showed clinically significant improvements in shoulder pain and disability, range of motion, or muscle strength in this case series. It was found that the impairment-based approach, which modifies the intensity of the techniques according to perceived tissue irritability, was helpful in addressing each patient's unique shoulder range of motion limitations. This approach uses a combination of mobilizations,

such as passive oscillatory mobilizations [Maitland mobilizations] and MWM.

In this case series, one of the primary factors influencing treatment selection was perceived tissue irritability. Recently, McClure and Michener created a classification system based (in part) on three levels of irritability to guide shoulder rehabilitation interventions. Tissue irritability is a concept that pertains to the tissue's capacity to withstand physical stress and is associated with both the tissue's physical state and level of inflammatory activity. The physical therapist in this case series was able to direct the intensity of treatment by classifying the tissue irritability stage, as suggested by McClure, Michener, and Kelley et al., but it is crucial to remember that the validity and reliability of this classification system have not been proven.

Patients with shoulder pain have previously been successfully treated with impairment-based interventions. The study's observed improvements in range of motion, pain, and disability scores are consistent with previous research examining the impact of combining manual therapy with exercise regimens. The exercise regimens detailed in the previously published literature, which primarily used general nonstretching shoulder exercises, are not comparable to the at-home stretching program utilized in this study. Furthermore, unlike in the current study, the interventions (manual therapy or exercises) were not modified for the patients during and in between sessions. One distinctive feature of our research was that the course of treatment during ensuing appointments was contingent upon the results of the reevaluation. Few studies—as far as we know—account for reevaluation. Future studies should look into the individual effects of each intervention in each patient with FSCS, as well as the interaction between the two interventions (manual therapy and home stretching program, for example).

In a prior study, the effects of low-grade and high-grade mobilization techniques were compared in patients with FSCS. In contrast to this case series, patients received more frequent treatment (twice weekly versus once weekly) and no exercises were given. After the first three months, both groups showed significant improvements. The study produced findings that were consistent with this case series.

In 44% of the trials evaluating interventions for various shoulder disorders, including frozen shoulder, muscle strength has been reported as an outcome measure. Although it is not frequently utilized as an outcome measure in research evaluating the effectiveness of manual therapy techniques in patients with primary FSCS, this case series took strength testing into consideration. Bang and Deyle also found that, in comparison to a control group that only received exercise, a group of patients with subacromial impingement syndrome who received manual therapy showed a longer-term increase in strength.

All measured glenohumeral ROM directions showed improvements. This result was anticipated because the majority of the manual therapy program's mobilizations targeted soft tissue restrictions in the glenohumeral joint. When the patient presented with a limitation in external rotation at 0° of abduction, only one scapular mobilization (e.g., scapular tilt) was used. Scapular mobilizations can be helpful in treating a subset of FSCS patients who meet different criteria from a shoulder kinematics prediction model when used in a multimodal manual therapy approach. In patients with FSCS, more research may look into helpful clinical criteria to identify expected responders to various shoulder mobilization techniques.

Three patients (patients 6, 8, and 11) who had type 2 diabetes mellitus showed improvements in pain, function, and range of motion that were comparable to those in the other cases. Diabetes type 2 is regarded as a risk factor for FSCS. Patients with type 2 diabetes frequently experience shoulder pain and disability. They also exhibit significant reductions in shoulder range of motion, specifically decreased external rotation, and muscle strength when compared to controls. To the best of our knowledge, there are few but comparable studies evaluating the

effectiveness of manual therapy interventions in patients with FSCS and with or without diabetes mellitus.

In the current study, patients received treatment six months after the start of symptoms, on average, and were monitored during that time. The natural history of FSCS has been described in detail by various writers, who have also reported varying average disease durations, which can range from several years to as long as fifteen months. Furthermore, this condition is typically divided into three sequential stages (painful, stiff, recovery) or four (preadhesive, freezing, frozen, thawing). However, some people disagree with these rigid timeframes and would rather divide the condition into two stages (more stiffness than pain or more pain than stiffness). The natural history of frozen shoulder, which describes the condition as self-limiting and progresses through stiff and recovery phases before full recovery, is not supported, according to a recent systematic review. Five of the eleven patients in this case series (patients 2, 3, 6, 7, and 8) most likely entered the study at the stiff/frozen stage, which corresponds to an average of nine to fifteen months after the onset of symptoms, based on the data. Furthermore, it is possible that patients 5 and 9 were in the thawing phase, which occurs between 15 and 24 months after the onset of symptoms and is characterized by a gradual decrease in stiffness and an improvement in range of motion.

There are restrictions on this case series. First, conclusions about the outcomes being the product of interventions are precluded by the absence of a control group. It's possible that the improvements seen in this study are just indicative of the illness's natural progression. Furthermore, the patients who were part of the group had varying baseline levels of shoulder pain and disability, which could have affected how well they responded to treatment.

CONCLUSION

Patients with primary FSCS experienced less shoulder pain and improved range of motion and muscle strength when a multimodal manual therapy approach was combined with a home stretching program based on tissue irritability and specific impairments in shoulder mobility (e.g., internal/external passive ROM at different levels of abduction). Subsequent clinical investigations are required to assess the effectiveness of this customized manual therapy and stretching exercise regimen, taking tissue irritability into account and contrasting it with the natural progression of the illness in a larger FSCS population.

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