CASE STUDY SERIES: FROZEN SHOULDER

Treatment of eight patients with frozen shoulder: a case study series

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Abstract
Objective: To review the therapeutic outcome of using soft tissue mobilization (STM) treatment techniques in combination with a home exercise programme to treat eight patients with a differential diagnosis of frozen shoulder.

Methods: Eight patients with frozen shoulder were seen in a National Health Service (NHS) outpatient physiotherapy clinic and treated using a combination of STM techniques and a therapeutic home exercise programme. Patients were seen for an average of 10 (SD = 2) visits over a mean of 14 (SD = 3) weeks. The primary outcome measures of improvement were active range of motion for shoulder flexion, abduction and external rotation.

Results: All patients improved significantly in the outcome measures. Mean improvement in shoulder flexion was 37° (SD = 12.4; \( P = 0.0001 \)); shoulder abduction 47° (SD = 30; \( P = 0.0004 \)); and for shoulder external rotation, 21° (SD = 9; \( P = 0.006 \)).

Conclusions: Treatment of soft tissue restriction in combination with therapeutic exercise may be a useful approach to this recalcitrant problem. Further work in the form of controlled studies are needed to compare this approach with other methods of treatment and to elucidate the ideal frequency and duration of treatment.

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Background

Frozen shoulder is a painful, debilitating disorder reportedly affecting 2–5% of the general adult population (Lundberg, 1969) and 10–20% of people with diabetes (Miller et al., 1996). Primary frozen shoulder is classically described as having three stages, with stage I involving pain, stage II pain and restricted movement, and finally stage III, involving painless restriction (Reeves, 1975). Most cases resolve over the course of 18–30 months. However, a minority of patients have a protracted course with ongoing restriction (Shaffer et al., 1992).

There is a lack of understanding of the aetiology of frozen shoulder although arthroscopic and histochemical examinations of the involved tissues (Hannafin et al., 1994) have shed some light upon the nature of the disorder. Bunker (1997) has shown a fibrous contracture of the rotator interval and coracohumeral ligament composed of dense Type-III collagen matrix and a high cellularity, composed of fibroblasts and myofibroblasts. An association with Dupuytren’s contracture has been described, particularly in patients with diabetes mellitus (Bunker and Anthony, 1995).
A review of 11 studies, by Bunker (1998), has described the arthroscopic appearance of shoulders in people with frozen shoulder, and reported pathological changes of the rotator interval, including highly vascular nodules and scar tissue at the entrance to the subscapular recess and around the base of the origin of the long head of the biceps. Contracture of the coracohumeral ligament was described by Midorikawa et al. (1994) with release of the ligament improving movement. The appearance of the glenoid labrum, the subscapularis, the middle and inferior glenohumeral ligaments, and the tendon of the long head of the biceps, were all normal in these studies.

A number of treatment approaches have been recommended for the management of frozen shoulder. These include pain management through analgesics, anti-inflammatories, steroid injections (Carette et al., 2003; Bulgen et al., 1984) and various treatment modalities. Management of restriction is mainly approached through physiotherapy, which commonly involves active and passive stretching and joint mobilizations (Wadsworth, 1988). In severe cases of restriction arthographic distension (Rizk et al., 1994), surgical capsular release (Oglivie-Harris and Myerthall, 1997) or manipulation under anaesthetic (Pollock et al., 1994) have been advocated.

In spite of the variety of approaches there remains a lack of evidence that treatment speeds recovery (Philadelphia Panel, 2001; Green et al., 2000). Therefore, a group of patients with frozen shoulder were assessed and treated with a physiotherapy regime, that included soft tissue mobilizations (STMs) and therapeutic home exercises, to determine if therapeutic intervention resulted in a measurable improvement in shoulder range of motion.

Materials and methods

Inclusion criteria

Adults with a differential diagnosis of frozen shoulder were referred from a rheumatologist-run shoulder clinic. Eight patients (2 men and 6 women) consecutively seen for treatment of frozen shoulder, at Addenbrookes NHS Trust in Cambridge, UK were included in this study. All patients consented to treatment and were fully informed of the plan and goals of treatment. Diagnostic criteria of frozen shoulder for inclusion in the study were:

1. painful, restricted active and passive range of motion of the shoulder;
2. capsular pattern of motion restriction;
3. an absence of radiological evidence of glenohumeral joint arthritis;
4. symptoms present for at least 3 months (Cyriax, 1993; Griggs et al., 2000).

Exclusion criteria

Exclusion criteria for this case study series were:

1. local corticosteroid injection to the affected shoulder within the last 3 months or current corticosteroid therapy;
2. neuromuscular disease;
3. shoulder symptoms due to other causes;
4. pregnancy;
5. history of metastatic cancer or diagnosis of cancer within 12 months;
6. unstable angina;
7. insulin dependent diabetes;
8. prior shoulder surgery.

Patients were allowed over-the-counter analgesics (including non-steroidal anti-inflammatories) as needed, but no other treatments were allowed during the course of the treatment if the patient was to be included in the case study series. Adherence was monitored via communication with the referring doctor and by interviewing the individuals in the study. No patients seen were excluded from this series.

Assessments were performed at every visit by the author. The primary outcome measure was active range of motion for shoulder flexion, abduction and external rotation. This was assessed using a hand-held goniometer, according to standard methods (Norkin and White, 1995).

For measurement of shoulder flexion, the stationary arm of the goniometer was placed along the midline of the lateral wall of the thorax; the axis of motion was 2 cm distal to the lateral aspect of the acromion process; and the motion arm of the goniometer was placed over the humerus and aligned to the lateral epicondyle of the humerus.

For measurement of shoulder abduction, the stationary arm of the goniometer was placed parallel to the midline of the thorax; the axis of motion was 2 cm distal to the posterior aspect of the acromion process; and the motion arm of the goniometer was placed over the posterior aspect of the humerus and aligned to the olecranon process of the humerus.
For measurement of shoulder external rotation, the stationary arm of the goniometer was placed in the sagittal plane, perpendicular to the sternum; the axis of motion was along the longitudinal axis of the humerus; and the motion arm of the goniometer was placed along the radius.

In all instances, the stationary arm of the goniometer followed any compensatory movement of the thorax so that only shoulder motion was being measured.

**Treatment**

Treatment sessions lasted 30 min. Each session was initiated by performing goniometric measurements of active range of motion of the shoulder. Once the measurements were recorded, the patients were treated. Treatment consisted of STM and a home exercise programme consisting of stretching and isometric strengthening, progressing to resisted exercises as tolerated. A written home exercise programme was provided to patients along with a demonstration by the therapist. Patients were asked to demonstrate the exercises to the therapist and were instructed when performing their home exercises to avoid causing pain of greater than a 5 out of 10 on a pain scale (10 being the worst).

The goals of treatment were to reduce restrictions in soft tissue mobility of the periartricular structures, to increase arthrokinematic and osteokinematic motion of the shoulder joints, to improve shoulder girdle muscle strength, and to help the patient achieve improved functional use of the affected limb for their activities of daily living. Patients’ unaffected limbs were used as their own controls. All patients were given the opportunity to express their goals as part of the goal-formulation process.

Soft tissues around the shoulder girdle were palpated for the presence of restricted physiological or accessory motion due to contracture, spasm or fibrosis. Physiological motion of the soft tissues is that motion which occurs in line with movement due to muscle contraction; accessory motion of the soft tissues is that motion which occurs out of line of the normal movement, due to muscle contraction. Thus, when a muscle contracts it, and the connected non-contractile soft tissues, either shorten or lengthen (physiological motion) whereas, when pressure is applied to soft tissue, deformation of the tissues occurs (accessory motion).

STM was directed towards resolving restrictions found during the palpation. The technique utilized involved addressing first superficial layers and then progressing to deeper tissues as the patient’s comfort level allowed. Specific STM techniques used included effleurage, cross-fibre friction, sustained pressure, and prolonged soft tissue approximation. These techniques were applied to the areas of soft tissue restriction, or areas adjacent to the restrictions.

The majority of treatment was performed with the patient in side-lying position, with the affected arm initially supported on the treatment table. As a tissue-relaxation response was palpated, the patient was asked to allow their affected arm to hang forward off the edge of the treatment table. This position placed the posterior capsule and lateral rotators of the shoulder in a position of stretch, for a prolonged period, and allowed greater access to the deep structures of the posterior aspect of the shoulder. Soft tissue restrictions of the supraspinatus, infraspinatus and teres minor were frequently palpated and addressed whilst patients were in this position.

In addition to the side-lying position, patients were treated in the prone and supine positions. In the prone position, the arm was allowed to hang off the table if tolerated, in order to place a prolonged stretch on the shoulder, and to allow access to the structures of the posterior axillary wall. Treatment in the supine position was performed to allow access to the anterior structures of the shoulder. Restrictions were primarily found in the proximal aspect of the biceps tendon (long head), the pectoralis minor and the coracohumeral ligament. The arm was sometimes also brought into horizontal adduction, in order to perform further work on the posterior aspect of the shoulder.

The home exercise programme consisted of stretching the posterior aspect of the shoulder (Fig. 1) and strengthening the shoulder, initially with isometric exercises (Figs. 2–5) and progressing to resisted exercises through range of motion, using commercially available elastic bands. Strengthening exercises included isometric flexion, abduction, external rotation and extension of the shoulder, progressing to the same actions performed isotonically, as able.

Patients were instructed in all exercises and given written instructions for their programmes (Figs. 1–5). The stretching exercise was usually given on the second visit, and the strengthening exercises were given when a response of improved range of motion was noted, by both the therapist and the patient. Strengthening exercises were progressed from isometric to resisted, through pain-free range of motion, when there was notable improvement of the quality of active motion (as indicated by a reduction in compensatory
movements such as shoulder shrugging). Instructions for the home exercise programme were to:

1. perform the exercises one to two times per day;
2. gradually build up the number of repetitions;
3. not force through pain;
4. stop performing the exercises if they exacerbated symptoms.

**Statistical analysis**

A two-tailed paired T-test was used to measure changes within groups from initial to final measurements (Bailey, 1997) using Microsoft Excel. This test was used to assess significance of any change in range of motion from baseline and is a useful test to use in small studies involving continuous data.
Results

Patients were seen for an average of 10 visits (SD = 2) over a mean of 14 weeks (SD = 3). Patients were discharged from physiotherapy when they reported satisfaction with their shoulder function, and the treating therapist felt satisfied with the outcome. All patients had significantly improved active range of motion.

Mean improvement were:

1. Shoulder flexion $37^\circ$ (SD = 12.4; $P = 0.0001$ Table 1).
2. Shoulder abduction $47^\circ$ (SD = 30; $P = 0.0004$ Table 2).
3. Shoulder external rotation $21^\circ$ (SD = 9; $P = 0.006$ Table 3).
4. A composite total range of motion was calculated by summing flexion, abduction and external rotation, in order to compare results with a recently published randomized controlled trial (Carette et al., 2003). A mean change in composite range of $105^\circ$ (SD = 44; $P = 0.00003$) was achieved.

In Carette et al.’s study, patients treated with physiotherapy three times a week for 4 weeks, corticosteroid injection, a combination of the two, or placebo injection, achieved mean changes in composite total range of motion of $53.3^\circ$ (SD = 8.8); $74.6^\circ$ (SD = 9.3); $93.2^\circ$ (SD = 9.6); and $34.6^\circ$ (SD = 9.3), respectively, at 3 months follow-up and $74.0^\circ$ (SD = 8.8); $84.2^\circ$ (SD = 9.3); $105.2^\circ$
Goal.

Discussion

As a follow-up to a randomized controlled pilot study, a series of case studies were performed on patients with frozen shoulder. The series was carried out by the author because a number of patients had been referred too late to be included as part of the pilot study.

An impairment-based approach to treatment was taken which was based on the impairments revealed during the physiotherapy assessment. For example, a finding of impaired mobility of the proximal aspect of the infraspinatous might be treated with STMs to improve that restriction. This approach has the advantage of giving the therapist the flexibility to adapt their treatment to the person, rather than treating the diagnosis. Further, as the patient responds to treatment, the therapist's intervention can be modified in response to patients' improvements, or lack of progress.

Although the aetiology and specific nature of frozen shoulder are not well understood, it is possible to palpate restrictions in the soft tissues surrounding the affected shoulder. These restrictions may be secondary to the pathology directly responsible for the frozen shoulder, or they may be integral to that process, however, this cannot as yet be ascertained. As patients in this study improved, fewer soft tissue restrictions were palpable, and their active range of motion improved, therefore, a relationship appears to be evident between treatment utilizing STMs together with home exercises, and improvement in active range of motion.

Several studies have demonstrated that subjective pain in patients with frozen shoulder improves over the course of time, and is not greatly affected by medical intervention. Certainly by a year following onset of symptoms, there appears to be no difference in the subjective experience of pain between patients who have had medical intervention and those who have not (Carette et al., 2003). Once the initial painful stage of the frozen shoulder subsides the primary complaint most patients seem to experience is functional limitation. This limitation appears to be caused primarily by restricted movement of the shoulder, and in many cases causes sleep disturbance and psychological distress. Early resolution of impaired shoulder movement would therefore appear to be a worthwhile goal.

Conclusions

An impairment-based treatment approach was used to treat a small group of patients with stage II frozen shoulder with good success, as measured by improved range of motion and subjective reports of the patients. STMs directed at specific limitations of the periarticular structures in combination with a simple home exercise programme appears to be an effective treatment for this typically recalcitrant problem. The patients in this study achieved a greater range of shoulder motion at a mean of 14 weeks, compared to those treated in a randomized controlled trial (Carette et al., 2003) measured at both 3 and 6 months follow-up. Current evidence in the literature does not support physical therapy interventions for frozen shoulder, and further research is warranted to elucidate best practice for treatment of the condition. The treatment techniques used in this study appear to be of benefit, and larger controlled studies may further define the key elements for successful resolution of frozen shoulder.

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References


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