Case Report

Use of thoracic spine manipulation in the treatment of adhesive capsulitis: a case report

Joshua R McCormack

Indiana University Health Ball Memorial Rehabilitation Services, Muncie, IN, USA

Adhesive capsulitis (AC) is a common and disabling shoulder condition seen in physical therapy, and there is no clear consensus as to the best treatment approach. Recently there has been emerging evidence that manual therapy directed at the thoracic spine may be beneficial for patients with shoulder pain; however, this has not been examined specifically in patients with AC. The purpose of this paper is to present the case of 59-year-old female referred to physical therapy with a diagnosis of AC. The patient presented with complaints of left shoulder pain and significant limitations in range of motion (ROM) and upper extremity function. The initial treatment included exercises and manual therapy directed at the glenohumeral and scapulothoracic joints, and after 10 visits only minimal progress had been made. Further examination revealed mobility and ROM deficits in the thoracic spine, and manual therapy directed at this region was incorporated into her treatment. After the first session of thoracic spine manual therapy (TSMT) a 25 degree improvement was noted in active shoulder flexion. After four total visits of TSMT substantial improvements in pain, ROM, and function were noted compared to those made during the first 10 visits. This case adds to the emerging evidence that manual therapy directed at the thoracic spine should be considered for patients with shoulder pain.

Keywords: Shoulder pain, Adhesive capsulitis, Frozen shoulder, Manual therapy, Thoracic spine, Manipulation

Background

Adhesive capsulitis (AC) is a common shoulder condition that involves progressive loss of glenohumeral mobility and leads to significant functional limitations.¹ It can be classified as being primary, occurring with an insidious onset, or secondary, associated with a predisposing condition. The progression of AC commonly follows a pattern of three stages.² Stage 1 is characterized by intense pain even at rest with a small loss of range of motion (ROM). Stage 2 is characterized by a more significant loss in ROM but is typically less painful, especially at rest. Stage 3 is considered to be the recovery stage and is marked by a slow increase in mobility. Adhesive capsulitis is considered to be 'self-limiting', with the potential of spontaneous resolution within 3 years.² However, some patients can suffer long-term pain and restricted shoulder motion well beyond this time.^{3,4}

Multiple treatments have been proposed to address the limitations involved with AC; however, there is no consensus regarding which is the best.^{5,6} Treatments commonly utilized by physical therapists to treat AC include; heat or ice modalities, ultrasound, electrical

stimulation, active and passive ROM exercises, and mobilization techniques.⁷⁻⁹ While the research supporting many of these treatments is limited, there is emerging evidence to support the use glenohumeral mobilizations.¹⁰⁻¹²

Regional interdependence is an area of research in physical therapy receiving increased attention lately.¹³ The concept of regional interdependence refers to the idea that seemingly unrelated impairments in a remote anatomical region may contribute to, or be associated with, the patient's primary complaint.¹³ A few studies have applied the concept of regional interdependence to patients with shoulder pain by using thoracic spine manual therapy (TSMT) for treatment, although none of them looked at AC specifically.¹⁴⁻¹⁸ Two studies^{14,15} examined patients with shoulder pain and concomitant dysfunction of the cervicothoracic spine and ribs and neither specifically excluded patients with AC. Winters *et al.*¹⁴ determined that manual therapy directed at this region was more effective than traditional therapy and Bergman *et al.*¹⁵ found it to be more effective than traditional medical care alone. Three additional studies¹⁶⁻¹⁸ examined patients with shoulder pain without regard to specific findings in the cervicothoracic region. Boyles *et al.*¹⁶ found that TSMT led to statistically significant improvements in

Correspondence to: Joshua R McCormack, PT, OCS, 3600 W. Bethel Ave, Muncie, IN 47304, USA. Email: joshmccormack@att.net

Figure 1 Body diagram of patient's complaints.

the Numeric Pain Rating Scale and Shoulder Pain and Disability Index (SPADI) at a 48 hour follow-up while Strunce *et al.*¹⁷ found immediate post-treatment improvements in shoulder ROM and pain scores. Mintken *et al.*¹⁸ attempted to find prognostic factors to identify which patients with shoulder pain might benefit from manual therapy directed at the cervicothoracic region. The authors examined 80 subjects with unilateral shoulder pain and did not specifically exclude subjects with AC. They determined that the presence of the following five variables were the best predictors of a successful outcome: pain-free shoulder flexion of less than 127 degrees, shoulder internal rotation of less than 53 degrees, a negative Neer test, not taking medications of any kind for shoulder pain, and duration of symptoms of less than 90 days. If three of the five variables were present, the chance of achieving a successful outcome improved from 61 to 89% (positive likelihood ratio=5.3; 95% confidence interval=1.7, 16).

The purpose of this report was to present the clinical decision making process and outcomes for a patient with a recalcitrant case of AC. This report sought to describe how the current evidence for treating the thoracic spine of patients with shoulder pain was examined and applied to a patient with AC after she failed to respond to traditional treatment directed at the shoulder.

Case Description

Patient characteristics

The patient, a 59-year-old right-handed female schoolteacher, was referred to physical therapy with a diagnosis of left shoulder AC and cervical spine degenerative disc disease (DDD). The patient's pain had begun insidiously approximately 3 months prior to her initial visit in physical therapy. Previous

treatment included seeing a chiropractor for cervical manipulation and modalities. She also received a cortisone injection into the glenohumeral joint and a home exercise program (HEP) of resistance exercises with an elastic band from an orthopedic surgeon. She reported that there was little or no improvement in pain or ROM after any of these treatments, so she returned to the orthopedic surgeon who then referred her to physical therapy. According to the medical record, radiographs of the shoulder revealed no significant findings, and radiographs of the cervical spine revealed degenerative changes at C4-5 and C5-6.

Examination

During her initial physical therapy evaluation, the patient reported generalized left shoulder pain and stiffness, left periscapular pain, and pain over the left upper trapezius muscle extending from the lateral neck to her shoulder (Fig. 1). She denied the presence of pain below the elbow and rated her pain intensity as 0/10 at best and 8/10 at worst over the previous 48 hours. She reported significant difficulty sleeping, an inability to lie on her left side, and difficulty with all activities of daily living including dressing and bathing. Her goals were to have decreased pain and to regain normal use of her left arm.

At the initial evaluation, the patient completed the short version of the Disabilities of the Arm, Shoulder, and Hand form (Quick DASH) and medical history forms. The patient's medical history was negative for potential red flags that could suggest non-musculoskeletal pathology. There was no history of diabetes mellitus and the patient denied a history of osteoporosis/osteopenia or other conditions that would contraindicate manual therapy. This was her first episode of shoulder pain and her Quick DASH score

was 64%. The Quick DASH is an 11 question shortened version of the 30 question DASH. It is scored from 0 to 100%, with higher scores representing increased disability. The test-retest reliability for shoulder patients has been reported to be excellent (ICC=0.90) and the minimal clinically important difference (MCID) is 8 points.¹⁹

During the physical exam the patient sat with a forward head posture and maintained her left upper extremity against her abdomen in a protective posture. Visual estimates of cervical spine ROM revealed slight limitations with right sidebending and rotation with pain over the left upper trapezius. All other cervical motions were judged to be normal and painfree. The reliability of visually estimating cervical spine ROM is poor.²⁰ However, more thorough measurement was deemed unnecessary because the examination findings described below suggested that the cervical spine was not related to the patient's symptoms. Spurling's test, cervical distraction test, and upper limb tension test A (median nerve bias) were all negative. These tests were performed according to the procedures used by Wainner *et al.*²¹ with the exception of the upper limb tension test, which was modified to be performed within the patient's available ROM. An upper extremity neurological screen including dermatomes, myotomes, and reflexes was unremarkable. Passive intervertebral movements (PIMs) of the cervical spine were tested with lateral glides²² and posterior to anterior pressures applied to the spinous process. Passive intervertebral movement testing did not reproduce the patient's shoulder symptoms nor was it locally painful. Motion at each spinal segment during these tests appeared symmetrical. Reliability of these techniques for assessing mobility has been reported to be poor while the reliability is moderate when assessing for symptom reproduction.^{22,23}

Examination of the shoulder revealed limitations in the capsular pattern proposed by Cyriax.²⁴ External rotation was most limited followed by abduction, internal rotation, and flexion (Table 1). Passive ROM was limited with a capsular end feel in the same directions as active ROM (Table 1). All shoulder ROM measurements were taken with a standard goniometer. Active flexion and abduction

measurements were taken with the patient standing while passive elevation was measured with the patient in supine. Both active and passive rotation measurements were taken with the patient in supine with the arm in 90 degrees of abduction. Goniometric measurements of shoulder ROM have been reported to have excellent intra-rater reliability (ICC 0.91-0.99).²⁵ Glenohumeral mobility testing revealed restrictions in all directions, and compensatory elevation of the shoulder girdle with scapular dyskinesia was noted during active elevation.

Isometric strength testing was performed with the patient in standing. Flexion and abduction were tested in approximately 90 degrees of elevation and were judged to be weak. Internal and external rotation were tested with the arm at the side in neutral rotation and were judged to be strong. All strength testing reproduced left shoulder, upper trapezius, and periscapular pain. Drop arm and empty can tests were negative, and the Neer impingement test could not be performed due to lack of ROM. The patient appeared to meet all of the inclusion/exclusion criteria of the Mintken *et al.*,¹⁸ however; the Quick DASH was assessed instead of the Shoulder Pain and Disability Index. Of the five factors identified,¹⁸ only one was present (internal rotation less than 53 degrees) within this patient's presentation.

Clinical impression

The findings of the clinical exam were consistent with stage II primary AC. The patient presented with decreased active and passive left shoulder ROM in a capsular pattern with minimal strength loss during isometric mid-range testing. She was pain free at rest but had notable pain with ROM.

While the referring diagnosis indicated DDD, the cervical spine did not appear to be contributing to the patient's symptoms. This is plausible as research has shown that cervical DDD is present in a large number of asymptomatic individuals.²⁶ The patient had a negative upper limb tension test A (median nerve bias) which has been found to have a sensitivity of 0.97 for diagnosing cervical radiculopathy.²¹ Spurling's, cervical distraction test, and the manual examination were all negative for cervical involvement and previous chiropractic treatment directed at the cervical spine had failed to improve her symptoms.

The pains reported over the lateral cervical and periscapular regions were thought to be related to sensitized muscular tissues. This hypothesis was based on the negative cervical exam and the potential for compensatory shoulder girdle elevation and scapular dyskinesia to overload the muscular tissues in these areas.

Table 1 Shoulder ROM at initial examination

	Active ROM Left/Right	Passive ROM Left
Flexion	110°/160°	110°
Abduction	95°/155°	100°
External rotation	20°/95°	25°
Internal rotation	40°/65°	40°

Note: Active flexion and abduction ROM were measured in standing, passive flexion and abduction ROM as well as both active and passive rotation were measured in supine. ROM, range of motion.

Intervention/outcomes

The patient was treated for two sessions per week with treatment consisting of traditional physical therapy interventions (Table 2) to address the deficits noted during the evaluation. This consisted primarily of ROM exercises, passive stretching, and scapular and glenohumeral joint mobilizations. Since the patient was considered to have stage II AC, interventions were focused on regaining ROM and joint mobility versus pain control. Within the first 10 treatment sessions, limited progress was noted with glenohumeral ROM or pain (Table 3).

Due to the lack of progress during the first several weeks of therapy the cervical spine was re-examined at visit 11. The thoracic spine was also examined at this time secondary to research indicating TSMT may be useful for patients with shoulder pain.^{14–18} The results of the cervical spine examination were the same as during the initial session with minimal objective findings. The examination of the thoracic spine revealed hypomobility and pain with PA joint mobility testing throughout the upper (T1–T4) and middle (T5–T8) portions. Visual estimates of thoracic spine ROM in sitting also revealed limitations in extension and rotation ROM. Inter-tester reliability of thoracic PA mobility testing has been found to be moderate²⁷ while visual estimation of ROM likely has poor reliability as has been noted with the cervical spine.²⁰

Revised clinical impression

At this time it was determined that the patient's symptoms were still consistent with stage II primary AC and that the cervical spine was not contributing to her presentation. However, thoracic spine mobility and ROM deficits were noted and it was hypothesized that these could be responsible for her current lack of response to treatment. Based on the review of available evidence^{14–18} it was determined that this patient may benefit from TSMT to address these

deficit in addition to continued treatment directed at the shoulder.

Intervention/outcomes

Following discussion of the exam results, treatment options, and current research the patient agreed to receive TSMT in addition to her current treatment regimen. For TSMT the patient was positioned in prone with the cervical spine in neutral. Treatment consisted of both low-velocity mid-range (grade III and IV), and high-velocity end-range (grade V), posterior to anterior forces directed at the mid and upper thoracic spine.¹⁸ The low-velocity techniques were repeated for approximately 30 seconds at four non-specific levels throughout the middle and upper thoracic spine. Then the high-velocity techniques were then repeated 1–2 times at each of those levels. There was no attempt to identify or treat specific segmental levels due to research suggesting an inability to localize treatment.^{28,29} To look for possible immediate treatment effects, shoulder flexion ROM was measured both immediately before and after TSMT. Prior to treatment active shoulder flexion ROM was 110°, and immediately following treatment it had improved to 135°. This represents an immediate post treatment improvement of 25° which greatly exceeds the 10° difference required to be confident a real change has occurred.²⁵ Seated thoracic extension and rotation exercises were added to the patient's HEP at this time to address the ROM limitations noted during the re-evaluation.

The same treatment regimen for the thoracic spine was repeated over the next three visits (visits 12–14) in addition to the previously established plan of active/passive ROM and joint mobilizations of the glenohumeral joint. At each visit the patient continued to report decreased pain and improved function. At visit 14 her thoracic spine joint mobility was judged to be normal and without pain during PA testing so TSMT was discontinued after this visit.

Table 2 Summary of treatment performed

Visit(s)	Intervention
1	Initial evaluation, HEP consisting of: table top passive flexion and external rotation stretches, supine wand external rotation stretch, left upper trapezius stretch, and a supine deep neck flexor exercise
2–4	HEP review, supine wand flexion and external rotation stretches, passive ROM performed by therapist in all planes with patient in supine, Grades II–IV posterior and inferior GH mobilizations
5–10	Supine wand flexion and external rotation stretches, pulleys for AA flexion and scaption, active scapular retraction and depression exercises, PROM and AA PNF patterns performed by therapist with patient in supine, Grade II–IV posterior and inferior GH mobilizations
11–12	Thoracic spine PA mobilizations (grades II–IV) and manipulation (grade V) directed at middle and upper segments, PROM, AA PNF, and GH mobilizations as in previous visits, HEP update to include seated thoracic rotation and extension stretches,
13–14	As above with addition of UBE backwards, standing wand scaption, doorway external rotation stretch, supine wand exercises
15–19	Continued as above (excluding thoracic spine techniques) with addition of; quadruped thoracic rotation stretch, resisted arm elevation in the sagittal and scapular planes, resisted sidelying external rotation

Note: HEP, home exercise program; ROM, range of motion; GH, glenohumeral; PROM, passive range of motion; AA, active assisted; PNF, proprioceptive neuromuscular facilitation; PA, posteroanterior; UBE, upper body ergometer.

Testing also revealed notable improvements in her pain level and shoulder ROM (Table 3).

The patient was seen 2 more visits without TSMT. At visit 16 a comprehensive re-evaluation was completed. At this time the patient's Quick DASH score had improved to 23% which greatly exceeded the minimal clinically important difference of 8 points.¹⁹ She also reported pain of no greater than 1/10 during the previous 48 hours. Range of motion was also greatly improved (Table 3) but remained limited. The patient was scheduled to leave for vacation the following week, so we continued therapy for two visits prior to her leaving to address the remaining deficits and progress her HEP. During this time treatment consisted of active and passive ROM exercises, glenohumeral joint mobilizations, as well as strengthening exercises to address deficits and restore normal scapulohumeral mechanics (Table 2). Upon returning from her vacation (visit 19), a final assessment was performed (Table 3), and the patient was discharged from therapy with instructions to continue with an HEP to address remaining deficits.

Discussion

After 10 visits of treatment directed at the glenohumeral and scapulothoracic joints only small improvements were noted in ROM and pain. The initial treatment plan was not changed earlier based on the fact that previous research on the effects of glenohumeral joint mobilization for AC utilized treatment periods of up to 12 weeks.^{10,12} However, further examination led to finding mobility and ROM deficits in the thoracic spine and the introduction of TSMT to address these deficits. After only four visits of TSMT, substantial improvements were noted compared to those made during the first 10 visits. The patient continued to make progress once it was determined the thoracic spine deficits had been address and TSMT was discontinued.

This case suggests that TSMT may be a useful treatment for patients with AC. Though this is only a case report, it is the first to look at using TSMT for AC specifically, and it adds to the emerging evidence that manual therapy directed at the thoracic spine should be considered for patients with shoulder pain.

While a cause and effect relationship cannot be inferred from a case report, significant improvements were noted with the only change in treatment being the addition of TSMT and home exercises directed at the thoracic spine. Furthermore, the patient did not report any increased discomfort or adverse effects following the TSMT treatment.

It is plausible that the results in this report could be attributed to the effects of time alone as AC is considered to be a self-limiting condition.² However, an immediate improvement in active shoulder flexion ROM of 25 degrees was noted after the first session of TSMT. This change is significantly greater than the measurement error that is associated with goniometry for this movement.²⁵ This large intra-session change makes it unlikely the improvements noted with this patient were due to the effect of time alone.

The underlying mechanisms for improvement in symptoms following spinal manipulation and manual therapy in general are not well understood. A model to explain the possible mechanisms has been proposed by Bialosky *et al.*³⁰ They suggest that a combination of biomechanical and neurophysiological mechanisms is responsible for the results seen. More specifically they state that a mechanical stimulus initiates a number of neurophysiological effects which produce the outcomes associated with manual therapy.³⁰ Based on this model the question then becomes where to apply the stimulus and the concept of regional interdependence may help to answer this. In this case the initial physical therapy treatment, including manual therapy, was directed at the shoulder region. However, minimal progress was made after multiple treatment sessions. Previous chiropractic treatment directed at the cervical spine was also unsuccessful in improving the patient's pain and mobility. The patient in this case report had thoracic mobility and ROM deficits and the concept of regional interdependence suggests that this could contribute to her shoulder pain and impairments. When incorporated with the Bialosky model,³⁰ it would seem plausible that TMST used to address the thoracic hypomobility initiated a neurophysiological response which led to the rapid improvements seen for this patient.

Table 3 Examination findings at select visits

	Initial visit	9th visit	14th visit	16th visit	Final visit (19th)
Flexion A/P ROM	110°/110°	110°/118°	136°/148°	140°/158°	150°/160°
Abduction A/P ROM	95°/100°	92°/106°	118°/150°	138°/161°	150°/165°
Internal rotation A/P ROM	40°/40°	51°/51°	nt/55°	60°/60°	65°/70°
External rotation A/P ROM	20°/25°	27°/27°	nt/50°	70°/76°	75°/80°
NRPS 0–10	8	6	2	1	1
Quick DASH	64%	nt	nt	23%	9%

Note: Thoracic spine manual therapy was introduced at the 11th visit and continued four sessions to the 14th visit. NRPS pain ratings refer to the worst pain over the previous 48 hours. ROM measurements refer to the left shoulder. A/P, active/passive; ROM, range of motion; Flex/Ext, flexion/extension; L/R, left/right; NRPS, Numeric Pain Rating Scale; DASH, Disabilities of the Arm, Shoulder, and Hand; nt, not tested.

The patient's response to TSMT could also have a possible biomechanical explanation. Previous studies^{31–33} have shown that corrections to thoracic spine posture can result in decreased shoulder pain and improved ROM. Decreased cervicothoracic mobility^{34,35} and dysfunctional scapular positioning^{36,37} have also been found to be related to shoulder pain. It is plausible that the TSMT and related exercises resulted in improved thoracic posture and/or scapular position and that this led to the improvements seen.

Another potential method for determining if a patient with shoulder pain would benefit from TSMT was developed by Mintken *et al.*¹⁸ They identified five variables to help predict which patients with shoulder pain were likely to experience rapid improvements following manual therapy directed at the cervical and thoracic spine. If three of the five identified variables were present, the chance of achieving a successful outcome improved from 61 to 89%. None of the variables were related to the thoracic spine and only one of the five variables identified were noted in this patient's presentation (internal rotation less than 53 degrees). Although this patient did not meet the criteria identified by Mintken *et al.*, it may still be a useful for predicting results in other patients with shoulder pain.

Future research is needed to determine the following: (1) if TSMT should be used routinely in the treatment of patients with AC, (2) if there is a subgroup of patients with AC who are more likely to respond to the addition of TSMT to their treatment, (3) if low velocity mobilizations, high velocity manipulations, or a combination of the two is the most effective treatment, (4) what mechanisms are responsible for the improvements noted in patients with AC following TSMT.

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