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**PATIENT SPECIFIC INTERVENTION AND MANAGEMENT
OF ADHESIVE CAPSULITIS**

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Case Report

A combination of modalities, manual therapy, and patient-specific goal oriented progressive end-range stretching and strengthening exercises, along with a consistently monitored home exercise program, may improve the outcome of the patient with shoulder adhesive capsulitis (SAC).

Abstract

Background and Purpose

This case report describes patient-specific progressive stretching and strengthening exercises along with end-range Glenohumeral joint (GHJ) mobilization and a consistently monitored home exercise program (HEP). There have been many approaches in treating the patient with Shoulder Adhesive Capsulitis (SAC) as described in the literature ^{1, 2, 3} including manual therapy, electric stimulation, joint mobilization and heat as well as basic and advanced modalities. There is a lack of evidence or studies to identify the best and most cost effective treatment for SAC. ^{1, 3, 4}.

The purpose of this case report is to describe the patient specific successful management of SAC utilizing best evidence, clinical expertise and patient combined efforts in therapy and at home.

Case description

This is a case study of a 62 year old endomorphic woman, executive director of a large company, who was diagnosed with primary SAC. Intervention of physical therapy was initiated two months after her initial injury. She was injured when she fell at home and broke her collar bone, after which her shoulder was immobilized with a sling for eight weeks. She developed left shoulder pain, stiffness and decreased range of motion (ROM), impaired GHJ mobility, functional

limitation and disability. The patient's orthopedic surgeon referred her to physical therapy for evaluation and treatment, with a diagnosis of adhesive capsulitis.

Outcome

This patient showed excellent progress. Outcome measurements including The Numerical Pain Rating Scale (NPRS), Shoulder Pain and Disability Index score (SPADI), and Disability of the Arm, Shoulder and Hand (DASH) score showed that she made an excellent recovery from her condition in 3 months, and reached her goals. As illustrated by the case report, intervention provided in a timely manner decreased her pain, improved her ROM and functional ability to move her arm and reduced her disability, allowing her to return to her quality of life prior to her injury.

Discussion

Outcomes of this case study showed that intervention should start immediately after the SAC diagnosis is confirmed. This case report showed that patient-specific, goal oriented, aggressive end-range stretching and strengthening exercises were effective when applied 2 to 3 times a week by an experienced physical therapist on a consistent basis in an out-patient setting. The patient contributed to the outcome by performing HEP 2 to 3 times daily to reduce pain, impairments, the functional limitations and disability and improve the quality of life at home and at work. Further research is warranted to find out the best and most cost effective intervention for SAC, which would result in the best outcome for the patient.

Introduction

Shoulder Adhesive Capsulitis (SAC) is a painful and debilitating condition affecting up to 3% to 5% of the general population and up to 20% of those with diabetes⁵. Approximately 70% of patients with frozen shoulder are women. However, males with frozen shoulder are at greater risk for longer recovery and greater disability⁶. There is an even greater incidence among patients with insulin dependent diabetes (36%), with increased frequency of bilateral shoulder involvement.^{12, 13}

SAC was first described as a gradual onset of pain felt near the insertion of the Deltoid, with an inability to sleep on the affected side and the restriction of active and passive elevation and external rotation of the shoulder. Adhesive capsulitis is characterized by pain, stiffness, and limited function of the gleno-humeral joint, which adversely affects the entire upper extremity. Patients typically describe an onset of shoulder pain followed by a loss of motion. The most common limitations in range of motion are flexion, abduction, and external and internal rotation. SAC is considered to be scar-like fibrotic tissue changes of the glenohumeral joint (GHJ) capsule, with the capsule also becoming taut and losing volume. This may lead to an inflammatory response of the GHJ with generalized pain. Patients typically experience pain, stiffness, limited range of motion, and disability in daily activities at home and at work. SAC, also known as frozen shoulder, is a condition characterized by pain and significant loss of both active range of motion (AROM) and passive range of motion (PROM) of the shoulder.

The “frozen shoulder” diagnosis has been used for many years in describing shoulder pain and limited motion, and was originally thought to be “periartthritis.” [Nevasier⁷](#) was the first to identify the pathology through histological and surgical examination of patients with frozen

shoulder. He concluded that frozen shoulder was not periarthrititis, but a “thickening and contraction of the capsule which became adherent to the humeral head,” that he termed, “adhesive capsulitis.” The typical decrease in joint volume was described using arthroscopy ⁸.

The exact pathophysiologic cause and etiology of this condition remains elusive and unclear.

Several studies have found that patients with frozen shoulder had both chronic inflammatory cells and fibroblast cells, indicating the presence of both, an inflammatory process, fibrosis, ligamentous tightness, fascial restrictions and muscular tightness.

SAC classification systems are proposed in the literature and frozen shoulder is most commonly classified as either primary or secondary. ^{9,10} Primary frozen shoulder is idiopathic in nature, and radiographs appear normal and substantially different from the changes produced by immobilization or degeneration. Secondary frozen shoulder develops due to some disease process, which can further be classified as systemic, extrinsic, or intrinsic. Physical therapists can address impairments and limitations associated with each of these contributors to the pathology of adhesive capsulitis with a variety of treatment methods. Systemic secondary frozen shoulder develops due to underlying systemic connective tissue disease processes and causes including diabetes mellitus, hypo or hyperthyroidism and hypoadrenalism. The increased appearance of SAC in diabetic patients was first described by [Bridman](#). ¹¹ Extrinsic secondary frozen shoulder occurs from pathology not related to the shoulder, such as cardiopulmonary disease, CVA, cervical disc pathology, humeral fracture, and Parkinsons. Intrinsic secondary frozen shoulder results from known shoulder pathology, including but not limited to rotator cuff tendinopathy, GHJ arthropathy and acromioclavicular joint (AC) arthropathy.

Primary Frozen shoulder is classically described as having four stages:

Stage I involves pain

Stage II involves pain and restricted movement

Stage III involves painless restriction¹⁴

Stage IV is the maintenance stage

Most cases resolve over the course of 19-30 months. However, a minority of patients have a protracted course of ongoing restriction.¹⁵ The individual stages last on average 6 months, but the timeframes are variable.¹⁰ Frozen shoulder is also known as a capsular restriction, where there is limited passive ROM, in which Abduction<100 °, External Rotation<50 °, Internal rotation<70 °, flexion<140 °.¹⁷

Stage I- The freezing stage is also known as the painful inflammatory phase.

Patients present with constant shoulder pain and ROM limitations in a capsular pattern.

Stage II- The frozen or stiff phase, the pain progressively decreases as does shoulder motion and patients commonly experience increased restrictions in function.

Stage III- The thawing phase- patients gradually regain shoulder movement and experience progressively less discomfort. The “thawing stage” was reported to last anywhere from 12 months to 42 months and is characterized by a steady return to shoulder mobility and function¹⁶.

Stage IV- In the maintenance stage, the frequency and intensity of the exercise regimen continues at a slower pace, and gradual progression is preferred.¹⁶

Various interventions can be utilized in the treatment of SAC. Both surgical and non-surgical options are available. Surgical treatments can include manipulation and capsular release under general anesthesia.¹⁸ Nonsurgical treatments include analgesics (e.g., acetaminophen, nonsteroidal anti-inflammatory drugs), oral prednisone, and intra-articular corticosteroid

injections. Often, physical therapy is prescribed; including the usage of modalities such as TENS, electrical stimulation, heat, cold and ultrasound; and a home program is recommended . Exercises utilized by the physical therapist in the treatment of SAC could include Codman, pendulum, passive end range stretching, active-assistive range of motion, myofascial soft tissue work, soft tissue mobilization, joint mobilization ¹⁹, and capsular stretch. As the patient progresses to the later stage, sub maximal isometric, concentric and resistive exercises could be utilized. Patients can utilize pulleys, ropes, self stretching and a home exercise program as instructed by the physical therapist. Biodex CPM (continuous passive motion) and high speed isokinetic treatment can be used for appropriate patients.

The goals of treatment include pain relief, restoration of movement, restoration of function and reduction of disability and patient education to the disease process and prevention.

The purpose of this case report is to describe the patient-specific physical therapy intervention by utilizing best evidence, clinical expertise and patient combined efforts in therapy and at home to successfully manage frozen shoulder.

Patient History and System Review

General demographics:

The patient (Pt) was a 62 year old endomorphic Caucasian female who, after immobilizing her collar bone fracture, was diagnosed with “Left Shoulder Adhesive Capsulitis” by the orthopedic surgeon. The patient was divorced, lived alone in her one story condo and described her health to be in relatively good condition. Prior to her injury, she walked two days a week, and went to the gym 2-3 times a week. The Pt was an executive manager/director for a real estate firm. Her job required her to travel both by car and plane in order to inspect real estate properties. When she

had to travel by plane, she had to carry her luggage and place it in the overhead bin on the plane. She had to ask for assistance when her symptoms became evident.

Since she lived alone, she needed to cook, dress, take out the trash, wash her hair, and carry her bag. She was financially dependent on her job income and had to drive to work every day.

The Pt injured herself after slipping on wet floor in the bathroom. She reached her arm out to catch herself and in the process broke her left collar bone. She could not move after the fall and she was immediately taken to the emergency room for x-rays and treatment. Her left arm was placed in a sling and she was referred to an orthopedic surgeon the following day. The orthopedic surgeon instructed her to keep the arm in a sling for eight weeks. At the end of the eight weeks, he referred her to a physical therapist for evaluation and treatment. Her diagnosis was Adhesive Capsulitis of the left shoulder.

During the initial evaluation, the Pt reported constant pain at left shoulder, even at rest. After being in a sling for 8 weeks, she developed stiffness and limited range of motion at left shoulder. The orthopedic surgeon informed her that the collarbone fracture was healed, and that it was time for her to move the arm. She was given some exercises by her physician; however, she could not do the exercises due to sharp and intense pain she experienced every time she tried to move the arm. The patient thought that her fracture was not healed yet, since it hurt even when she was resting. As a result she kept her arm immobile.

Patient's Goals:

- Pt wanted to experience less pain and not have to take the prescribed pain killer “oxycodone”. She reported that she could not function at work when she took her pain medication.

- Pt also wanted to increase her range of motion. She wanted to be able to use her arm for daily living activities, such as eating, dressing, self hygiene, driving, and carrying groceries. She wanted to be independent again, and return to her activity level prior to her injury.
- Pt also wanted to be able to perform her work duties without difficulty, like using her computer, typing and carrying objects.
- In addition to being able to use her left arm at work and at home she wanted to continue her prior physical activities such as walking and going to the gym to be physically fit and to lose the 10 lbs she gained since she broke her collar bone.

The Pt was taking oxycodone 10 mg 3 times a day. Her X-rays for the shoulder and collar bone revealed satisfactory improvement, but not so perfect alignment. MRI was not performed.

The Pt was given cortisone shot on Friday prior to the physical therapy evaluation; however she reported no relief with pain.

The Pt had history of vaginal cervical cancer (tumor removed) followed by a hysterectomy in 1974. She was in remission, and had a regular check up every year. Pt also reported having a stiff neck on and off over the years, due to her work. Her mother died last month, at the age of 82, from pulmonary disease and congestive heart failure (CHF). She was a smoker for 50 years. The Pt did not remember her father or his health history but knew that her grandmother died from pancreatic cancer in her 80's. The Pt was nonsmoker, non drinker and right hand dominant.

Examination / System review:

Cardiovascular and pulmonary: Patient's resting heart rate was 74 bpm. Resting blood pressure was 130/85 mm Hg and resting in a chair, respiratory rate was 16 pm.

Integumentary system: Skin integrity was normal: left 1/3 of lateral collar bone ½ inch slightly raised; skin pliability and color were normal and there were no visible scars present.

Neuromuscular system: Patient was wearing sling on left arm at the time of initial visit. Gait was normal but left arm was not being used. Pt could only maintain balance on right leg alone for 7 seconds and left leg alone for 5 seconds. She experienced no problems when climbing or going down the stairs.

Musculoskeletal systems: The Pt's height was 5'7", weight 170 lbs, and her BMI 26.6 kg/m^2 .

Range of motion test: All measurements were taken by the same therapist utilizing goniometric measurements in the supine position.

Table 1: Initial AROM/PROM of the shoulder

ROM	Active range of motion	Passive range of motion
Flexion	70° with elbow bend 10°	75° with elbow bend 8
Abduction	65°	70°
External rotation	-10 °to neutral 45° abducted	-5 ° at 45 ° abducted shoulder
Internal rotation	25 ° shoulder at 45 ° abducted	30° shoulder at 45 ° abducted

Reliability of tests for the shoulder joint ROM has yet to be determined. Shoulder goniometric measurement of external rotation range of motion (ROM) is frequently performed during shoulder evaluation. Intra-therapist ICCs (0.88 and 0.93) and inter-therapist ICCs (0.85 and 0.80) were high. These findings suggest that reliable measures of passive external rotation ROM of the shoulder can be obtained from patients with shoulder pathology using standard goniometry and by placing the patient in a supine position ³².

Manual muscle testing: Physical therapists require an accurate, reliable method for measuring muscle strength. They often use manual muscle testing (MMT) or hand-held dynamometric muscle testing (DMT). Few studies documented the reliability of MMT (³⁵) and showed the Intra-rater reliability of MMT and DMT. The test-retest reliability coefficients for the MMT ranged from .63 to .98 and were statistically significant ($p < .05$) for the shoulder abduction test. Muscle strength testing was done on the pt as charted below.

Table 2: Initial MMT and grip strength

Muscle strength test	Left shoulder in sitting position
Flexion in available range 65 °	2+/5
Abduction in available range 60 °	2+/5 pain
External rotation	2+/5 pain in available range
Internal rotation	3+/5 in available range
Hand grip strength left	20 ft/lbs
Hand grip strength right	65 ft/lbs

Hand grip test: # 2 grip test with Jamar calibrated on 1-5-2013. Validity of Jamar and Rolyan dynamometers have acceptable concurrent validity with known weights (correlation coefficients were $r \geq 0.9994$), excellent inter-instrument reliability (intra-class correlation coefficients ranged from 0.90 to 0.97) and strong concurrent validity . Jamar and Rolyan dynamometers measure grip strength equivalently and can be used interchangeably [V³⁴](#)).

Communication, Affect Cognition, Learning: Pt's communication was normal, her emotional state and behavior was normal. She was very concerned about her shoulder pain, and the functional outcome.

Objective Examination

Observation:

Left clavicular fracture was healed with a ½ inch bump on the lateral 1/3rd of the clavicle bone close to the acromio- clavicular joint (A/C joint). There was minimal edema at the sub acromial bursa. She had a forward head posture and decreased cervical curvature.

Pain and Behavior of symptoms:

Aggravating Factors: Raising her arm with forward elevation, sideways or in external rotation or reaching back with internal rotation were limited and painful. Pt could not lie on her left side and she had to put a pillow under left arm and wear the sling during sleep.

Easing Factors: Rest, ice, medication, massage, occasional heat or shower gave her pain relief for a few hours.

The Numerical pain rating scale (NPRS) (Childs et al 2005) is a self reported measurement tool used to indicate average pain experience. The scale is anchored at two opposing extremes “0” indicating “no pain” and “10” indicating “most extreme pain”. Based on NPRS, left shoulder pain level was at 2/10 while she was at rest, 8/10 at worst, and 5-6/10 during midday. She could not roll at night, could not sleep on left side and her sleep was interrupted 4-6 times during the night. Left shoulder pain increased with work and daily activities. She experienced more pain as the evening progressed, and had to take oxycodone to relieve the deep aching pain at left shoulder.

Test and measures

Palpation: Tender sub acromial bursa, biceps tendon, A/C joint and superior scapular border of supraspinatus and Infraspinatus, pectoralis minor, upper traps, cervical occipital and scalenius muscles.

Postural Assessment: Patient presented with decreased cervical lordosis, forward head posture but thoracic and lumbar curve were normal. Left humeral head position was anterior compared to right shoulder, and scapular winging 2 inches lateral compared to left scapular inferior angle to spine distance position.

GHJ mobility test: Anterior /posterior and inferior glides were very poor. There was no sulcus sign in any direction. Pt had hypo mobility in all directions at GHJ and left humerus head position anterior compared to right shoulder. Left shoulder was higher than right shoulder in sitting and standing posture.

Neurological test:

Reflexes were normal Cervical 4-8 motor. There was no numbness or sensory deficit. Sensation was intact to light touch and deep touch.

Preferred Practice Pattern:

This Pt's preferred practice pattern for the left shoulder was Musculoskeletal Pattern 4D - Impaired joint mobility, Motor Function, Muscle Performance and Range of Motion Associated with Connective tissue dysfunction. The ICD 9 code for SAC is 726.0.

The Pt's preferred practice pattern for the cervical dysfunction was Musculoskeletal - Pattern F: Impaired Joint Mobility, Motor Function, Muscle Performance, Range of Motion, and Reflex Integrity Associated with Spinal Disorders. The ICD 9 Code for Cervical Spondylosis is 723.1.

Differentials diagnosis:

A significant number of patients present with both neck and shoulder pain. This Pt had cervical spine pathology and left SAC. Four different cervical spine tests that were utilized for Pt's treatment were the Compression test, distraction test, Spurling test, and Valsalva test, all of which were negative and had no effect on shoulder pain. Distraction test relieved the neck pain but had no effect on the shoulder pain. Findings concluded that the Pt had cervical spondylosis with limited AROM and PROM of cervical spine. She had poor segmental mobility cervical spine dysfunction. Cervical dysfunction was chronic and did not cause referred pain to the left shoulder. There are no specific special tests for adhesive capsulitis.²⁰ SAC is marked by loss of AROM and PROM. The definition and classification defined by Lundberg was shoulder joint elevation of <135 °, with restricted motion localized in GHJ. History, clinical and radiological examination showed normal alignment, no pathology of the bone structure and joint space in GHJ.¹⁷

The shoulder special tests may be used to rule in or rule out other pathologies. This Pt had tenderness over the long biceps tendon, and Speed and Yergason tests confirmed the biceps pathology. The empty can test, drop arm test were negative, and ruled out Supraspinatus tear. Infrapinatus test was negative, which indicated no tear in the posterior rotator cuff muscles.. Hawkins and Neer’s impingement tests were also positive for acromioclavicular pathology.

Some examples for sensitivity and specificity percentages are listed in table format below:

TEST	sensitivity	specificity
Empty can/drop arm test	44.1%	89.5 %
Infrapinatus test	41.6 %	90.1%
Hawkins-Kennedy test	71.5%	66.3%
Neer impingement test	68.0%	68.7%

Table 3: is provided from Journal of Physical Therapy May 2012 page 744

Commonly used treatment options for SAC:

Non operative treatment of SAC in general showed 90% success rate per [Levine W N et al](#) ²¹ over an average of 4 months therapy, which included oral non steroidal, anti-inflammatory drugs (NSAID). It has been suggested that “gentle” therapy (pain free pendulum and active exercises) is better than “intensive” therapy (passive stretching and manipulation up to and beyond the pain threshold). Patients with SAC often maintain some deficiencies in the range of motion even after “successful” therapy. ²²

There are controlled studies regarding the effectiveness of the end range mobilization techniques in the treatment of SAC that show they are warranted ⁴ . [Jewell](#) ³⁸ suggested in a Meta- Analysis of physical therapy intervention for SAC treatment, that joint mobilization and exercises were the most effective intervention. Physical therapy intervention used in the treatment of SAC frequently includes modalities, manual therapy techniques and therapeutic exercises.

Modalities

The goal of modality usage in the treatment of SAC include relieving pain and affecting scar tissue (collagen) formation. However, the use of ultrasound, massage, iontophoresis and phonophoresis has not been proven to be beneficial in the treatment of the SAC ²³

Heat modalities

Ultrasound is the application of heat through sound waves to deep tissue of the body. It is used to reduce pain, relax tight muscles and reduce muscle spasm. Ultrasound is shown to have an analgesic effect from the vasodilatation that it causes, which may help remove the byproducts of the injured tissue, that often stimulates the pain fibers. ²⁵ Muscle temperature is reported to rise 1-2 Centigrade (C°) in 20 to 30 seconds, as mentioned by [Drez](#) ²⁴ Ultrasound is also shown to relieve muscle spasms by decreasing receptor activity and sensitivity to stretching

Transcutaneous electric stimulation (TENS): In conjunction with exercises and manipulation, TENS has been shown to significantly increase range of motion more than heat. ²⁶ There are two theories of why TENS is effective in pain relief: The first theory “the gate control theory of pain” states that if the fibers transmitting touch and proprioception sensations are over stimulated, they may “flood” the pathways to the brain, preventing the pain signals from reaching the brain. ²⁷ The second theory postulates that “the electrical stimulation of nerve fibers causes the release of body’s own “natural opiates”, thereby decreasing pain. The pain relief is directly proportional to the TENS parameters of frequency and amplitude. As both frequency and amplitude increase, pain relief also increases ¹⁶.

Soft tissue mobilization (STM): Soft tissue mobilization and deep friction massage may have benefits in the treatment of SAC. Deep friction massage using the Cyriax Method is shown to be superior to superficial heat and diathermy treatment of SAC. Utilizing the Cyriax method, STM directed at the specific limitation of the periarticular structures in combination with a simple home exercise program appeared to be an effective treatment in patients with SAC stage II, as measured by improved ROM of the subjects. ²⁸

Passive motion: SAC involves fibrotic changes to capsular ligamentous structures. Continuous passive range of motion (CPM) or dynamic splinting are used to help elongate collagen fibers. CPM was compared to conventional PT in 57 patients with SAC. Both groups improved after 4 weeks of therapy, however, patients with stage II ²⁹ noted better outcomes when physical therapy was combined with the Dynamic splint protocol although there was no statistically significant difference between standard physical therapy or dynamic splint Protocol alone.

Manual therapy techniques: Joint mobilization to the GHJ is an effective intervention for SAC. Several studies showed that posterior glides to the humeral head were more effective than anterior glides to improve external rotation ROM in the patient with SAC ³⁰. Johnson and colleagues randomly assigned 20 patients with SAC to physical therapy intervention including grade III stretch mobilization and distraction at the end range of abduction and external rotation. After 3 sessions, the posterior mobilization group had significantly improved their external rotation by 31 degrees versus only 3 degrees in the anterior mobilization group. In addition, high-grade joint mobilization techniques were more effective than low-grade mobilization in improving GHJ mobility and reducing disability of patients with SAC.

Therapeutic exercises: Most commonly used exercises for patients with SAC are active-assistive range of motion (AAROM) exercises and passive ROM. Pt uses the uninvolved arm, or equipment such as the rope and pulley, wand/ T bar or exercise balls. Generally, these exercises are performed for flexion, abduction and external and internal rotation range of motions, which are most limited. [Griggs, et al.](#)³¹ found that physical therapy including 4 self stretches (passive flexion , horizontal adduction, internal rotation behind the back with the unaffected arm, and external rotation at 0° using a cane) performed twice a day produced a satisfactory outcome in 90% of stage II SAC. These patients significantly improved in pain, ROM, and shoulder function. However, the study did not compare the intervention to other types of therapy. Griggs suggests that more aggressive therapy such as manipulation is rarely necessary.

Resistive exercises typically include strengthening of the scapular stabilizers, rotator cuff, and lower trapezium muscles. As the range of motion improves, shoulder strengthening is appropriate intervention as long as the therapist stimulates normal movement pattern without substitution of scapular movements over GHJ mobility.

Proprioceptive neuromuscular facilitation (PNF): PNF is the application of specific stimuli to elicit and improve motor activity . Emphasis is placed on a pattern of movement performed from the proximal to distal portion of the extremity. The goal behind the creation of PNF was to develop a hands-on treatment approach that enables clinicians to analyze and assess patient's movement. PNF is not a treatment approach; it is a tool that allows for simultaneous assessment and treatment of neuromuscular dysfunction ³⁹.

Hold-relax and contract-relax techniques are used frequently in the management of SAC.

During this technique, the patient will relax the antagonist muscles, and then the physical therapist will move the limb through the available range to the point that soft tissue limitation is felt to gain further ROM.

End range isometric exercises are used for anterior deltoid muscles in the end range of forward flexion in supine after passive stretch to train the deltoid muscles to contract isometrically for 3-5 seconds. The patient can improve strength in the gained range during therapy sessions and maintain this range of motion. These techniques, when used effectively, can improve the patient outcome.

The home program designed in the first treatment session by the physical therapist is individualized and patient specific. Includes, self ROM and strengthening exercises for rotator cuff and scapular stabilization.

Internal rotation, arm behind the back stretch starts with shoulder extension in the sagittal plane, a move towards the other hip with the elbow bent, and a move towards the spine from the dorsal side of the affected arm toward the space between the shoulder blades. This prevents shoulder shrug and elevation of the humerus head and stretches the anterior shoulder without compromising the biceps and creating tendon irritation. Exercise intensity and repetition needs to be adjusted for each patient. Maitland irritability rules are applied. Patient's presentation of signs and symptoms, patient's complaint and objective finding of severity, irritability, nature, stage and stability are assessed and reassessed on a continuous basis, to determine the patient's progress and response to therapy.

Interventions used in this case

The intervention for this Pt started with patient education and patient advice to continue using her left upper extremity during daily living (ADL) and instrumental daily activities (IADL). Pt was advised to perform a daily walking, strengthening and conditioning program to improve the fitness and wellness of her upper and lower extremities. She was treated 3 times a week for the first 4 weeks with 6 minute therapeutic ultrasound at $1.5\text{w}/\text{cm}^2$, frequency to the anterior GHJ to deliver deep heat to the shoulder capsular structures, biceps tendon, sub acromial bursa and rotator cuff soft tissues. Soft tissue mobilization to deltoids, rotator cuff muscles, biceps tendon and upper trapezius musculature for 6 minutes was followed by Maitland joint mobilization. For the initial phase of SAC, Grade 1 to 2 anterior posterior (AP) joint mobilizations, inferior glides (IG) to GHJ, were used, to relieve pain and muscle spasm for this patient's left shoulder. Treatment was followed with passive stretching exercises in supine position in anatomical planes.

When acute pain was not present and stiffness was the major issue, grade 3 and 4 Maitland mobilization were utilized, to improve GHJ mobility. Refer to Table 4 for patient treatment during 0 to 12 weeks intervention.

Table 4: Patient Intervention

INTERVENTION	THER X	JOINT MOBS	STM	US/STIM
1-2 WEEKS	AA, PROM	GRADE 1 ,2	YES	YES
2-4 WEEKS	AA, PROM	GRADE 2,2+	AS NEEDED	AS NEEDED
5-6 WEEKS	AA,A,PROM	GRADE 2+,3	AS NEEDED	AS NEEDED
7-10 WEEKS	A, R, PROM	GRADE 3 ,3+	NO	NO
10-12	A,R, PROM	GRADE 3,4	NO	NO
12-24	NOT SEEN	NO	NO	NO

Table 5: Patient's expected AAROM, AROM were:

AROM	1-2 WEEKS	3-4 WEEKS	5-6 WEEKS	7-12 WEEKS
FLEXION	90 ° IN SUPINE	120° IN SUPINE	140° IN SUPINE	155 ° SUP/SIT.
ABDUCTION	80° IN SUPINE	100°	130° IN SUPINE	150° SUP/SIT.
EXTERNAL.ROT	20° AB 45° SUP	45° AB 60° SUP	75° AB 90° SUP	80 ° AB 90° SUP/SITTING
INTERNAL ROT	30 AB 45° SUP	45° AB 60° SUP	50° AB 90° SUP	60° AB 90° SUP /SITTING
EXTENSION	10 ° STANDING	30° STANDING	60° STANDING	75° STANDING

Therapeutic exercises are the most commonly used and prescribed exercises for adhesive capsulitis. Initially, in this case active-assistive range of motion (AAROM) and PROM was used.

In the later part of the treatment, Maitland mobilization, PNF and end range stretch and strengthening exercises were utilized. For her home exercise program, the Pt used her uninvolved arm, or utilized equipments such as PVC pipe for wand exercises in supine, rope and pulley, and T-bar or golf club and exercise ball for AAROM and PROM. All exercises performed in the clinic were 2 sets of 10, 2 to 3 sets for active and AAROM. Passive end range stretching performed by the physical therapist were done with 5 to 10 sec hold in end range for 1 or 2 sets of 10 repetition. Pt also used the same principle for stretching at home and in the office.

Outcomes

Disability, pain and function were measured for this patient using the Shoulder pain disability index (SPADI) and the Disabilities of the Shoulder and Hand (DASH). Using the SPADI, which has a disability and pain component, the means of the two scales are averaged to produce a total score ranging from 0 (best) to 100 (worst). The minimum detectable change (90% confidence) for the SPADI is 13 points. The DASH was chosen as an outcome tool to assess functional improvement.³² The minimum clinically important difference (MCID) of the DASH was 15 points; this represented the change in score needed to be considered clinically significant.

Pt reported resolution of pain during the day and at night and she was very happy with her progress and functional outcome. Occasional left shoulder aching at the end of the day depended on the activity level. Left shoulder pain ranged from about 0 to 2/10 but the pain resolved quickly with 20 to 30 minutes of exercises. She had been doing exercises religiously at home. She worked in short intervals and watched her postural correction, moving around every 20 to 30 minutes instead of sitting all day in front of the computer. On her last visit, the pt showed positive Hawkins and Neer test A/C joint impingement test at left shoulder. However she was satisfied with the progress and wanted to continue with home and gym exercises at that point. The patient was followed up by phone call on 3-7-2013. She reported that she was doing great and she had joined the gym and continued with her program 2 times a day for 30-40 minutes. She lost 6 pounds since she started the therapy. Her current height: 5'7" weight was 164 lbs BMI: 25.7 kg/m². She was still in the overweight category but she was determined to return to normal weight. Her progress is summarized in table 6, 7 and 8 below:

Table 6: Left shoulder AROM progress and improvement

AROM	11-02-2012	12-03-2012	01-04-2013	02-15-2013
Flexion	70 °	140 °	155 °	176 °
Abduction	65 °	130 °	145 °	165 °
External rotation	-10 ° /45 ° abd	55 °	75 °	87°
Internal rotation	20° sup 45 °abd	35°	60°	62°
Extension	20°	40°	60°	80 °
Internal rot aib	Right hip	L1 level	T12 level	T 6 level

Abd (abduction) arm in the back (aib), L1 lumbar first vertebra, T 12

(Thoracic 12 th) vertebra level; T6 (Thoracic 6' th) vertebra level.

Table 7: Left shoulder muscle strength progress and improvement.

MMT	11-02-2012	12-03-2012	01-04-2013	02-15-2013
Flexion	2+/5	3/5	3+/5	4+/5
Abduction	2/5 with pain	2+/5	3+/5	4/5
External rotation	2+/5 with pain	2+/5 less pain	3+/5	4/5
Internal rotation	3+/5	3+/5	4/5	4+/5
Biceps	3/5	3+/5	4/5	5/5
Left hand grip strength	20 ft/lbs	N/T	46 ft/lbs	60ft/lbs
Right hand grip strength	65 ft/lbs	N/T	72 ft/lbs	75 ft/lbs

Table 8: Initial, mid-treatment, and final NPRS, SPADI, DASH, and Global Rating Score

Left shoulder	11-02-2012	01-04-2013	02-15-2013
Numeric pain level NPRS	2 to 8/10	2 to 3/10	0 to 1/10
SPADI total pain score	70 %	12%	4%
SPADI total disability score	90 %	20%	1.25%
DASH	77.5	Not tested	16.5
Global rating of change score	Not tested	Not tested	6 out of 7 great deal better than started

Discussion:

This case report shows that a combination of modalities, manual therapy, and patient-specific goal oriented progressive end-range stretching and strengthening exercises, along with a consistently monitored home exercise program improved the outcome of the patient with SAC. Patient-specific Maitland mobilization techniques along with exercises achieved excellent results for this patient. In this case, Pt was treated with ultrasound/electric stimulation and soft tissue mobilization prior to Maitland mobilizations and end range stretching and strengthening exercises. Pt achieved her goals of returning to independent function and decreasing her pain with

this combination of modalities, exercises and manual intervention. The use of modalities in the treatment of SAC was effective in this case; however, the efficacy of Ultrasound as an intervention for SAC is still controversial. In the study by [Robertson](#)³⁷ it was reported that there was little evidence that therapeutic ultrasound is more effective than placebo ultrasound for treating people with pain of musculoskeletal injuries or promoting soft tissue healing. On the contrary, in agreement with the findings of this case, the study by Durmus³⁶ concluded that Ultrasound and ES were effective methods to reduce pain.

Team work between the doctor, physical therapist and insurance company, as well as other health care professionals was essential in achieving the desired level of progress.

In this case report, the team approach was effective to help the patient reduce pain and ROM impairment, and improve functional limitation and disability. The patient significantly improved in terms of pain, range of motion, and shoulder function and she was able to return to her previous activity level prior to injury.. Treatment lasted approximately three months with successful management and avoidance of further, costly tests or surgical procedures. According to the literature, if untreated, SAC might go unresolved for 12 to 18 months or longer sometimes up to 30 months.¹⁰

Shoulder joint ROM impairment and functional limitation causes a tremendous burden to patients.

This study showed that patients with SAC can be treated successfully with an experienced physical therapist. It is a lengthy process and there are a lot of obstacles to achieve full use of a frozen shoulder.

Conclusion:

This single case report has shown that SAC treated with a combination of modalities, joint and soft tissue mobilization, and exercise, along with a consistent home program, resulted in excellent outcome. Physical therapy interventions were initiated as soon as a diagnosis was made to prevent further impairment, functional limitation and disability. The Pt significantly improved in pain, range of motion and shoulder function and was able to resume her daily activities without limitation. Utilizing best evidence, clinical expertise and patient combined efforts, in therapy and at home, provided a successful outcome.

Since there is no gold standard for treatment of SAC, high-quality, larger randomized control studies are needed to define the key elements for the best intervention and management for SAC.

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CONSENT TO PARTICIPATE

Case Report prepared by Doctor of Physical Therapy Student, University of South Florida

I, Teresa Clark, (Patient) give my permission for Yalcin Ekren (Student) to use information about me in a formal, written Case Report prepared as a curriculum requirement for the Doctor of Physical Therapy degree at University of South Florida. The primary purpose of the Case Report is education.

I am aware that a Case Report describes the process used in developing my specific physical therapy plan of care including the treatments administered and outcomes of therapy. I also understand that a Case Report is NOT a research study. My decision to participate (or to decline participation) will not influence in any way the physical therapy services I receive. I will receive the same physical therapy services, as recommended by the PT student and PT supervisor, whether or not I participate. The Case Report simply describes my physical therapy.

Confidentiality will be maintained at all times. The case report will NOT identify me by name and will NOT include any information about me that might enable someone to identify me.

Additional requests for consent will be presented and explained to me should photographs, or videos be deemed necessary in the Case Report. I have the option to consent to all future requests.

I am aware that the completed Case Report will be presented orally and/or in poster format to students and faculty within the Program. Additionally, the Case Report may be presented to a group of licensed health care professionals as a component of a formal educational meeting.

The Case Report may be submitted for publication in a physical therapy professional journal. If the Case Report is submitted for publication, I have the right to read the manuscript before it is published. Please select one of the following:

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Relationship to person in Case Report: (Select one)

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Supervising Physical therapist or clinical instructor (name): YALCIN EKREN

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