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Introduction

Adhesive Capsulitis, also known as Frozen Shoulder, is a common shoulder pathology that impairs quality of life due to difficulty with shoulder mobility, pain and activities of daily living. There are a variety of diagnostic strategies, treatment and clinical recommendations associated with this condition which will be discussed in detail in this course. The best approach to take when considering diagnosis and treatment for a patient with Adhesive Capsulitis should be multifaceted to address patient symptoms, improve quality of life, pain and range of motion.

Section 1

Just like most musculoskeletal pathologies, Adhesive Capsulitis is relatively common and affects some demographics more than others. The fact that most clinicians will end up treating a patient with Adhesive Capsulitis makes it important to recognize populations at risk, common symptoms, and stages of Adhesive Capsulitis.

Incidence and Prevalence^{1,2}

Adhesive Capsulitis (AC) is also known as Frozen Shoulder. It occurs when there is a progressive pain and restriction in range of motion of either shoulder. It can impact anyone but is most common between ages 40-60. It impacts 2 to 5 percent of people globally and women are four times more likely than men to develop AC. In fact, 8 percent of men and 10 percent of women working age have AC at any given time. The African American and Hispanic/Latino population are more affected than any other race or ethnicity.

Risk Factors for AC

There are certain comorbidities and conditions that increase the risk for developing AC based on the type.

- 1) Primary idiopathic frozen shoulder^{1,3,4}
 - i. Occurs suddenly with no injury, trauma or precipitating event.
 - ii. Type one and two diabetes mellitus are highly correlated with primary AC. People with Type 1 Diabetes Mellitus have a high risk as 60 to 75% of that population have AC in their lifetime. A population grouped into Type 1 and Type 2 Diabetes Mellitus and thyroid problems has AC in their lifetime at a rate of 10 to 38 percent. Other comorbidities that are correlated with AC include cardiovascular disease, coronary artery disease, autoimmune disease, Dupuytren's disease, obesity, Parkinson's Disease.
- 2) Secondary Adhesive Capsulitis⁴
 - i. Occurs after a trauma or injury such as shoulder surgery, rotator cuff tear, impingement or hemiplegia.

Complaints/Symptoms^{4,5}

People with Adhesive Capsulitis complain of different symptoms based on how far along the disease process is and which stage the shoulder is in. A common symptom is loss of functional movement in shoulder in all planes, making reaching, activities of daily living, lifting objects and even driving difficult. Another common complaint is pain which is worst in freezing stage while the patient is gradually losing range of motion. This typically improves in frozen and thawing phase. Pain is worse at night during the early stage of AC.

Stages^{3,4}

According to evidence, gradual stiffening of the glenohumeral joint is a result of cells that have inflammatory properties entering the joint capsule and synovium, which is the lining of the joint capsule. This results in gradual loss of range of motion by collagenous adhesions depositing into the glenohumeral joint capsule in random assortment. Stages are listed below.

- 1) Freezing – Two to nine months^{3,4}

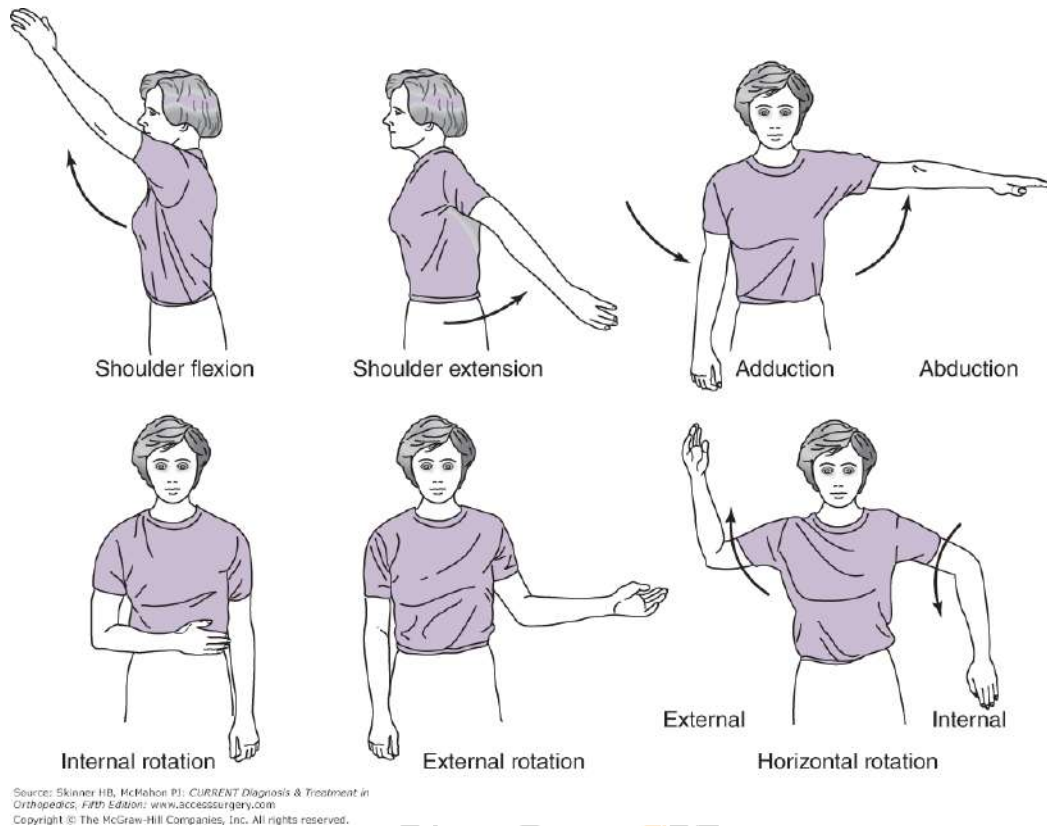
- a) This is the most painful stage where patients first start having symptoms resembling AC. There will be slow development of severe widespread shoulder pain. This pain will be worse at night than any other time. Within the joint, there are inflammatory markers at this stage but there are no collagenous deposits or adhesions. Range of motion will gradually decrease during this stage but typically not be severely limited yet.
- 2) Frozen (Adhesive) – four to twelve months
 - a) This stage is characterized by a severe loss of glenohumeral joint range of motion in the shoulder. This is marked in external rotation, flexion, abduction and internal rotation. Within the joint there is inflammation, preliminary adhesions and contracture of the joint capsule.
- 3) Thawing – Five to 26 months
 - a) Within the thawing stage there is a gradual return of shoulder motion. The joint shows no further evidence of inflammation. Adhesions in the glenohumeral joint capsule are proliferous which explains the slow return of range of motion. As this stage progresses pain improves as well.
- 4) Chronic
 - a) A few sources describe a fourth chronic stage as separate from above. This is marked by very little pain but lasting stiffness in the glenohumeral joint. This is due to adhesions continuing to dominate the joint capsule and little improvement in range of motion is noted.

Range of Motion⁶⁻⁸

It is important to note normal range of motion to understand how severely limited range of motion with adhesive capsulitis can be. As is well understood by physical therapists, active range of motion is the available degree a person can move a joint in a certain plane. Passive range of motion however is the maximum available motion with external pressure applied to reach the end feel (true stopping point of joint range of motion whether hard, soft or painful to move farther). There are normalized values that every physical therapist will learn in school, but that doesn't consider age, employment status, comorbidities and other factors. Below are the values for the accepted normal values for active, not passive range of motion and values that were obtained from taking

population average of people of working age from 40 to 50 years old. This is relevant to the adhesive capsulitis population as this is the average age group with AC.

- 1) Normal Shoulder Range of Motion
 - a) Needed for Activities of Daily Living
 - i) Flexion and Abduction: 130 degrees
 - ii) Extension: 60 degrees
 - b) End range for average age of 45 years old (normalized value)
 - i) Flexion: 160 degrees (180 degrees)
 - ii) Abduction: 150 degrees (180 degrees)
 - iii) Extension: 50 degrees
 - iv) External rotation: 55 degrees (90 degrees)
 - v) Internal rotation: 70 degrees
 - vi) Adduction: 45 degrees
- 2) Typical Adhesive Capsulitis Range of Motion at Frozen stage (degrees less than average)
 - a) Flexion: around 115 degrees (45 degrees)
 - b) Abduction: 100 degrees (50 degrees less)
 - c) External rotation: 33 degrees (22 degrees)
 - d) Internal rotation: 18 degrees (52 degrees)



Section 1: Summary

- 1) The most common population to suffer from Adhesive Capsulitis are women age 40-60 with comorbidities of Diabetes Mellitus or systemic disease and symptoms are decreased range of motion in the shoulder, pain which is most pronounced at night in the freezing stage
- 2) The common pattern for restriction of range of motion is external rotation, abduction and flexion which make activities of daily living difficult for people affected
- 3) Symptoms progress through freezing, frozen, thawing and sometimes chronic stages, meaning Adhesive Capsulitis can progress from two months to two years

Section 1: Key Words

Adhesive Capsulitis (AC) – A pathology of the shoulder involving a gradual loss in range of motion, pain and loss of function

Primary Idiopathic AC – A type of Adhesive Capsulitis where there is no precipitating event and is associated with systemic comorbidities

Secondary AC – A type of Adhesive Capsulitis following a trauma to the shoulder or a surgery

Dupuytren's disease – contracture of fascia over palm of hand causing contracture of finger flexion and comorbidity associated with Adhesive Capsulitis

Section 2

Physical Therapists should be comfortable and knowledgeable of factors to ask in a subjective history and to assess in a physical examination that represent a typical patient with AC. Physical Therapist Assistants should be familiar with personal factors and components of the physical examination to report progress to the Physical Therapist. There are many differential diagnoses that may mimic AC and common tests to rule them out, which are detailed in this section.

History and Physical Examination^{1,3}

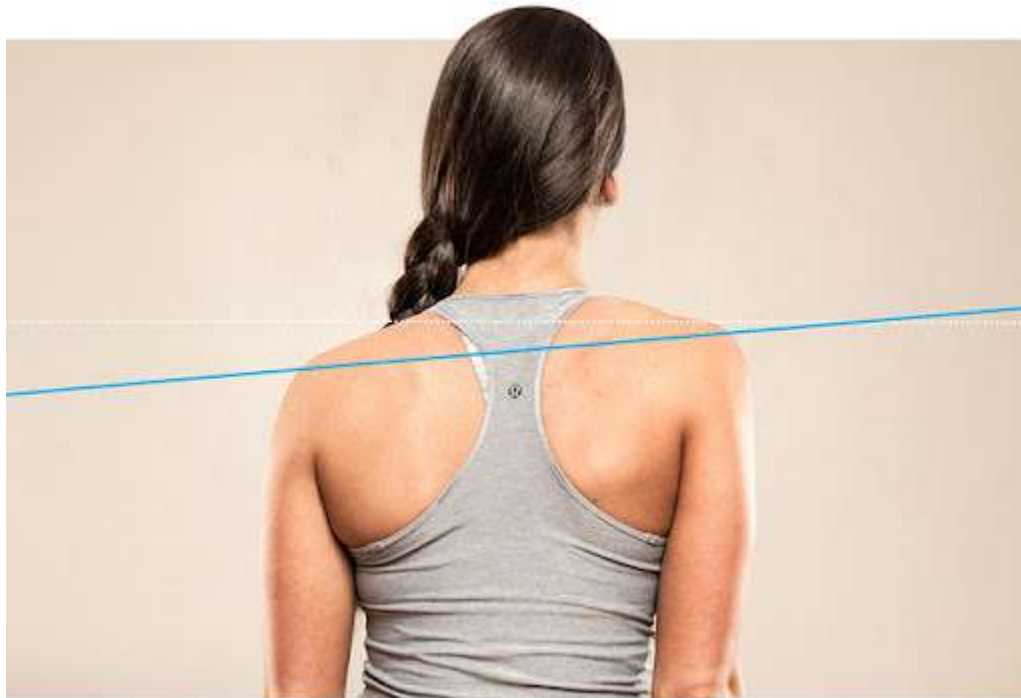
History

Just like treating any other clinical problem a patient would seek physical therapy for, an examination begins with a thorough subjective history. A clinician should ask details about a patient's symptoms including when and where they started, if there was a gradual or sudden onset after an injury, what improves and worsens pain, what the patient's daily routine looks like including what they do for work and what they struggle to do functionally on a daily basis. A patient may admit some cardinal signs of AC including night pain, restrictions in shoulder mobility limiting reaching, lifting and ADL function and/or a gradual loss of shoulder mobility. The patient may fit some of the clinical categorization of AC, including age 40-60, female, comorbidities of cardiovascular or thyroid disease, diabetes or recent cerebrovascular accident.

Physical Examination^{4,7,9}

A clinical examination for AC as with any shoulder pathology should be thorough assess mobility, pain and strength at the glenohumeral joint, scapulothoracic joint, the cervical and thoracic spine. Any of these areas may be compensating for lack of shoulder mobility with AC. Clinicians should note that especially in the freezing stage, patients will

likely need breaks during the examination due to high pain levels. Here are the major elements of a clinically supported physical examination for detecting and treating AC.



<http://c1healthcentre.co.uk/uneven-shoulders-should-i-worry/>

1) Posture

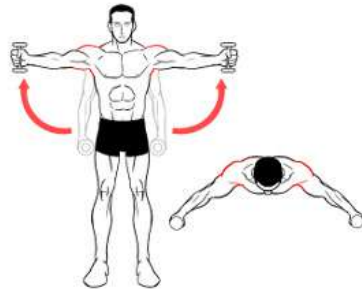
- a) Note the curvature and position of the spine, including whether excess lordosis or kyphosis is present, if there are any hinge points in the cervicothoracic or thoracolumbar junction
- b) Shoulder alignment, level of bilateral shoulders, scapular position, humerus position
 - i) Note scapular protraction vs retraction and compare bilaterally

2) Dynamic active range of motion

- a) Cervical and thoracic spine in flexion, extension, lateral flexion, rotation
- b) Shoulder planes of motion bilaterally and measure with a goniometer if there are deficits.

- i) Flexion, extension, scaption (scapular abduction 40 degrees anterior to frontal plane), abduction, adduction, external rotation, internal rotation

Scaption Plane



<https://www.northsidesportsmed.com.au/articles/2018/5/15/what-is-scaption-and-why-is-it-important>

- 3) Passive range of motion in all planes of shoulder bilaterally
 - a) Note pain, range of motion deficits
- 4) Palpation of muscles surrounding cervical and thoracic spine and shoulder girdle looking for points of tension or trigger points
- 5) Resistive/strength testing in all shoulder planes, cervical and thoracic spine
 - a) Strength is typically preserved but patients often won't have enough range of motion for traditional test positions for manual muscle testing. Therefore, strength can be depicted with Grades 0 through 5 with degree of motion defined or based on plane of motion available with Grades 0 through 5. For example, a patient who can only abduct their left upper extremity 50 degrees but holds against moderate pressure would be a 4/5 at 50 degrees abduction by the first method described. This test would be a 2-/5 or able to move through partial range of motion for the second method described. It is important to stay consistent and document the method of muscle testing to document progress throughout treatment.
- 6) Accessory joint motion of cervical, thoracic spine and glenohumeral joint
 - a) Cervical and thoracic posterior to anterior, medial and lateral passive accessory motion in supine and prone to detect joint stiffness and pain generators from spine

- b) Shoulder accessory joint motion
 - i) Distraction – joint play in open packed joint position (50 degrees abduction with slight horizontal adduction and external rotation)
 - ii) Inferior glide – joint play of humeral head moving downward in the joint capsule
 - iii) Posterior glide – joint play of humeral head moving backward in joint capsule
 - iv) Anterior glide – joint play of humeral head moving forward in joint capsule
- c) Inferior, posterior and anterior glide will be restricted with hard joint end feel compared to opposite shoulder
- d) Grades of accessory joint motion¹⁰
 - i) Grade 1 – little amplitude at start of range of motion
 - ii) Grade 2 – large amplitude at start of range of motion
 - iii) Grade 3 – large amplitude that enters restriction/stiffness
 - iv) Grade 4 – small amplitude that enters and stretches stiffness/pathology
 - v) Grade 5 – manipulation with short amplitude and quick velocity

Shoulder End Feel¹⁰	Description	Example
Bony (Hard)	Sudden limit to joint range of motion	Elbow Extension
Stretch of soft tissue (Firm)	Slightly gives but firm when at end range	Shoulder External Rotation
Approximation of soft tissue (Soft)	Two or more muscles compressed	Elbow flexion

7) Movement restrictions^{5,11}

- a) Restrictions in the affected shoulder would likely follow the capsular pattern at the shoulder resulting in most range of motion deficit in passive and active range of motion in frozen stage in external rotation, abduction and flexion

- b) Shoulder musculature develops an impact on joint range of motion in many ways. The rotator cuff muscles (subscapularis, infraspinatus, supraspinatus or teres minor) and the glenohumeral internal rotators limit external rotation, which in turn limits abduction and flexion movements because external rotation is necessary for elevation, flexion and abduction of the shoulder

8) Outcome Measures Studied in AC¹²

The upper extremity has many studied outcome measures that gain a picture of how shoulder pathology affects a patient's life. For Adhesive Capsulitis, the most effective outcome measures are the SPADI and DASH as well as pain rating (NPRS), which are detailed below.

- a) Shoulder Pain and Disability Index (SPADI)
 - i) 0 to 100 score (higher is more disability and pain)
 - ii) 13 questions which detect pain and functional disability
 - iii) Highly reliable at 90%
- b) Disability of the Arm, Shoulder and Hand scale (DASH)
 - i) 30 questions exploring ability to use upper extremity
 - ii) 1-5 scale to rate each activity on difficulty, higher is more difficult
 - iii) Reliability excellent above 90%
- c) Numeric Pain Rating Scale
 - i) Rated from 0 to 10
 - ii) 0 is no pain and 10 is most severe pain

Differential Diagnosis^{1,3,13-15}

Differential diagnosis is a key part of the examination of any upper extremity pathology. Because AC can be a diagnosis of exclusion, a clinician must know what types of pathologies can mimic Adhesive Capsulitis to understand how to best treat the range of motion restrictions and pain that develop from AC and to refer out when suspect of insidious pathology such as neoplasm or autoimmune disease.

- 1) Acromioclavicular arthropathy

- a) Occurs most often in people who are middle aged and occurs when the cartilage between the acromion and clavicle becomes worn out
- b) Range of motion is not affected
 - i) Compression and adduction are painful
- 2) Autoimmune Disease
 - a) Immune system attacks its own tissues creating joint inflammation, stiffness and pain that can mimic AC
 - b) Examples are Lupus erythematosus and Rheumatoid Arthritis
 - c) The patient will often have effusions in other joints and a rash as part of the clinical presentation
- 3) Biceps tendinopathy
 - a) Tenderness and inflammation of the proximal biceps tendon (usually long head at attachment to glenoid)
 - b) Most common in patients in active people over age 35
 - c) Pain and loss of range of motion especially in shoulder flexion, most noticeable when lifting objects
 - d) Speed or Yergason positive test (descriptions are in subsequent section)
- 4) Cervical disk degeneration
 - a) Cervical active range of motion is restricted, hand weakness, light touch sensation is impaired
 - b) Can refer pain to shoulder
- 5) Glenohumeral osteoarthritis
 - a) Cartilage in glenohumeral joint becomes worn out due to overuse
 - b) Shoulder muscle atrophy, pain with all shoulder mobility, similar range of motion deficits to adhesive capsulitis
- 6) Neoplasm

- a) Similar to adhesive capsulitis in terms of range of motion and pain deficits.
 - b) Night pain and pain with movement that is not relieved with rest to distinguish from adhesive capsulitis, which is typically more painful with movement
- 7) Rotator cuff tendinopathy or tear
- a) Tendinopathy occurs with overuse or incorrect movement patterns of the rotator cuff muscles
 - b) Tear occurs with trauma or more uncommonly chronic overuse tearing one or more of the four rotator cuff muscles
 - c) Only active range of motion, not passive is affected with movement with tendinopathy
 - d) With a rotator cuff full thickness tear, no active range of motion in the respective rotator cuff muscle will be possible with 0/5 strength and with a partial thickness tear range of motion actively will be likely restricted but will have some clinically detected strength
 - e) Painful arc of motion within shoulder flexion or abduction
 - f) Specific focal tenderness over affected rotator cuff tendon
 - i) Hawkins and Neer tests are positive (discussed below)
- 8) Subacromial and subdeltoid bursitis
- a) Only active range of motion is restricted due to pain, not passive range of motion
- 9) Subacromial Impingement Syndrome
- a) Occurs with influx of inflammation and deterioration of subacromial area outlined by the head of humerus, coracoacromial ligament, AC joint and acromion
 - b) The head of humerus compresses rotator cuff tendons resulting in pain, loss of range of motion and painful arc of motion
- 10) Labral tear
- a) Superior Labrum Anterior to Posterior (SLAP) tear occurs from trauma such as a fall with hand stretch in front of body or from repetitive overhead activity.

- b) Many types of labral tears depending on the classification based on radiography of labrum quality
- c) Complaints of diffuse shoulder pain, mostly in front of GH joint
- d) Positive tests of Speed, Yergason and active compression test

Common Tests for Diagnosing AC^{3,13,16-18}

Adhesive Capsulitis diagnosis is based on a clinical examination and past medical history. A clinician must rule out other pathology to determine whether a patient has AC or not.

1) Shoulder Shrug Sign

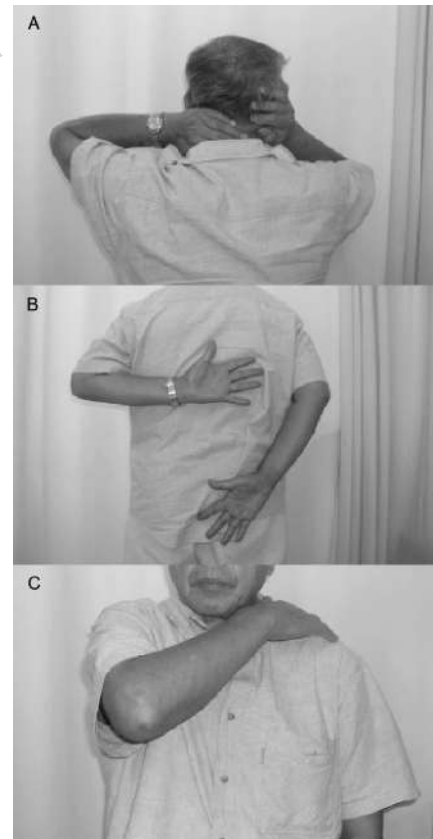
- a) Patient is unable to achieve 90 degrees of glenohumeral abduction free from elevation of entire scapula and shoulder girdle

2) Passive and Active range of motion

- a) Test-retest reliability measuring shoulder range of motion with a goniometer for flexion and extension is 0.8 to 0.9 which is considered highly reliable
- b) If range of motion is restricted to AC levels (see range of motion section on page 5), a clinician can use this information to assist in diagnosing AC.

3) Functional Tests

- a) Record bilaterally for baseline and follow up measurements
- b) Hand to neck, Hand to scapula, Hand to opposite scapula (see picture below for these tests in respective order)
 - i) Intratester and intertester reliability of average of 0.86 (indicating good reliability)
 - ii) Hand to neck measures shoulder flexion, abduction, external rotation
 - iii) Hand to scapula measures shoulder



https://www.researchgate.net/figure/Photograph-illustrating-results-of-the-function-related-tests-from-1-patient-with-a-right_fig1_687189

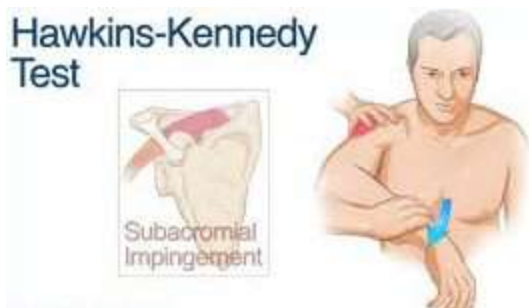
extension, adduction and internal rotation

- iv) Hand to opposite scapula measures shoulder flexion and horizontal adduction
- 4) Clinical presentation and noncontrast MRI are considered most diagnostically accurate
 - a) Ligamentous thickening of GH joint capsule
- 5) Blood testing is not indicated as accurate and radiographs are helpful to rule out fracture, arthritis, necrosis and tendinopathy but are not helpful in detecting AC

Special Tests for Differential Diagnosis^{13,16-18}

These are common special tests for shoulder pathology that are routine to perform to rule out AC as the pain and range of motion restrictions occur across many shoulder pathologies. A lot of these tests will be provocative but may assist in ruling out other shoulder pathology if results are negative.

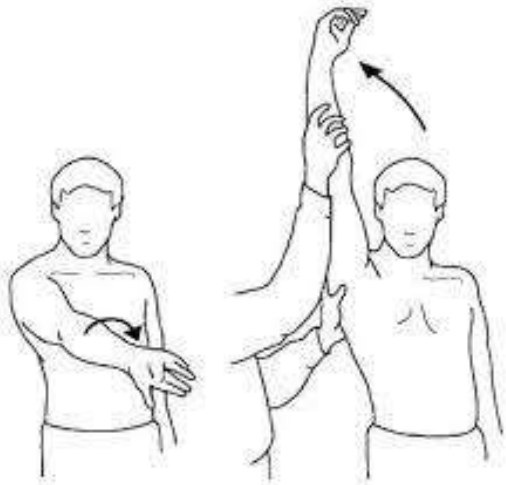
- 1) Hawkins Kennedy Impingement Test
 - a) Impingement is positive if a patient has pain in 90 degrees of shoulder flexion and elbow flexion with internal rotation of shoulder
 - b) Could also be positive with AC, if range of motion allows test position
 - c) Rules out Impingement at 72% and rules in impingement at 66% if positive
 - d) 0.4 reliability which is poor



<https://samarpanphysioclinic.com/painful-arc-syndrome/>

- 2) Neer Impingement Test
 - a) Therapist holds scapula stable with one hand while telling patient to fully relax shoulder and flex shoulder with complete internal rotation

- b) Reliability rating of 0.6 which is fair
- c) Rules impingement in and out at 60%



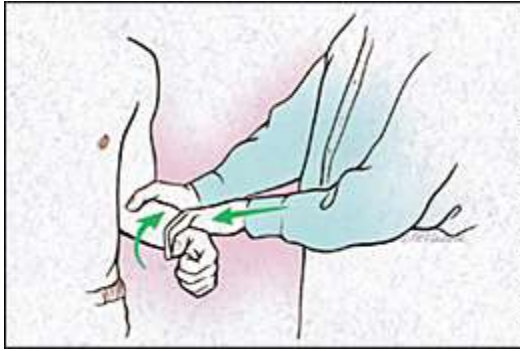
<https://physicaltherapyweb.com/neer-test-orthopedic-shoulder-examination/>

3) Speed

- a) Shoulder flexion, external rotation, full elbow extension, forearm supination and is positive if patient has pain in the bicep tendon as examiner puts resistance inferiorly for arc of motion
- b) Detects labral tears and biceps tendinitis
 - i) Rules in at 88% and rules out at 20%
- c) Reliability 0.6 (fair)

4) Yergason

- a) Detects biceps tendonitis and SLAP labral tear
 - i) Rules in at 92% and rules out at 20%
- b) Pain with resisted external rotation and supination of arm from neutral starting position of humerus and 90 degrees of elbow flexion and pronation
- c) Reliability 0.6 (fair)



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<https://www.aafp.org/afp/2009/0901/p470.html>

Clinical Checklist for AC¹⁹

The Journal of Orthopedic and Sports Physical Therapy created a clinical checklist for the management of patients with Adhesive Capsulitis to improve outcomes and streamline clinical care. A summary is provided below and is available in References section at Kelley et al.

- 1) Is the patient appropriate for PT, PT and another consultation or not appropriate for PT at all
 - a) If differential diagnosis provides red flags (fracture, neoplasm, etc), refer out
- 2) The clinician can expect the diagnosis to be AC
 - a) 40-60 years old
 - b) Slow development of range of motion deficits and pain which limit daily activities
 - c) GH range of motion loss especially in external rotation, abduction and flexion which reproduces pain
 - d) Accessory joint motion limited in every direction
 - e) Should consider other diagnosis if passive range of motion is within normal limits, if patient is positive with upper limb nerve tension tests, or if imaging reveals arthritis
- 3) High, medium and low irritability
 - a) With AC, patients will have various levels of irritability due to the nature of adhesions building in glenohumeral joint. It is important for clinicians to assess the stage, irritability and pain levels of each patient with AC because treatment strategy is driven by stage, pain and irritability level.

- b) High: pain at >7/10
 - i) Modalities, low level joint mobilization, pain free mobility and strengthening exercises
- c) Medium: pain at 4-6/10
 - i) Modalities, education to complete activities pain free at home
 - ii) Grade 2-3 mobilizations moderate as tolerated without pain
 - iii) Moderate stretching and neuromuscular reeducation to improve function without increasing inflammation
- d) Low: <3/10 pain
 - i) Full range of motion joint mobilizations (Grade 3-4)
 - ii) Education to complete near normal activities if remains low level pain
 - iii) Progressive stretching and ROM, strengthening to full range of motion and strength

Section 2: Summary

A thorough examination involves assessing global posture, then local posture of the affected upper extremity, range of motion, strength, accessory joint motion and which movements elicit pain. Common diagnoses that may mimic Adhesive Capsulitis are osteoarthritis, neoplasm, tendinopathy, impingement, bursitis and labral tears. It is important to know which stage a patient's Adhesive Capsulitis is to guide treatment and education on adjusting daily activities.

Section 2: Key Terms

Scaption – Plane of scapular movement of elevation involving glenohumeral flexion and abduction

SPADI – Shoulder Pain and Disability Index which is a common outcome measure used to assess disability that affects daily life from the shoulder

DASH – Disabilities of the Arm, Shoulder and Hand that rates all upper extremity symptoms and loss of function

Intrarater reliability – consistency of a measurement between the same examiner

Interrater reliability – consistency of a measurement between multiple examiners

Section 3

Interventions to improve symptoms of Adhesive Capsulitis have various affect depending on the stage of pathology, a patient's pain level and range of motion deficits. There are many conservative and nonconservative options for management of this condition, and these are often used in combination to reach best outcomes. It is important for Physical Therapists and Physical Therapist Assistants to know when to continue treatment or refer to an orthopedic physician based on clinical outcomes.

Treatment^{3,13,17}

Generally, treatment of AC is controversial and best evidence tends to contradict each other. After reviewing best clinical practice, optimal treatment includes a combination of multiple approaches including physical therapy techniques, medication and sometimes assisted by nonconservative management. best evidence also overlaps many treatment attempts below and tends to involve physical therapy and conservative or nonconservative treatment. As a clinical guideline, if a patient still has symptoms after 4-6 months of conservative treatment it is indicated to try nonconservative treatment.

Conservative Treatment^{3,13,17}

- 1) Physical Therapy (specific interventions detailed below)
- 2) Medication
 - a) Nonsteroidal anti-inflammatory drugs
 - i) Assist in managing joint inflammation and pain
 - b) Oral and injectable corticosteroids
 - i) Corticosteroid injection decreases stiffness of adhesions in freezing and frozen stages which has resulted in up to 30% improvement combined with PT than just PT alone
- 3) Acupuncture
- 4) Hydrodilation
 - a) Occurs with capsular stretching after injection of air or water into joint capsule

- b) Proven no better than corticosteroid injection
- 5) Suprascapular nerve block
 - a) The suprascapular nerve innervates almost three quarters of the GH joint musculature and has yielded similar results to corticosteroid injection but it varies from case to case
- 6) Cryotherapy
 - a) Whole body immersion in cold air at around -120 degrees Celsius
 - b) Proven to improve range of motion in combination with PT more than PT alone

Nonconservative Treatment^{13,20,21}

- 1) Manipulation under anesthesia
 - a) Physician moves shoulder in all planes to break up adhesions
 - b) Pain and range of motion improvement with over 80% satisfaction
 - c) Indications
 - i) Half as much external rotation as opposite shoulder
 - ii) Failure of conservative management
 - iii) Frozen stage of AC
 - d) Near 85% success rate based on follow up measures of pain and range of motion
- 2) Arthroscopic capsular release
 - a) Arthroscope inserted into GH joint with radiofrequency to cut tissue surrounding joint to free range of motion in all planes
 - b) Occasionally done in conjunction with corticosteroid injection
 - c) Range of motion improves statistically even five years out in all stages of levels of adhesions in glenohumeral joint

Physical Therapy and Best Practice for Treatment of AC^{3,5,11,13,22-25}

As a general rule, early physical therapy is important for restoring most possible ROM and improving pain. Late treatment won't resolve ROM and pain as well due to extensive adhesions that fill the GH joint capsule. Best evidence supports a clinical examination as discussed prior and developing a plan for treatment involving the following interventions which are broken into categories of mobility including mobilization and stretching, strengthening and modalities. These interventions should be done in the order of modality, mobility then strengthening or mobility, strengthening then modality to increase range of motion most.

1) Mobility (Mobilization and Stretching)^{3,4,17}

- a) Mobilization: mobility of humerus in respective direction to improve arthrokinematic mobility and global movement of external and internal rotation, abduction, flexion and extension. Mobilizations are typically completed at Grade 1 to 4 to gain mobility, performed for 30 to 60 seconds and repeated in three cycles with pre and post measurements of range of motion
 - i) Posterior mobilization of humeral head respective to glenoid at end range
 - (1) Proven to increase range of motion by 26 degrees
 - ii) Inferior and anterior mobilization improves range of motion in shoulder abduction on average of 20 degrees
 - iii) Mobilization in available shoulder plane movement (flexion, extension, abduction, etc) involves mobilizing humerus on glenoid with goal of increasing global shoulder movement involving short movements at end range
 - iv) Posterior mobilization and mobilization at end range when combined with scapular and glenohumeral activation and strengthening exercises improved pain, functional status and range of motion
- b) Stretching/Mobility
 - i) Posterior capsule stretching
 - (1) Proven to increase all planes of shoulder range of motion in just one session in thawing stage

- (2) Below is a picture of “sleeper stretch” which is a common way to self stretch the posterior capsule of the shoulder
- ii) Scapular mobility upward rotation repeated at 10-15 repetitions and three sets is also effective in restoring range of motion as the glenohumeral joint and scapulothoracic joint will be restricted
 - iii) Shoulder girdle stretches
 - (1) Levator scapula, upper trapezius, pectoralis minor, major
 - (2) Hold for 10-15 seconds, four to five times
 - (3) Short stretch times due to high pain level often experienced with stretches
 - iv) Passive range of motion, active assisted range of motion to active range of motion for all shoulder planes of motion including external rotation, internal rotation, abduction, flexion, extension, and scaption
 - (1) Complete passive if very painful for patient, active assisted with help from therapist or dowel/cane assisted by other upper extremity, or active if in thawing phase.
 - (2) 5-10 times a day at 15 to 20 repetitions each session



Self stretch of posterior capsule

<https://www.thephysicaltherapyadvisor.com/2017/01/11/why-does-my-shoulder-hurt/>

1) Strengthening/Activation Exercises^{5,22,26-28}

a) Scapular activation/strengthening sequence

- i) Protraction, retraction, upward rotation closed chain against wall or floor or open chain resisted
- ii) Dynamic scapular recognition exercises involving biofeedback cueing patients out of aberrant movements of the scapula

(1) Improved range of motion of shoulder external rotation at half year and upward rotation, flexion, abduction at two weeks

(2) 10-15 repetitions and three sets

b) Activation and strengthening of middle and lower trapezius helps to improve tipping of scapula and assist with lessening activation of upper trapezius which tends to be compensating for lack of glenohumeral ROM with AC

c) Proprioceptive Neuromuscular Facilitation (PNF)

- i) In a recent meta-analysis PNF improved disability, function, ROM in external rotation and abduction and pain more effectively than other methods of physical therapy⁵
- ii) Rotating, diagonal movements designed to begin with strongest and proceed with weaker muscles to increase range of motion and activation of muscles in singular planes in D1 or D2 patterns

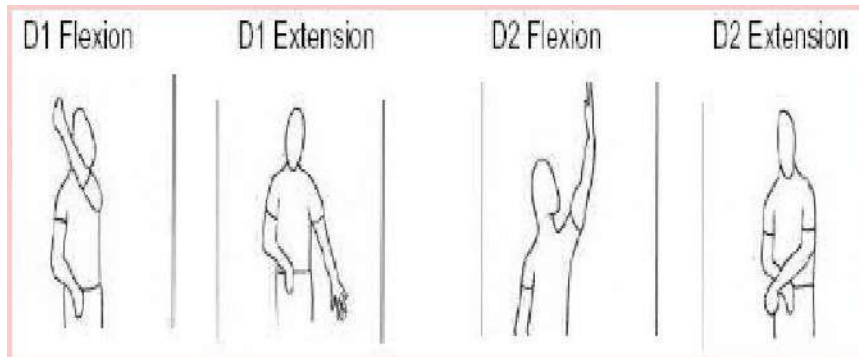
(1) D1 flexion starts in shoulder extension, abduction, external rotation, forearm pronation, wrist ulnar deviation and finger extension and ends in shoulder flexion, adduction and external rotation, forearm supination, wrist flexion and finger flexion

(2) D1 extension is complete reverse of D1 flexion beginning in shoulder flexion, adduction and external rotation, forearm supination, wrist radial deviation and flexion, finger flexion and ending in shoulder extension, abduction, external rotation, forearm pronation, wrist ulnar deviation and finger extension

(3) D2 flexion begins in shoulder extension, adduction, internal rotation, forearm pronation, wrist ulnar deviation and finger flexion and ends in shoulder flexion,

abduction, external rotation, forearm supination, wrist radial deviation and finger extension

- (4) D2 extension is more applicable to AC due to increasing mobility in shoulder capsular pattern and is the opposite of D2 flexion
 - (a) Begins in shoulder flexion, abduction, external rotation, forearm supination, wrist radial deviation and finger extension and ends in shoulder extension, adduction, internal rotation, forearm pronation, wrist ulnar deviation and finger flexion



<http://morphopedics.wikidot.com/physical-therapy-management-of-supraspinatus-tendinitis>

1) Rhythmic Initiation

- a) Movement in D1 or D2 patterns to activate appropriate muscle groups
- b) Guided by therapist first, can progress to active assisted, active resisted then active range of motion

2) Rhythmic Stabilization

- a) Within D1 or D2 pattern, isometrics at end range holding for 5-10 seconds to increase activation of muscle groups

3) Dynamic Reversals

- a) Within D1 or D2 pattern, manual resistance by therapist to activate appropriate group

- b) Effective to switch between eccentric and concentric activation through entire available range of motion
- 4) Hold relax and Contract relax
- a) Hold relax: Move tight muscle to end range to set up stretch and instruct patient to “hold” for a few seconds and therapist moves further into the stretch for 4-5 repetitions
 - b) Contract relax: contraction of agonist (target muscle) then instruction for contraction of antagonist (opposite muscle in terms of shoulder mobility), hold contraction for 5-10 seconds, therapist again moves further into available range of motion repeating 4-5 times
 - c) Hold relax and contract relax PNF techniques are used when muscular tension inhibits joint range of motion resulting in dysfunction. The mechanism of these techniques is stretching taut muscles and the process of reciprocal inhibition from motor neurons and maximal contraction of the inhibiting muscle (subscapularis, internal rotators) inhibits alpha motor neuron and allows further stretching. Stretching the inhibiting muscles allows for less restriction of range of motion, allowing the joint further motion in adjunct to achieving increases in interarticular motion with mobilizations.
- 5) Modalities^{5,26,29}
- a) Icing for improving inflammation after mobility exercise
 - b) Heating to improve muscular tissue extensibility before session/mobility
 - c) Cryotherapy
 - i) Whole body immersion in cold air at around -120 degrees Celsius and proven to decrease inflammation and improve ROM in patients with AC combined with PT than PT alone
 - d) Ultrasound had no significant effect on pain or range of motion for AC treatment over 90 days
 - e) Kinesiotaping: technique applying extensible tape over muscles to encourage activation in desired movement patterns due to stimulation of nerve receptors of skin and feedback to muscles

- i) Used as adjunct, low quality evidence supports but it may assist in activating shoulder girdle in correct pattern outside of physical therapy sessions
- f) Electrotherapy, Short wave diathermy, iontophoresis, TENS
 - i) Low quality evidence when compared to other physical therapy techniques

Section 3: Summary

As detailed above, interventions fall into nonconservative and conservative management. Physical therapy falls into conservative management and best evidence supports treating Adhesive Capsulitis with a multifaceted approach early on in disease process focusing on mobility, activation and strengthening exercises as well as pain control. A physical therapist should generally refer for nonconservative management if a patient is not improving in 4-6 months.

Section 3: Key Terms

Arthokinematic – mobility of the surfaces of joints involving spin, glide and roll to help create a global movement such as shoulder flexion

Joint Mobilization – application of force to joint surfaces with goal of improving range of motion and pain in that joint

Proprioceptive Neuromuscular Facilitation (PNF) – approach for activating muscles typically in diagonal patterns by increasing nerve receptor activation with manual facilitation and stretching

Aberrant movement – movement pattern that is not in correct sequencing due to underlying muscular or joint dysfunction

Section 4: Case Study

Sara is a 52-year-old female who had a hospital stay for two days for management of hypertension and hyperglycemia due to poorly controlled Type 2 Diabetes Mellitus. This patient was evaluated by a Physical Therapist in acute care, and mobility findings were that patient could complete three stairs to enter her home, ambulate and complete bed mobility and transfers with independence. The acute care Physical Therapist did note that the patient was able to complete hand to neck test at just 50% on the left upper extremity compared to the right upper extremity and referred to outpatient physical therapy.

Sara arrived at her physical therapy evaluation with a diagnosis of shoulder stiffness a few days after her hospital stay. She reported her left shoulder began hurting a few months ago, mostly at night. She states she had a rotator cuff surgery five years ago on that side. She would use ice and heat to reduce her symptoms along with taking Ibuprofen, which helped slightly. She reports little pain now but has extreme difficulty washing dishes, performing work duties as a receptionist with reaching for files and has had to rely on her right arm for most tasks.

- 1) What parts of Sara's past medical history are important in guiding an examination for her shoulder symptoms?
- 2) What clinical diagnosis does Sara fit into based on her case history?
- 3) State three differential diagnoses that a Physical Therapist may screen for during an evaluation.
- 4) List five items that should be part of a clinical examination for Sara's case.
- 5) List 2-3 options for interventions on the first week of treatment.

Responses

- 1) Sara's comorbidities of hypertension (cardiovascular disease), Diabetes Mellitus, and past rotator cuff surgery are important risk factors for Adhesive Capsulitis. Sara is also a female and at the most common age group (40-60) to have Adhesive Capsulitis.
- 2) Adhesive Capsulitis and primary idiopathic or secondary from prior rotator cuff surgery. She is in Frozen stage.
- 3) Rotator cuff tear, impingement, biceps tendinopathy, labral tear, subacromial or subdeltoid bursitis, neoplasm, glenohumeral arthritis, autoimmune disease, acromioclavicular arthropathy
- 4) SPADI or DASH for outcome measures, posture, bilateral active and passive range of motion, bilateral resistive/strength testing, bilateral arthrokinematics/accessory joint motion in shoulder, cervical and thoracic spine, special tests to rule out impingement, rotator cuff tear, labral tear.
- 5) Mobility at Grade 2-4 joint mobilization, prolonged posterior capsule stretching, PROM/AAROM of global shoulder movements, activation exercises of scapular and glenohumeral musculature.

Conclusion¹³

As discussed above, Adhesive Capsulitis diagnosis, examination and treatment is highly individualistic due to its multiple stages and varying quality of evidence in physical therapy and nonconservative management. Generally, if conservative management fails in four months, nonconservative management should be considered. A physical therapist should consider a combination of mobility, strengthening and modalities to improve pain, range of motion and quality of life in patients with AC. The process of physical therapy may involve trial and error of interventions above to improve outcomes. Similar to treating any other patient in physical therapy it is important for the physical therapist to educate the patient throughout treatment as AC is typically frustrating due to limiting to daily activities and sleep.

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