CLINICAL GUIDELINES

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Shoulder Pain and Mobility Deficits – Adhesive Capsulitis:
Clinical Practice Guidelines
Linked to the International Classification
of Functioning, Disability, and Health
from the Orthopaedic Section of the
American Physical Therapy Association

RECOMMENDATIONS..................................................xx
INTRODUCTION.........................................................xx
METHODS..............................................................xx
CLINICAL GUIDELINES:
Impairment/Function-Based Diagnosis..................................xx
CLINICAL GUIDELINES:
Examinations........................................................xx
CLINICAL GUIDELINES:
Interventions.........................................................xx
SUMMARY OF RECOMMENDATIONS.............................xx
AUTHOR/REVIEWER AFFILIATIONS & CONTACTS........xx
REFERENCES........................................................xx

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Recommendations

Pathoanatomical features: Clinicians should assess for impairments in the capsuloligamentous complex and musculotendinous structures surrounding the shoulder complex when a patient presents with shoulder pain and mobility deficits. The loss of passive motion, particularly external rotation with the arm in varying degrees of shoulder abduction, is a significant finding that can be used to guide treatment planning. (Recommendation based on theoretical/foundation evidence)

Risk Factors: Clinicians should recognize that 1) patients with diabetes mellitus and thyroid disease are at risk for developing adhesive capsulitis, and 2) adhesive capsulitis is more prevalent in individuals who are over than 40 years old, females, and have had previous episode of adhesive capsulitis in the contralateral arm. (Recommendation based on moderate evidence)

Clinical Course: Clinicians should recognize that AC occurs as a continuum of pathology characterized by a staged progression of pain and mobility deficits. At 12-18 months, mild to moderate mobility deficits and pain may persist but many patients report minimal to no disability. (Recommendation based on weak evidence)

Diagnosis/Classification: Clinicians should recognize that patients with adhesive capsulitis present with a gradual and progressive onset of pain and loss of active and passive shoulder motion in both elevation and rotation. Utilizing the evaluation and intervention components described in this guideline will assist clinicians in medical screening, differential evaluation of common shoulder musculoskeletal disorders, diagnosing tissue irritability levels, and planning intervention strategies for patients with shoulder pain and mobility deficits. (Recommendation based on expert opinion)

Differential Diagnosis: Clinicians should consider diagnostic classifications other than adhesive capsulitis when the patient’s reported activity limitations or impairments of body function and structure are not consistent with the diagnosis/classification section of this guideline, or, when the patient’s symptoms are not resolving with interventions aimed at normalization of the patient’s impairments of body function. (Recommendation based on expert opinion)

Examination -- Outcome Measures: Clinicians should use validated functional outcome measures, such as the Disabilities of the Arm, Shoulder and Hand, the American Shoulder and Elbow Surgeons Shoulder Scale, or the Shoulder Pain and Disability Index. These should be utilized before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with adhesive capsulitis. (Recommendation based on strong evidence)

Examination -- Activity Limitation Measures: Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient’s shoulder pain to assess the changes in the patient’s level of shoulder function over the episode of care. (Recommendation based on expert opinion)
Examination – Physical Impairment Measures: Clinicians should measure pain and active and passive shoulder ROM to assess the key impairments of body function and body structures in patients with adhesive capsulitis. ( Recommendation based on theoretical/foundation evidence)

Intervention -- Corticosteroid injections: Intraarticular corticosteroid injections combined shoulder mobility and stretching exercise are more effective in providing short-term (4-6 weeks) pain relief and improved function compared to shoulder mobility and stretching exercises alone. ( Recommendation based on strong evidence)

Interventions – Patient Education: Clinicians should utilize patient education that 1) describe the natural course of the disease, and 2) promote activity modification to encourage functional, pain free range of motion, and 3) match the intensity of stretching to the patient's current level of irritability. ( Recommendation based on moderate evidence)

Interventions – Modalities: Clinicians may consider using short-wave diathermy, ultrasound, or electrical stimulation combined with mobility and stretching exercises to reduce pain and improve shoulder range of motion in patients with adhesive capsulitis. ( Recommendation based on weak evidence)

Interventions – Joint Mobilization: Clinicians may consider the use of joint mobilization procedures to reduce pain, and increase motion and function in patients with adhesive capsulitis. ( Recommendation based on weak evidence.)

Interventions -- Stretching Exercises: Clinicians should instruct patients with adhesive capsulitis in stretching exercises. The intensity of the exercises should be determined by the patient's tissue irritability level. ( Recommendation based on moderate evidence.)
Introduction

AIM OF THE GUIDELINE
The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based practice guidelines for orthopaedic physical therapy management of patients with musculoskeletal impairments described in the World Health Organization’s International Classification of Functioning, Disability, and Health (ICF).

The purposes of these clinical guidelines are to:

- Describe evidence-based physical therapy practice including diagnosis, prognosis, intervention, and assessment of outcome for musculoskeletal disorders commonly managed by orthopaedic physical therapists
- Classify and define common musculoskeletal conditions using the World Health Organization’s terminology related to impairments of body function and body structure, activity limitations, and participation restrictions
- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions
- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure as well as in activity and participation of the individual
- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists
- Provide information for payers and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions
- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy

STATEMENT OF INTENT
This guideline is not intended to be construed or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns of care evolve. These parameters of practice should be considered guidelines only. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made in light of the clinical data presented by the patient and the diagnostic and treatment options available. However, we suggest that significant departures from accepted guidelines should be documented in the patient’s medical records at the time the relevant clinical decision is made.
METHODS

Content experts were appointed by the Orthopaedic Section, APTA as developers and authors of clinical practice guidelines for musculoskeletal conditions of the shoulder that are commonly treated by physical therapists. These content experts were given the task to identify impairments of body function and structure, activity limitations, and participation restrictions, described using ICF terminology, that could 1) categorize patients into mutually exclusive impairment patterns upon which to base intervention strategies, and 2) serve as measures of changes in function over the course of an episode of care. The second task given to the content experts was to describe interventions and supporting evidence for specific subsets of patients based upon the previously chosen patient categories. It was also acknowledged by the Orthopaedic Section, APTA content experts that only performing a systematic search and review of the evidence related to diagnostic categories based on International Statistical Classification of Diseases and Health Related Problems (ICD) terminology would not be sufficient for these ICF-based clinical practice guidelines as most of the evidence associated with changes in levels of impairment or function in homogeneous populations is not readily searchable using the ICD terminology. Thus, the authors of this guideline independently performed a systematic search of the MEDLINE, CINAHL, and the Cochrane Database of Systematic Reviews (1966 through September 2011) for any relevant articles related to classification, examination, and intervention for musculoskeletal conditions related to classification, outcome measures, and intervention strategies for shoulder adhesive capsulitis and frozen shoulder. Additionally, when relevant articles were identified their reference lists were hand-searched in an attempt to identify other relevant articles. This guideline was issued in 2012 based upon publications in the scientific literature prior to September 2011. This guideline will be considered for review in 2017, or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the Orthopaedic Section of the APTA website: www.orthopt.org

Levels of Evidence

Individual clinical research articles will be graded according to criteria described by the Center for Evidence-Based Medicine, Oxford, United Kingdom (http://www.cebm.net) for diagnostic, prospective, and therapeutic studies. An abbreviated version of the grading system is provided below (TABLE 1). The complete table of criteria and details of the grading can be found on the web at http://www.cebm.net.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tr>
<td>I</td>
<td>Evidence obtained from high quality diagnostic studies, prospective studies, or randomized controlled trials</td>
</tr>
<tr>
<td>II</td>
<td>Evidence obtained from lesser-quality diagnostic studies, prospective studies, or, randomized controlled trials (eg, weaker diagnostic criteria and reference standards, improper randomization, no blinding, &lt;80% follow-up)</td>
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<tr>
<td>III</td>
<td>Case controlled studies or retrospective studies</td>
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<td>IV</td>
<td>Case series</td>
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<td>V</td>
<td>Expert opinion</td>
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Table 1. Levels of Evidence
The overall strength of the evidence supporting recommendations made in this guideline were graded according to guidelines described by Guyatt et al, as modified by MacDermid and adopted by the coordinator and reviewers of this project. In this modified system, the typical A, B, C and D grades of evidence have been modified to include the role of consensus expert opinion and basic science research to demonstrate biological or biomechanical plausibility. (TABLE 2)

<table>
<thead>
<tr>
<th>Grades of Recommendation</th>
<th>Strength of Evidence</th>
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<tbody>
<tr>
<td>A</td>
<td>Recommendation based on Strong Evidence A preponderance of Level I and/or Level II studies support the recommendation. This must include at least 1 Level I study</td>
</tr>
<tr>
<td>B</td>
<td>Recommendation based on Moderate Evidence A single high quality randomized control trial or a preponderance of Level II studies support the recommendation</td>
</tr>
<tr>
<td>C</td>
<td>Recommendation based on Weak Evidence A single Level II study or a preponderance of Level III and IV studies including statements of consensus by content experts support the recommendation</td>
</tr>
<tr>
<td>D</td>
<td>Recommendation based on Conflicting Evidence Higher quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies.</td>
</tr>
<tr>
<td>E</td>
<td>Recommendation based on Theoretical/Foundational Evidence A preponderance of evidence from animal or cadaver studies, from conceptual models/principles or from basic sciences/bench research support this conclusion</td>
</tr>
<tr>
<td>F</td>
<td>Recommendation based on Expert Opinion Best practice based on the clinical experience of the guidelines development team</td>
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Table 2. Grades of Evidence

REVIEW PROCESS
The Orthopaedic Section, APTA also selected consultants from the following areas to serve as reviewers of the early drafts of this clinical practice guideline:
- Claims review
- Coding
- Epidemiology
- Medical practice guidelines
- Orthopaedic physical therapy residency education
- Orthopaedic physical therapy clinical practice
- Orthopaedic surgery
- Rheumatology
- Physical therapy academic education
- Sports physical therapy/rehabilitation clinical practice
- Sports physical therapy residency education
CLASSIFICATION
The terms adhesive capsulitis and frozen shoulder have both been used for patients with shoulder pain with mobility deficits. Adhesive capsulitis will be used in this guideline to describe both primary idiopathic adhesive capsulitis and secondary adhesive capsulitis, related to systemic disease such as diabetes mellitus and thyroid disorders, as well as extrinsic or intrinsic factors including cerebral vascular accident, proximal humeral fracture, causative rotator cuff or labral pathology. The term adhesive capsulitis is used, rather than frozen shoulder, because it is the term used in the ICD.

The ICD-10 code associated with adhesive capsulitis is M75.0. The corresponding ICD-9 CM code, commonly used in the USA, is 727.3. The primary ICF body function codes associated with shoulder pain and mobility deficits/adhesive capsulitis are b28014 pain in the upper limb, b28016 pain in joints, and b7100 mobility of a single joint. The primary ICF body structure codes associated with adhesive capsulitis are s7201 joints of shoulder region and s7203 ligaments of shoulder region.

The primary ICF activities and participation codes associated with adhesive capsulitis are d4150 maintaining a lying position, d5400 putting on clothes, d5401 taking off clothes, d4452 reaching. The secondary ICF activities and participation codes associated with adhesive capsulitis are d2303 completing the daily routine, d4300 lifting, d4302 carrying in the arms, d4454 throwing, d4551 climbing, d4554 swimming, d5100 washing body parts, d5101 washing whole body, d5202 caring for hair, d6201 gathering daily necessities, d6402 cleaning living area, d6501 maintaining dwellings and furnishings, d6600 assisting others with self care, and d9201 sports.

CLINICAL GUIDELINES

PREVALENCE
The prevalence of shoulder pain has been reported to be between 2.4 and 26.0%.25, 69 Primary adhesive capsulitis is reported to affect 2 to 5.3% of the general population.5, 17, 71, 98 The prevalence of secondary adhesive capsulitis related to diabetes mellitus and thyroid disease is reported to be between 4.3 and 38%.5, 7, 17, 71, 98 Milgrom et al77 compared 126 patients (67 females, mean age 55.0 ± 8.4 and 50 males, mean age 54.7 ± 8.7) with idiopathic adhesive capsulitis to prevalence data and found a significantly higher prevalence of diabetes among both females (23.7% versus 4.7%) and males (38.0% versus 6.5%) with adhesive capsulitis as compared to the age-matched population. The type of diabetes, type I or II, was not identified. A significantly higher prevalence of hypothyroidism among females (21.1% versus 7.9%) with idiopathic adhesive capsulitis was found compared to the age-matched regional population.
PATHOANATOMICAL FEATURES
The glenohumeral joint is a synovial joint containing a synovial membrane lining the interior joint capsule and encasing the long head of the biceps tendon into the biceps groove. The glenohumeral capsule, coracohumeral ligament, and the glenohumeral ligaments - superior, middle, and inferior, comprise the capsuloligamentous complex. This complex surrounds the glenohumeral joint inserting onto the humerus, (superior to the lesser tuberosity, surgical and anatomic necks) from the coracoid and glenoid rim via the labrum and glenoid neck. The capsuloligamentous complex and rotator cuff tendons create an intimate static and dynamic constraining sleeve about the glenohumeral joint.28, 100

II Cadaver studies demonstrate the restricting influence of the subscapularis and selected capsuloligamentous complex portions.96, 123 The proximal portion of the capsuloligamentous complex and subscapularis were found to limit external rotation when the glenohumeral joint was positioned up to 45 degrees of abduction. Turkel123 found the subscapularis limited external rotation the most with the arm at zero degrees of abduction. It has been suggested that a greater loss of external rotation at 45 degrees versus 90 degrees of abduction indicates subscapularis restriction.44

II The rotator cuff interval forms a triangular shaped tissue bridge between the anterior supraspinatus tendon edge and upper subscapularis border with the apex located on the biceps sulcus lateral ridge at the margin of the transverse humeral ligament.102 The rotator cuff interval is primarily composed of the superior glenohumeral ligament and the coracohumeral ligament.29, 36, 63, 103 Recently, the anterosuperior capsule was found to have not only a anterior limb but a posterior limb containing the previously unrecognized posterosuperior glenohumeral ligament.103

IV Adhesive capsulitis is marked by the presence of multiregional synovitis, consistent with inflammation50, 83, 87, 131 yet focal vascularity and synovial angiogenesis (increased capillary growth) rather than synovitis are described by others.20, 55, 132, 133 Accompanying angiogenesis, there is evidence of new nerve growth in the capsuloligamentous complex of patients with adhesive capsulitis which may explain the heightened pain response.49 Regardless if the synovial pathology is angiogenesis or synovitis, significant pain can result at rest or with motion.

IV Significant capsuloligamentous complex fibrosis and contracture are consistently observed upon open or arthroscopic shoulder surgery and histologic examination. The entire capsuloligamentous complex can become fibrotic, but the rotator cuff interval and specifically the capsuloligamentous complex are predominantly involved.55, 82, 91, 93, 97, 124, 125, 132 The rotator cuff interval is part of the anterosuperior complex which functions as a superior hammock. With the arm at the side, the anterior limb restricts external rotation while the posterior limb restricts internal rotation.51, 103 Coracohumeral ligament release in patients with a adhesive capsulitis resulted in a dramatic increase in shoulder external rotation.50, 82, 91, 93, 97 Others have noted significant subacromial scarring,55, 84 loss of the subscapular recess,71, 85 and inflammation of the long head of the biceps tendon and its synovial sheath151 and musculo-tendinous contracture.84
Clinicians should assess for impairments in the capsuloligamentous complex and musculotendinous structures surrounding the shoulder complex when a patient presents with shoulder pain and mobility deficits. The loss of passive motion, particularly external rotation with the arm in varying degrees of shoulder abduction, is a significant finding that can be used to guide treatment planning. When a patient presents with global passive range of motion deficits, particularly external rotation with the arm at the side, adhesive capsulitis should be highly suspected.

**RISK FACTORS**

III Although the etiology of adhesive capsulitis has not been identified, there are a number of associated factors. Recent evidence implicates elevated serum cytokine levels cause or result in a sustained intense and protracted inflammatory/fibrosis response effecting the synovial lining and capsuloligamentous complex in patients with adhesive capsulitis. To date, the relationship between cytokines and the “trigger” response, whether it is insidious or related to minor trauma, is unknown.

III Individuals with type I and II diabetes mellitus have a greater propensity of developing adhesive capsulitis. Patients with Dupuytren’s disease or type I diabetes mellitus for ten or more years have a greater incidence of primary adhesive capsulitis.

II Milgrom et al in a prospective study identified risk factors for idiopathic adhesive capsulitis by comparing new cases (n=126) to age-matched controls over a 2.5 year period. There was 29.3% with diabetes mellitus. Patients with adhesive capsulitis were at greater risk for diabetes mellitus compared to an age-matched population; risk ratio in males 5.9 (95% CI 4.1-8.4) and females 5.0 (95% CI 3.3-7.5). Balci et al evaluated patients with type II diabetes mellitus (n= 297, 60% female) to determine the presence of adhesive capsulitis and other conditions. They found that 29% (males 33.6%, females 25.9%) had adhesive capsulitis as defined by having at least one month of shoulder pain, inability to lie on the affected side and restricted active and passive shoulder motion of 3 or more planes. They found a significant relationship between adhesive capsulitis and Dupuytren's disease. Adhesive capsulitis was associated with age (mean =59.23 ± 8.24) and the duration of diabetes. Aydeniz et al compared 102 patients (mean age = 58.0 ± 9.1) with type II diabetes mellitus to an age and sex-matched control group and found that 14.7% had adhesive capsulitis compared to 3.9% in the controls. Dupuytren's contracture was higher in the diabetic group (12.7%) versus the control group (3.9%). There were significant associations between age, diabetes, duration and musculoskeletal complications (i.e. Dupuytren's contracture, trigger finger).

II Thyroid disease is a risk factor associated with adhesive capsulitis. Milgrom et al reported that 13.4% of patients with adhesive capsulitis were found to have thyroid dysfunction. The majority of the patients who developed adhesive capsulitis were females (16 of 17). They reported a risk ratio of thyroid dysfunction in males of 2.6 (95% CI: 0.4 -17.0) and females, 7.3 (95% CI: 4.8-11.1) in patients with adhesive capsulitis.
II Cakir performed physical examinations on 137 patients (female 111, male 26) with hyper/hypothyroidism. The prevalence of adhesive capsulitis was 10.9%. In addition, both Dupuytren's contracture (8.8%) and carpal tunnel syndrome (9.5%) were associated with thyroid disease.

II Age can be considered a risk factor since adhesive capsulitis commonly occurs between 40 and 65 years old (avg. 51-55 years). Females appear to be affected more than males. However, more males (33.6%) than females (25.9%) had adhesive capsulitis in an identified group of patients with diabetes mellitus. Having adhesive capsulitis on one side places an individual at risk for opposite arm involvement (5% to 34%) and it can occur up to 14% of the time simultaneously.

IV Other associated factors include prolonged immobilization, myocardial infarction and trauma or autoimmune disease.

B Clinicians should recognize that 1) patients with diabetes mellitus and thyroid disease are at risk for developing adhesive capsulitis, and 2) adhesive capsulitis is more prevalent in individuals who are over 40 years old, females, and have had previous episode of adhesive capsulitis in the contralateral arm.

CLINICAL COURSE
A continuum of adhesive capsulitis' three stages have been described. Stage 1, known as the 'painful' or 'freezing' stage. This stage may last for less than 3 months and patients describe sharp pain at end ranges, achy pain at rest and sleep disturbance. Impingement is often the suspected clinical diagnosis early in this stage since there are minimal to no restrictions. A gradual loss of motion due to pain occurs in all directions. Arthroscopic examination reveals synovitis/angiogenesis and near normal motion under anesthesia. Stage 2, known as the 'freezing' stage, is characterized by pain and loss of motion for 3 to 9 months. The synovitis/angiogenesis proliferates resulting in loss of capsular volume and motion under anesthesia. Stage 3, known as the 'thawing' stage is characterized with pain that begins to resolve but significant stiffness persist over 9 to 14 months. This stage may progress to pain resolution, but motion restrictions may persistent that are unchanged even under anesthesia. Arthroscopy reveals capsuloligamentous complex fibrosis and receding synovial involvement. Although adhesive capsulitis was initially considered a 12-18 month self-limited process, mild symptoms may persist for years depending on the degree of fibroplasia and subsequent resorption. Patients with diabetes mellitus may have a protracted recovery and poor outcomes.

II Binder et al performed a prospective study (n=40) on patients with adhesive capsulitis. The criteria for inclusion in this study were shoulder pain for at least one month, sleep disturbance due to pain, inability to lie on the affected shoulder, restriction in all active and passive shoulder movements, and at least a 50% reduction in external rotation. Patients were excluded if they had sensory symptoms in the affected arm, radiation of pain to the neck,
generalized arthritis, fractures or dislocations of the humerus, cervical spondylosis or evidence of referred pain. The authors noted that at 6 months and 3 years (minimum) after the diagnosis, 90% and 40%, respectively, did not regain the normal range of motion (ROM) when compared to an age and sex matched control group. They concluded that at a long term follow-up (mean 44 months), measurable mobility deficits persisted but patients had little functional deficits.

IV Griggs et al\(^\text{45}\) assessed 75 patients with Stage 2 adhesive capsulitis. The criteria for inclusion in this study were no or only trivial shoulder trauma, loss of active and passive shoulder range of motion (more than a 50% loss of external rotation) especially with shoulder abducted at 90°, pain at the extremes of all motions, globally limited glenohumeral translation, and normal findings from radiographs of the glenohumeral joint. Exclusion criteria included intrinsic glenohumeral pathology, a history of substantial shoulder trauma, initiation of successful treatment within six weeks before the initial evaluation by the senior author, and reflex sympathetic dystrophy. The investigators found that 27% of 75 patients continued to have mild pain with activity and all patients demonstrated mobility deficits compared to their uninvolved side at an average of 22 months following the onset of adhesive capsulitis. The vast majority of patients (90%) were satisfied with their outcome. Less than half (40%) reported residual shoulder disability with a Disabilities of the Arm, Shoulder and Hand (DASH) score average of 9.7/100 ±13.6 (0-100; 0= no disability). However, ROM did not correlate with patient-rated outcome scores Simple Shoulder Test (SST) and DASH, but pain with activity rating did correlate with functional loss. Diabetes mellitus and male gender were related to worse ROM outcomes. Seven percent of the patients went onto manipulation and/or capsular release. Prior rehabilitation and workers’ compensation or pending litigation were associated with the need for manipulation and/or capsular release.

IV Shaffer et al\(^\text{117}\) retrospectively examined patients with adhesive capsulitis (n=62) who were treated conservatively. The criteria for inclusion in this study were a minimum of one month of shoulder pain and stiffness for which no other cause could be identified, documented restriction of passive glenohumeral and scapulothoracic motion of 100° of abduction or less and less than 50% of external rotation when compared to the contralateral shoulder. Participants were excluded if they had intrinsic problems with the shoulder, arthritis involving the glenohumeral or acromioclavicular joint, sympathetic dystrophy, neuromuscular disorder, referred pain, an arthrogram that failed to show evidence of a frozen shoulder, received manipulation of the shoulder before frozen shoulder had developed, or an open operation on the shoulder to treat the frozen shoulder. In an average of 6 months, pain resolved and motion returned to normal or within 10 -15 degrees of normal. At an average of 7 year follow up, 89% of patients had no functional deficits but 50% continued to report mild pain or stiffness. However, ROM loss did not correlate with functional loss.

IV Levine et al\(^\text{68}\) performed a retrospective review of 98 patients (105 shoulders) with the diagnosis of idiopathic adhesive capsulitis. The criteria for inclusion in this study were diagnosis of adhesive capsulitis and treatment by one of four shoulder surgeons. The criteria for exclusion were glenohumeral osteoarthritis, rotator cuff tear, previous ipsilateral shoulder surgery, fracture, dislocation or injection, and incomplete follow-up. The Short Form-36, American Shoulder and Elbow Surgeons Shoulder Scale (ASES) and SST were used as patient-rated outcome measures,
and ROM as impairment measures. The average length of treatment was 4.7 months and 18.1% had diabetes mellitus. Symptoms resolved in 89.5% of the patients who were managed non-operatively with either PT, non-steroidal anti-inflammatory drugs or intra-articular corticosteroid injections or some combination of the three. No difference in recovery was seen between patients with diabetes mellitus and those without diabetes. Ten percent of the patients required operative management with this group demonstrating greater loss of elevation and external rotation both initially and preoperatively. In other words, those who went on to have surgery had less ROM at diagnosis than those who did not require surgery and ROM continued to decrease during the non-operative treatment.

Clinicians should recognize that adhesive capsulitis occurs as a continuum of pathology characterized by a staged progression of pain and mobility deficits. At 12-18 months, mild to moderate mobility deficits and pain may persist but many patients report minimal to no disability.

DIAGNOSIS/CLASSIFICATION

The diagnosis of shoulder pain and mobility deficits associated with primary or secondary adhesive capsulitis is determined from the history and physical examination. Patients typically present with a gradual and progressive onset of pain, likely sleep-disturbing night pain, and pain at end range of movements. Patients also present with painful and restricted active and passive ROM loss in both elevation and rotation that occurs for at least 1-month duration and has either reached a plateau or worsened. Functional activities such as, reaching over head and behind the back or out to the side, become increasingly difficult due to pain and/or stiffness.

The primary purpose for diagnosis/classification of shoulder pain is to direct intervention and inform prognosis. Traditionally, a pathoanatomic model has been used to identify the symptomatic tissue(s) and distinguish between various pathologies. A classification schema proposed indicates primary frozen shoulder and idiopathic adhesive capsulitis are considered identical and not associated with a systemic condition or history of injury. Furthermore, secondary adhesive capsulitis or frozen shoulder is defined by a relationship between a disease or pathology with three subcategories: systemic, extrinsic, and intrinsic. Systemic secondary adhesive capsulitis includes those patients with a history of diabetes mellitus and thyroid disease. Extrinsic secondary adhesive capsulitis includes patients whose pathology is not directly related to the shoulder, yet it results in a painful and stiff shoulder such as cerebral vascular accident, myocardial infarction, cervical disc disease, distal extremity fracture or self-imposed immobilization. Intrinsic secondary adhesive capsulitis describes patients with a known pathology of the glenohumeral joint soft tissues or structures such as rotator cuff tendonopathy, biceps tendonopathy, calcific tendinitis, acromioclavicular joint arthropathy or glenohumeral joint arthropathy and proximal humeral/scapular fracture. Loss of shoulder ROM and pain that is associated with post-operative stiffness should not be considered adhesive capsulitis. These categorization presents a theoretical framework, however there is a lack of evidence as to their ability drive treatment decision-making and prognosticate outcome.
Classification

Patients with adhesive capsulitis present with a number of impairments, but most characteristically have a global loss of both active and passive ROM. Generally, ROM loss of greater than 25% in at least two planes, and passive external rotation loss is greater than 50% or less than 30 degrees of external rotation have been used to define adhesive capsulitis. Cyriax described patients with adhesive capsulitis as having normal strength and painless responses to resisted tests. However, others have described patients with adhesive capsulitis as having reduced shoulder muscle power with isometric testing specifically weakness of the internal rotators, elevators, and external rotators. Special tests such as impingement signs and Jobe’s test are not helpful in differentiating adhesive capsulitis from rotator cuff tendinopathy as they reproduce pain because they involve end range positioning of the painful and stiff capsuloligamentous complex.

A medical diagnosis of adhesive capsulitis may be helpful in describing the tissue pathology, but does not aid in treatment decision-making for rehabilitation. An impairment-based classification is necessary to guide rehabilitation, however, there is no published classification system. Thus, this guideline includes a proposed model for diagnosis, examination, and intervention criteria planning for patients with shoulder pain and mobility deficits, using the following components:

- Evaluation/Intervention Component #1 - Medical Screening
- Evaluation/Intervention Component #2 - Differential Evaluation of Clinical Findings suggestive of Musculoskeletal Impairments of Body Functioning (ICF) and the associated Tissue Pathology/Disease (ICD)
- Evaluation/Intervention Component #3 - Diagnosis of Tissue Irritability Level
- Evaluation/Intervention Component #4 - Intervention Strategies for Shoulder Pain & Mobility Deficits

This model is depicted in Figure 1.
Recommended Shoulder Impairment/Function-based Diagnosis, Examination and Intervention Criteria:
Shoulder Pain & Mobility Deficits Components

Evaluation/Intervention Component #1
Medical Screening

Appropriate for Physical Therapy Evaluation and Intervention

versus

Appropriate for Physical Therapy Evaluation and Intervention Along with Consultation with Another Healthcare Provider

versus

Not Appropriate for Physical Therapy Evaluation and Intervention

Consultation with Appropriate Healthcare Provider

Evaluation/Intervention Component #2
Differential Evaluation of Clinical Findings suggestive of Musculoskeletal Impairments of Body Functioning (ICF) and the associated Tissue Pathology/Disease (ICD)

diagnostic classification criteria and associated interventions

Shoulder Pain & Mobility Deficits / Adhesive Capsulitis

Rule in if:
- Patient's age is between 40 and 65 years
- Patient reports a gradual onset and progressive worsening of pain and stiffness
- Pain and stiffness limit sleeping, grooming, dressing, and reaching activities
- Glenohumeral passive ROM is limited in multiple directions with external rotation the most limited
- Glenohumeral external rotation ROM decreases as the humerus is abducted from 45° toward 90°
- Passive motions into the end-ranges of glenohumeral motions reproduce the patient's reported shoulder pain

Rule out if:
- Passive ROM is normal
- Radiographic evidence of glenohumeral arthritis is present
- Passive glenohumeral external rotation ROM increases as the humerus is abducted from 45° to 90° and the reported shoulder pain is reproduced with palpatory provocation of the subscapularis myofascia
- Upper limb nerve tension testing reproduces the reported symptoms and shoulder pain can be increased or decreased with altering nerve tension positions
- Shoulder pain is reproduced with palpatory provocation of the relevant peripheral nerve entrapment site

Evaluation/Intervention Component #3
Diagnosis of Tissue Irritability Level

High Irritability
Characterized by:
- Reports high levels of pain (\( \geq 7/10 \))
- Consistent night or resting pain
- High levels of reported disability on standardized self-report outcome tools
- Pain occurs before end ranges of active or passive movements
- Active range less than passive due to pain

Moderate Irritability
Characterized by:
- Reports moderate levels of pain (4-6/10)
- Intermittent night or resting pain
- Moderate levels of reported disability on standardized self-report outcome tools
- Pain occurs at end ranges of active or passive movements
- Active range similar to passive

Low Irritability
Characterized by:
- Reports minimal levels of pain (\( \leq 3/10 \))
- No night or resting pain
- Minimal levels of reported disability on standardized self-report outcome tools
- Pain occurs with overpressures into end ranges of passive movements
- Active range same as passive

Shoulder Stability & Movement Coordination Impairments / Dislocation of Shoulder Joint, or Sprain and Strain of Shoulder Joint

Rule in if:
- Patient's age is less than 40 years
- History of shoulder dislocation
- Excessive glenohumeral accessory motions in multiple directions
- Apprehension at end ranges of flexion, horizontal abduction, and/or external rotation

Rule out if:
- No history of dislocation
- Presence of global glenohumeral motion limitations
- No apprehension with end range shoulder active or passive motions
### Shoulder Pain & Muscle Power Deficits / Rotator Cuff Syndrome

#### Rule in if:
- Symptoms developed from, or worsens with, repetitive overhead activities – or from an acute strain such as a fall onto the shoulder
- Midrange (about 90 degrees) catching sensation / arc of pain with active elevation
- Manual resistive tests to the rotator cuff muscles, performed in mid-ranges of shoulder flexion and abduction, reproduce the patient's reported shoulder pain
- Rotator cuff muscle weakness

#### Rule out if:
- Resistive tests are pain free
- Supraspinatus, infraspinatus, and biceps brachii have normal strength
- Significant loss of passive motion

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#### Evaluation/Intervention Component #4

**Intervention Strategies for Shoulder Pain & Mobility Deficits**

**High Irritability**

**Modalities**
- Heat for pain modulation
- Electrical Stimulation for pain modulation

**Self Care/Home Management Training**
- Patient education on positions of comfort and activity modifications to limit tissue inflammation and pain

**Manual Therapy**
- Low intensity joint mobilization procedures in the pain free accessory ranges and glenohumeral positions

**Therapeutic Exercises**
- Pain free passive ROM exercises
- Pain free active assisted ROM exercises

**Moderate Irritability**

**Modalities**
- Heat for pain modulation - as needed
- Electrical Stimulation for pain modulation - as needed

**Self Care/Home Management Training**
- Patient education on progressing activities to gain motion and function without producing tissue inflammation and pain

**Manual Therapy**
- Moderate intensity joint mobilization procedures, progressing amplitude and duration of procedures into tissue resistance without producing post-treatment tissue inflammation and associated pain

**Therapeutic Exercises**
- Gentle to moderate stretching exercises, progressing the intensity and duration of the stretches into tissue resistance without producing post-treatment tissue inflammation and associated pain

**Neuromuscular Reeducation**
- Procedures to integrate gains in mobility into normal scapulohumeral movement while performing reaching activities

**Low Irritability**

**Self Care/Home Management Training**
- Patient education on progression to performing high demand functional and/or recreational activities

**Manual Therapy**
- End range joint mobilization procedures, high amplitude and long duration of procedures into tissue resistance

**Therapeutic Exercises**
- Strong stretching exercises, progressing the intensity and duration of the stretches into tissue resistance without producing post-treatment tissue inflammation and associated pain

**Neuromuscular Reeducation**
- Procedures to integrate gains in mobility into normal scapulohumeral movement during performance of the activities performed by the patient during his/her functional and/or recreational activities
**Component #1.** Medical screening involves the history and physical examination to determine whether the patient’s symptoms originate from a common musculoskeletal disorder of shoulder rather than from a more serious pathology, such as a tumor or infection.\(^{80, 135}\) In addition to serious medical conditions, the clinician should screen for the presence of psychosocial issues that may affect prognosis and treatment decision-making for rehabilitation. For example, elevated scores on the Tampa Kinesiophobia Scale or Fear Avoidance Beliefs Questionnaire have demonstrated a relationship to a longer recovery, chronic symptoms and work loss in patients with shoulder pain.\(^{42, 59, 79}\) And, identifying cognitive behavioral tendencies during the patient's evaluation can direct the therapist to employ specific patient education strategies to optimize patient outcomes to physical therapy interventions and potentially provide indications for referring the patient for consultation with another medical or mental health practitioner.\(^{10}\)

**Component #2.** Differential evaluation of musculoskeletal clinical findings is used to determine the most relevant physical impairments associated with the patients reported activity limitations and medical diagnosis. Clusters of these clinical findings that are commonly co-existing in patients are described as impairment patterns in the physical therapy literature and are labeled according to the key impairment(s) of body function associated with that cluster. These impairment patterns are useful in driving the interventions, which focus on normalizing the key impairments of body function, that in turn, improve the movement and function of the patient and lessen or alleviate the activity limitations commonly reported by the patients who are meet the diagnostic criteria of that specific pattern. Key clinical findings to rule-in and rule-out the common impairment patterns, and their associated medical conditions, are shown in Figure 1. Impairment-based classification is critical for matching the intervention strategy that is most likely to provide the optimal outcome for a patient's clinical findings. However, it is important for clinicians to understand that patients with shoulder pain often fit more than one impairment pattern and that the most relevant impairments of body function and the associated intervention strategies often change during the patient's episode of care. Thus, continual reevaluation of the patient's response to treatment and the patient's emerging clinical findings is important for providing the optimal interventions throughout the patient's episode of care.

**Component #3.** Diagnosis of tissue irritability is important for guiding the clinical decisions regarding treatment frequency, intensity, duration, and type with the goal of matching the optimal dosage of treatment to the status of the tissue being treated. Irritability is a term used by rehabilitation practitioners to reflect the tissue’s ability to handle physical stress,\(^{81}\) and is presumably related to its physical status and the degree of inflammatory activity present. Three phases of irritability are operationally defined in Figure 1. The primary clinical finding that determines the level tissue irritability is the relation between pain and active and passive movements. Other clinical findings that characterize the level of tissue irritability are the reports of pain level, frequency of pain, and the level of disability reported by the patient.

**Component #4.** Because irritability level often reflects the tissue’s ability to accept physical stress, clinicians should match the most appropriate intervention strategies to the phase of irritability.\(^{60}\) Patients with high irritability are not ready for significant physical stress to the affected tissues and therefore the treatment would emphasize activity modification and appropriate modalities, medication and manual therapy to relieve pain and inflammation, with only low levels of exercise. Patients with moderate irritability should be ready for controlled
physical stress in the form of progressive manual therapy, mild stretching and strengthening activities and basic functional activity. They should generally tolerate basic functional activities. Patients with low irritability are ready for progressive physical stress in the form of stretching, manual therapy, resistive exercise and higher demand physical activity.

Clinicians should recognize that patients with adhesive capsulitis present with a gradual and progressive onset of pain and loss of active and passive shoulder motion in both elevation and rotation. Utilizing the evaluation and intervention components described in this guideline will assist clinicians in medical screening, differential evaluation of common shoulder musculoskeletal disorders, diagnosing tissue irritability levels, and planning intervention strategies for patients with shoulder pain and mobility deficits.

DIFFERENTIAL DIAGNOSIS

In addition to the 3 most common shoulder conditions outlined in Diagnosis/Classification section of this clinical guideline:

- Adhesive capsulitis
- Sprain and strain of shoulder joint/dislocation
- Rotator cuff syndrome/tendinopathy of the supraspinatus, infraspinatus, biceps brachii;

the following conditions, using ICD-10 terminology, should be considered in the differential diagnosis when a patient presents with shoulder pain:

- Acute calcific tendonitis/bursitis
- Bursitis of the shoulder
- Cervicalgia
- Cervical disc disorders
- Cervicothoracic syndrome
- Contusion of shoulder and upper arm
- Diseases of the digestive system
- Fracture of clavicle
- Fracture of scapula
- Fracture of shaft of humerus
- Fracture of upper end of humerus
- Glenohumeral osteoarthritis
- Impingement syndrome of the shoulder
- Injury of blood vessels at shoulder and upper arm level, including avascular necrosis
- Injury of muscle and tendon at shoulder and upper arm level, including labral lesions
- Injury of nerves at shoulder and upper arm level, including suprascapular nerve entrapment
- Juvenile rheumatoid arthritis
- Neoplasm
- Osteoporosis with pathological fracture
- Pain in thoracic spine
Persistent somatoform pain disorder
Primary arthrosis of the shoulder
Psychological and behavioral factors associated with disorders or diseases Secondary arthrosis of the shoulder
Pyogenic arthritis
Radiculopathy
Rheumatoid arthritis
Somatoform autonomic dysfunction
Sprain and strain of acromioclavicular joint
Sprain and strain of sternoclavicular joint

Clinicians should consider diagnostic classifications other than adhesive capsulitis when the patient’s reported activity limitations or impairments of body function and structure are not consistent with the diagnosis/classification section of this guideline, or, when the patient’s symptoms are not resolving with interventions aimed at normalization of the patient’s impairments of body function.

IMAGING

Diagnosing adhesive capsulitis is primarily determined by history and physical examination, but imaging studies can be used to rule out underlying pathology. Radiographs are normal with adhesive capsulitis, but can identify osseous abnormalities, such as glenohumeral osteoarthritis. Arthrographic findings associated with adhesive capsulitis are a joint capsule capacity of less than 10-12 ml and variable filling of the axillary and subscapular recess. Magnetic resonance imaging (MRI) helps with the differential diagnosis by identifying soft tissue and boney abnormalities. Magnetic resonance imaging has identified abnormalities of the capsule and rotator cuff interval in patients with adhesive capsulitis. Mengiardi et al performed magnetic resonance arthrograms on 122 patients who were treated with arthroscopic capsular release and compared them to an age and sex-matched control group; finding thickened coracohumeral ligament and joint capsule in the rotator cuff interval, a smaller axillary recess volume, but without axillary recess thickening. Using MRI, axillary recess thickening, joint volume reduction, rotator cuff interval thickening, and proliferative synovitis surrounding the coracohumeral ligament were observed in patients with adhesive capsulitis. A recent study using ultrasonography with arthroscopic confirmation identified fibrovascular inflammatory soft tissue changes in the rotator cuff interval in 100% of 30 patients with adhesive capsulitis with symptoms less than 12 months. Homsi et al performed ultrasound examinations on 306 individuals with painful shoulders and 121 asymptomatic shoulders. Positive arthrographic evidence of adhesive capsulitis was identified in 17 patients who had no previous history of trauma or surgery. At least two of the following criteria had to be met: intra-articular contrast injection volume < 8 mm, obliteration of the axillary recess and irregularities of the capsule insertion at the humeral anatomic neck. The coracohumeral ligament was identified in 88.2% of individuals with adhesive capsulitis versus 76% in the asymptomatic group.
Coracohumeral ligament thickening was significantly greater (p=0.0001) in the adhesive capsulitis group compared to the asymptomatic and painful shoulder groups.

**Examination**

**OUTCOME MEASURES**

There are several outcome measures designed to assess patients with shoulder disorders. These tools can be classified as shoulder joint specific, shoulder disease specific or upper limb specific. Over 30 tools have been published, however not all have demonstrated acceptable measurement properties. The shoulder outcome tools that are most widely used and embraced by professional societies involved with the treatment of shoulder pain are the Constant Score and Disabilities of the Arm Shoulder and Hand (DASH), Shoulder Pain and Disability Index (SPADI) and the American Shoulder and Elbow Surgeons Shoulder Scale (ASES). The Constant Score is the most widely used scale in Europe. It has 2 sections, a patient self-report and a clinician-report, and a range of 0 – 100 (100 = maximum use of the shoulder). The self-report section contains 5 questions for a maximum total of 35 points; a single pain question (15 points) and 4 questions regarding assessing work, sport, sleep and position of arm use (20 points). Measurement properties of the Constant score self-report section have been investigated, however because there is only four items to assess patient-rated function, it is not clear if the Constant score items comprehensively represent the construct of shoulder use and it is not recommended for use.

Two most recent systematic reviews indicate the ASES, DASH, and SPADI, and Simple Shoulder Test (SST) have been the most studied shoulder outcome tools for psychometric properties. The ASES, DASH, and SPADI have demonstrated acceptable psychometric properties, however the SST has only limited or no evidence as to the error in the measure and clinically meaningful change. The ASES, DASH, and SPADI are recommended for clinical use.

The ASES has 2 sections, a patient self-report and clinician-report. The ASES-patient self-report section ASES total score ranges from 0 – 100 (100 = maximum shoulder use), with 50 points maximum for pain (1 question) and 50 points maximum for activities / participation questions (10 questions). Studies of the ASES patient-rated portion indicated adequate measurement properties. The minimal detectable change (MDC) is the change that is considered greater than the measurement error in the scale. The MDC with 90% confidence bounds for the ASES has been reported of 9.4, and the minimal clinically important difference (MCID) of 6.4 ASES points. The DASH is a 30 question patient-rated questionnaire. The score ranges from 0 – 100 (0 = no disability). The measurement properties of the DASH have been extensively investigated. The MDC has been reported to be 6.6 – 12.2 (weighted average = 10.5), and the MCID of 10.2 DASH points.
The SPADI\textsuperscript{112} is a 13 item patient-rated tool with 2 domains, 5 pain items, and 8 items of disability. Each domain score is equally weighted for the total score. The total score ranges from 0 – 100 (0 = no pain or difficulty). Studies of the SPADI indicated adequate measurement properties.\textsuperscript{15,114} The MDC with 90\% confidence bounds for the SPADI is reported from a single study of 18.1\textsuperscript{116} and an MDC with 95\% confidence bounds of 18.0,\textsuperscript{3} and the MCID of 8.0,\textsuperscript{99} and 13.1\textsuperscript{114} SPADI points. Most recently,\textsuperscript{121} the SPADI has demonstrated superior responsiveness as compared to the DASH in patients with adhesive capsulitis.

Clinicians should use validated functional outcome measures, such as the Disabilities of the Arm, Shoulder and Hand, the American Shoulder and Elbow Surgeons Shoulder Scale, or the Shoulder Pain and Disability Index. These should be utilized before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with adhesive capsulitis.

**ACTIVITY LIMITATIONS**

Activity limitation measures have not been reported in the literature other than what is indicated on self report questionnaires. The following measures can help the clinician to assess changes in the patient’s level of function over time.

- Pain during sleep
- Pain and difficulty with grooming and dressing activities
- Pain and difficulty with reaching activities - to the shoulder level, behind the back, and overhead

Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient’s shoulder pain to assess the changes in the patient’s level of shoulder function over the episode of care.

**PHYSICAL IMPAIRMENT MEASURES**

Active and Passive Shoulder Range of Motion

**ICF category**

Measurement of impairment of body function: mobility of a single joint

**Description**

The amount of active or passive external rotation ROM of the glenohumeral joint as measured with a standard goniometer.

**Measurement method**

*Glenohumeral External Rotation in Adduction*

To measure external rotation ROM with the shoulder adducted, the patient is positioned in supine with the shoulder comfortably by the side. The examiner passively externally rotates the glenohumeral joint until end range is reached. ROM is measured by placing the axis of the
goniometer on the olecranon process. The stationary arm is aligned with the start position. The moveable arm is aligned with the ulnar styloid process. Alternately, the patient can be asked to actively externally rotate to end range.

**Glenohumeral External Rotation in Abduction**
External rotation ROM may also be measured with the shoulder abducted to 45° or to 90° in the frontal plane (if the patient has the available abduction ROM). Placement of the axis and arms of the goniometer are similar to the adducted position.

**Glenohumeral Internal Rotation in Abduction**
Internal rotation ROM is measured with the shoulder abducted to 90° of glenohumeral elevation, the patient is positioned in supine. The examiner passively internally rotates the glenohumeral joint until end range is reached, ensuring that there is no scapular compensation. ROM is measured by placing the axis of the goniometer on the olecranon process. The stationary arm is aligned with the start position. The moveable arm is aligned with the ulnar styloid process. Alternately, the patient can be asked to actively internally rotate to end range.

**Shoulder Flexion**
To measure flexion ROM, the patient is positioned in supine with the shoulder comfortably by the side. The examiner passively flexes the shoulder until end range is reached (no compensations from the trunk, the lumbar spine should not move). ROM is measured by placing the axis of the goniometer on the greater tubercle. The stationary arm is aligned with the midline of the trunk. The moveable arm is aligned with the lateral epicondyle. Alternately, the patient can be asked to actively flex to end range.

**Shoulder Abduction**
To measure abduction ROM, the patient is positioned in supine with the shoulder comfortably by the side. The examiner passively abducts the shoulder until end range is reached (shoulder must still be in the same plane). ROM is measured by placing the axis of the goniometer on the head of the humerus. The stationary arm is aligned parallel with the midline of the sternum. The moveable arm is aligned with the midshaft of the humerus. Alternately, the patient can be asked to actively abduct to end range.

**Nature of variable**
Continuous

**Unit of Measurement**
Degrees

**Measurement properties**
Measurements of shoulder ROM made with a standard goniometer demonstrate intraclass correlation coefficients (ICC’s) ranging from 0.80- 0.99. Specifically, measures of passive glenohumeral external rotation ROM in patients with adhesive capsulitis have yielded ICC’s ranging from 0.98-0.99 (95%CI:0.95-0.99).
Clinicians should measure pain and active and passive shoulder ROM to assess the key impairments of body function and body structures in patients with adhesive capsulitis.

**Interventions**

Multiple interventions have been described for the treatment of adhesive capsulitis and there is emerging evidence from high-quality randomized studies regarding both short and long-term efficacy.

**CORTICOSTEROID INJECTIONS**

Although corticosteroid injections are not directly part of the physical therapist’s scope of practice, patients who have, or should consider receiving glenohumeral joint intraarticular corticosteroid injections for adhesive capsulitis are commonly seen by physical therapists. Corticosteroids are administered to dampen the inflammatory response and reduce pain in patients with adhesive capsulitis. These studies implicate the initial barrier to joint motion is pain and muscle guarding versus fibrosis since all studies demonstrate significant improvements in motion immediately following steroid injections.

Carette et al\(^2\) performed a randomized controlled prospective study of 93 patients with adhesive capsulitis. The criteria for patients to be included in this study were 18 years or older, symptoms for more than one year, diagnosed with adhesive capsulitis defined as the presence of shoulder pain with limitation of both active and passive movements of the glenohumeral joint of more than 25% in at least two directions compared to the contralateral shoulder, and a total score of more than 30 on the shoulder pain and disability index. The exclusion criteria included adhesive capsulitis secondary to another cause (except diabetes mellitus) such as inflammatory, degenerative, metabolic, or infectious arthritis, cerebrovascular accident or fracture, presence of blood coagulation, and an allergy to radiologic contrast material. This study compared four different interventions. Group 1 was treated with a fluoroscopy guided glenohumeral joint intraarticular corticosteroid injection. Group 2 received a combination of the fluoroscopy guided glenohumeral joint intraarticular corticosteroid injection and supervised PT. Group 3 received a fluoroscopy guided glenohumeral joint intraarticular saline injection and supervised PT. Group 4 had only a saline injection (the placebo group). All groups performed a physical therapist instructed home exercise program (HEP) so those in group 4 can be considered the HEP group. Patients were assessed at 6 weeks, 3 months, 6 months and 1 year with ROM, the SPADI, and the SF-36. Supervised PT consisted of 12 one-hour sessions over a 4 week period. The interventions were based upon whether the patient was more acute “capsulitis” stage or in a more chronic stage. Those in the acute group received pain-relieving modalities (transcutaneous electrical nerve stimulation and ice), low grade joint mobilization, and active range of motion exercises. Those in the chronic group had ultrasound applied, high grade joint mobilizations, active and active assisted range of motion exercises as well as isometrics. At 6 weeks, the steroid injection/PT group demonstrated the largest change in the SPADI score, however, the scores were not statistically different from the steroid injection only group. Moreover, both steroid groups improved significantly more than the non-steroid groups. At 6 months, the SPADI scores were similar among the groups, however, active and passive ROM were better in
the steroid injection/PT group. There were no differences among the groups at 12 months. This study concluded that at 6 weeks, intraarticular injection alone or with supervised therapy is more effective than 12 sessions of supervised PT or HEP. Although this study is well controlled, their placebo group (actually HEP) is considered an effective treatment for adhesive capsulitis.\textsuperscript{18, 61}

\textbf{I} Ryans et al\textsuperscript{115} also investigated the effect of steroid injections and physiotherapy, performing both a glenohumeral joint intra-articular and subacromial injections. The criteria for patients to be included in this study were subjects age 18 years or older, a painful shoulder in the fifth cervical dermatone distribution of more than 4 weeks and less than 6 month duration, and a limitation of active and passive range of movement greater than 25\% in abduction and external rotation compared to the contralateral shoulder. Subjects were excluded from the study if the pain had existed for less than 4 weeks, symptoms existed for more than 6 months, had received previous intra-articular injection or prior physiotherapy for the current episode of shoulder pain, the limitation to movement was only in one plane, bilateral adhesive capsulitis, evidence of osteoarthritis, complete rotator cuff tear, cervical spine disease, history of shoulder trauma, inflammatory joint disease, or history of a cerebrovascular accident. Patients (n=80) were assessed in a randomized, blinded placebo-controlled study, randomly assigned to 4 groups as per Carrette et al\textsuperscript{23} except they did not use fluoroscopy guided injections and only 8 sessions over 4 weeks of PT were delivered. The PT program included proprioceptive neuromuscular facilitation, mobilization, interferential electrical stimulation and exercise. The Shoulder Disability Questionnaire (SDQ), AROM and PROM, global self-rated disability using a visual analog scale (VAS) and pain using a VAS were used to assess outcomes. All groups performed a standardized HEP of stretching so their placebo group will be considered the HEP group. At 6 weeks the injection groups significantly improved in the SDQ compared to the other groups but patients treated in supervised PT gained significantly more external rotation motion. All groups significantly improved by 16 weeks but no difference was present between the groups. One of the difficulties with this study is that only 71\% of the patients completed the study at 16 weeks. The most common reason of attrition was failure to improve occurring most often in the placebo group (HEP). Authors recommended the use of intra-articular and subacromial corticosteroid injections to provide short-term improvements (6 weeks) for reliving shoulder disability and PT for improving external rotation ROM.

\textbf{II} Bulgen et al\textsuperscript{18} compared 4 intervention groups: paired intra-articular and subacromial injections, joint mobilization, ice/proprioceptive neuromuscular facilitation, and no treatment (simple home pendulum exercise) in a prospective randomized study of 41 patients. The criteria for patients to be included in this study were pain in the shoulder for at least 1 month, sleep disturbance at night due to pain, inability to lie on the affected shoulder, restriction in all active and passive shoulder movements, and a reduction in external rotation of at least 50\%. Exclusion criteria included patients with sensory symptoms in the affected arm, radiation of pain to the neck, generalized arthritis, fractures, or dislocations of the humerus, cervical spondylosis, and evidence of referred pain. Pain, using the VAS, and ROM were assessed. Pain was significantly reduced and ROM was significantly improved by the fourth week of treatment for all groups and continued until 6 months. Improvement was most obvious in the steroid group, reaching statistical significance for improved motion but not pain during the first 4 weeks. No significant differences were seen among the groups at 6 months. The study concluded there is little long-
term advantage of one treatment over the other, however, steroid injections improve both ROM and to a lesser extent pain, in the first 4 weeks.

II Van der Windt et al\textsuperscript{127} compared intra-articular injections (average of 2.2 per subject) to physiotherapy in a prospective randomized controlled trial on 109 patients with a stiff, painful shoulder (capsular syndrome). The criteria for patients to be included in this study were painful restricted glenohumeral passive mobility. Lateral rotation was more limited than abduction and medial rotation. Exclusion criteria included a painful arc, pain or weakness with resisted motion testing, bilateral symptoms, corticosteroid injections or physiotherapy during the preceding 6 months, shoulder surgery, dislocation or fracture, diabetes mellitus, systemic disorders of the musculoskeletal system, and neurological disorders. Physiotherapy consisted of 12 30-minute sessions involving passive joint mobilization and exercises. Heat, ice and electrical stimulation could also be used to reduce pain, at the therapist's discretion. Treatment was varied based upon symptom severity. Outcome assessment included a VAS for pain, the shoulder disability questionnaire (a 16-item functional disability questionnaire) and ROM. At 7 weeks, 77\% of the patients treated with injections were considered treatment “successes” compared to only 46\% treated with physiotherapy. Treatment success was based on the patient rating themselves as having made complete recovery or much improvement. Statistically significant differences were found in nearly all outcome measures. At 26 and 52 weeks, there were no differences between the two groups noted in any of the outcome measures.

II Arslan and Celiker\textsuperscript{4} randomly allocated 20 patients to receive either an intra-articular glenohumeral joint steroid injection or physiotherapy and a non-steroidal anti-inflammatory drug. The criteria for patients to be included in this study were total range of motion less than 50\% of normal range, no previous injections in the involved shoulder, no history of allergy to local anesthetics or steroids, absence of coagulation disease, and absence of polyarthritis or neurological diseases that might lead to shoulder pain. Physiotherapy consisted of hot packs, ultrasound (3.5 w/cm\textsuperscript{2} for 5 minutes), passive glenohumeral stretching exercises, and wall climb. The mean duration in supervised PT was 2 weeks and both groups performed a HEP. Range of motion and pain outcome measures revealed similar improvements in both groups at 2 weeks and 12 weeks. The authors concluded steroid injections alone were as effective as PT for improving ROM and reducing pain.

II DeJong et al\textsuperscript{38} performed a prospective randomized double-blind study in which they investigated the use of low-dose (10 mg) and high dose (40 mg) triamcinolone acetonide (corticosteroid) intra-articular injections given to patients with adhesive capsulitis. The criteria for patients to be included in this study were shoulder pain with spontaneous onset or caused by a minor trauma, restriction of passive range of motion of the glenohumeral joint (a 45° or more reduction of external rotation), disruption of sleep while lying on afflicted shoulder, and no evidence of other pathology that could produce the symptoms. Patients were excluded if there was evidence of cervical radiculopathy, paresis, or other neurological changes in the upper limb on the involved side, or they had insulin dependent diabetes. Thirty-two patients were given the low-dose injection while 25 receive higher dose injection. Three injections were given at weekly intervals with no concurrent intervention used. Outcomes included pain VAS, passive ROM and disturbances of sleep and functional shoulder and arm ability were measured on a four-point
ordinal scale. Measurements were taken at 1, 3 and 6 weeks. Significant differences in pain were found at all follow-up intervals favoring the high dose group. Both sleep disturbance and functional ability were significantly better in the higher dose group. The authors recognize that this study did not provide information of that steroid injections were more efficacious to other treatment interventions. However, they demonstrated that higher dose corticosteroid (40 mg compared to 10mg) may have greater effect on relieving symptoms related to adhesive capsulitis.

I Jacobs et al\textsuperscript{56} randomized 53 patients with idiopathic frozen shoulder to a group that received manipulation under anesthetic or a group that received an intra-articular steroid injection with distension. The criteria for patients to be included in this study were not clearly defined. Exclusion criteria included additional or alternative pathologies (diabetes type 1 and 2) and patients who had received a steroid injection into the affected shoulder before referral. The manipulation consisted of forced motion using a short lever into all end ranges. At short-term intervals as well as the 2-yr follow-up the authors found no difference between the two groups in the Constant score, a VAS, or the Medical Outcomes Study: 36 Item Short Form Survey (SF 36). They, therefore, recommend steroid injection over manipulation, because the clinical outcome is the same with less risk.

II Bal and colleagues\textsuperscript{6} performed a study that examined the difference between intra-articular corticosteroid injections followed by a 12-week HEP and intra-articular serum physiologic injections followed by a 12-week HEP. The criteria for patients to be included in this study were the presence of shoulder pain with limitation of both active and passive movements of the glenohumeral joint of 25\% in at least two directions, between 18 and 70 years of age, had symptoms between 6 weeks and 6 months, and no treatment other than analgesics in the last 6 months. Patients were excluded from the study if they had uncontrolled diabetes mellitus, had previous shoulder surgery, and had contraindication of injection. At the second week, changes in abduction ROM, SPADI-total score, SPADI-pain score, and medians of University of California-Los Angeles end-result scores were statistically better in the corticosteroid group. However, none of these changes remained significant at 12 weeks.

I Seventy-one patients with primary frozen shoulder were randomly assigned to treatment groups of glenohumeral joint corticosteroid injection versus subacromial corticosteroid injection.\textsuperscript{92} All injections were performed under diagnostic ultrasound guided conditions. Both groups were treated with non-steroidal anti-inflammatory medication, a HEP consisting of gentle active assisted passive forward flexion, abduction, external rotation, adduction and sleeper stretch exercises. The HEP was instructed to be performed with 10 repetitions with a 5-10 second hold time to tolerance, 3-5 times daily. Strengthening was not performed until shoulder pain subsided. Inclusion criteria was limitations of both active and passive motion in at least two directions (abduction and forward flexion < 100\°, external rotation < 20\° or internal rotation < L3). Patients demonstrating secondary frozen shoulder due to rotator cuff tendinopathy, calcific tendinitis or osteoarthritis using diagnostic ultrasound and radiography were excluded from the study. Data was collected at pre-injection, 3, 6 and 12 weeks after the injection. The VAS, Constant score, and ROM were used as outcome measures. The authors found that both groups had marked improvement in all parameters. Only the 3 week VAS demonstrated statistically significant differences favoring the intra-articular injection. No differences were noted at 6 and
12 weeks. The Constant score and ROM measures were not statistically different at any time frame post-injection. The authors concluded that a subacromial corticosteroid injection was as effective as an intra-articular corticosteroid injection. They could not rule out all forms of rotator cuff tendinopathy using ultrasonography. Therefore, many patients thought to have primary frozen shoulder may have secondary frozen shoulder stemming from rotator cuff tendinopathy. The authors also recognize that they did not use any control group just performing exercise. The study highlights the idea that subacromial tissue may be involved in primary AC, subacromial injections may be added to the intervention, as well as the diagnostic difficulty of distinguishing primary from secondary frozen shoulder.

IV Lorbach et al reported on the effectiveness of fluoroscopic guided intra-articular corticosteroid injections. Twenty-five patients (9 male, 16 female) with the mean age of 49 years old and stage II frozen shoulder were included in this study. Patients were included in the study if their clinical findings were consistent with stage II Reeves classification criteria. Patients with diabetes mellitus, previous intra-articular injections were signs of glenohumeral joint osteoarthritis are excluded from the study. Treatment consisted of three fluoroscopically-guided intra-articular cortisone injections with a 4 week time interval between injections. Physical therapy was started after 4 weeks consisting of joint mobilization twice a week and instruction in daily stretching exercise program in pain free ranges. Outcome measures were ROM, ASES score and the SF 36 were administered pretreatment, 4, 8, 12, 24 and 52 weeks. The results demonstrated significant improvement in all outcome measures at 4 weeks and progressing through one year. The most significant gains were noted in the first 4 weeks following the beginning of injections. Interestingly, range of motion measures compared to the uninvolved side at one year still demonstrated significant relative restrictions of 24° for flexion, 25° for abduction, and 15° for external rotation. Internal rotation range of motion was not found different from side to side. The ASES score, although dramatically improved at one year, still only average 73 of 100. This study demonstrates the short term benefit of intra-articular steroid injections in patients with primary frozen shoulder. Even though 90% of the patients were satisfied at 1 year follow-up, approximately 25% still have significant restrictions when compared to the uninvolved extremity.

I Blanchard et al performed a systematic review assessing the effectiveness of corticosteroid injections compared to physiotherapeutic interventions for adhesive capsulitis. Six studies were eligible for inclusion in the final review. They concluded a medium effect for corticosteroid injections compared to physiotherapy interventions and a 6-7 week follow-up. Small effects were recognized from 12-52 weeks. Their conclusion was that the corticosteroid injections are more beneficial than physiotherapy interventions in the treatment of adhesive capsulitis in the short term and to a lesser degree in long term. The review also showed that physiotherapy interventions alone were better than control groups and offers a positive alternative to patients who declined injection.

A Intraarticular corticosteroid injections combined with shoulder mobility and stretching exercise are more effective in providing short-term (4-6 weeks) pain relief and improved function compared to shoulder mobility and stretching exercises alone.
PATIENT EDUCATION

Patient education is central to each patient-physical therapist interaction and critical to the rehabilitative management of patients with adhesive capsulitis. The insidious nature of adhesive capsulitis is perplexing to patients, who often have concerns about catastrophic conditions. Patients generally suffer from exquisite pain in the early stages yet their recovery follows a fairly predictable course. Describing the pathology (synovitis/angiogenesis progressing to fibrosis) can allay fears and ready them for the stage progression. Encouraging activity modification while emphasizing functional pain free ROM, is important to prevent self-imposed immobilization. Patients need to understand that exercises should be performed without significant pain.

I Diercks et al\textsuperscript{39} investigated the use of “supervised neglect” compared to aggressive therapy in 77 patients with adhesive capsulitis. The criteria for patients to be included in this study were more than 50% motion restriction of the glenohumeral joint in all directions of a period of 3 months or more. Exclusion criteria included significant injury to the ipsilateral shoulder or arm, a surgical procedure on the shoulder, arm, cervical spine, thorax, or breast within the previous 2 years, diabetes mellitus, and intra-articular deformities, degenerative arthritis or inflammatory arthritis. The group of patients defined as “supervised neglected” were provided with “an explanation of the natural course of the disease,” instruction in pendulum exercises, and active stretching techniques within the pain free ROM. The aggressive therapy group was treated in supervised therapy with exercise and manual techniques up to and beyond their pain threshold. Patients were encouraged to perform a HEP of maximal reaching. At follow-up (24 months) 89% of patients in the "supervised neglected" group achieved a Constant score of 80/100 versus 64% of the aggressively mobilized group. The "supervised neglect" treatment approach was superior to aggressive therapy.

B Clinicians should utilize patient education that 1) describe the natural course of the disease, and 2) promote activity modification to encourage functional, pain free range of motion, and 3) match the intensity of stretching to the patient's current level of irritability.

MODALITIES

Heating modalities or electrical modalities theoretically can have positive benefit on pain in the treatment of patients with adhesive capsulitis. However, the impact of a singular modality on the natural course of adhesive capsulitis is difficult to determine as therapeutic modalities are typically applied as adjunctive treatments to manual therapy and/or therapeutic exercises.

II Dogru et al\textsuperscript{40} conducted a randomized controlled trial analyzing the effects of ultrasound for the treatment of adhesive capsulitis. There were 49 subjects in this trial. The criteria for patients to be included in this study were shoulder pain for a minimum of 3 months with no major trauma, greater then 25% loss of shoulder motion in all planes of movement, pain with motion with a minimum VAS-score of 40 mm, and normal findings on radiographs of the glenohumeral joint. Exclusion criteria included arthritis, malignancy, cardiac disease, infection, coagulation
disorder, and secondary capsulitis due to rotator cuff tears, fractures, dislocations, and reflex sympathetic dystrophy. Ten ultrasound treatments (3 MHz ultrasound for 10 minutes at 1.5 W/cm²) were performed to the affected shoulder over a 2 week period. The control group underwent sham ultrasound with an inactive unit. Regardless of the ultrasound treatment assignment, subjects received superficial thermotherapy via an electrical hot pack at 60°C for 20 minutes followed by pendulum exercise and active ROM exercises. An SF-36, pain with motion, the SPADI, and ROM measurements for forward flexion, external rotation and internal rotation were taken at the end of 10th treatment session and again 3 months after entering the study. Range of motion improvements were greater in the ultrasound versus the sham group reaching statistical significance for the motions of internal and external rotation when comparing pre-treatment to post-treatment and 3 month follow-up, while flexion and adduction were significantly greater only at the post-treatment time period. However, these improvements of ROM were not correlated with pain, disability, or general health status.

IV Mao et al⁷⁴, utilized arthrography to quantify changes in glenohumeral joint volume in patients with adhesive capsulitis treated with deep heating modalities as adjunctive treatments to passive mobilization and home program. Half of the 12 participants received ultrasound (1 MHz continuous ultrasound was performed at 0.8-1.2 W/cm² for 8 minutes) while the other subjects received continuous short wave diathermy (20 minutes duration). The criteria for patients to be included in this study were a history of pain and stiffness in the shoulder for more than 1 month, shoulder pain elicited at terminal range of all planes of motion, shoulder range of motion limited to flexion of less than 140°, abduction of less than 120°, internal rotation of less than 70°, and external rotation of less than 50°. Patients were excluded if their arthrograms showed a rotator cuff tear. Treatments were performed two to 3 times per week for 4 to 6 weeks. The authors found an increase in capsular volume was associated with increased external rotation ROM. The actual efficacy of the heating modalities could not be determined because no control group was used. Significant differences in outcome between the two forms of deep heating are also unknown, as no analysis was performed.

II Guler-Uysal et al⁴⁶ recently conducted a prospective, randomized trial of 42 patients with adhesive capsulitis comparing the use of moist hot pack and continuous short wave diathermy to Cyriax inspired manual techniques such as joint mobilizations and transverse friction massage. The criteria for patients to be included in this study were shoulder pain for a minimum of two months with no major shoulder trauma, loss of active and passive shoulder range of motion, pain with motion with a minimum VAS pain score of 30 mm, and normal findings on glenohumeral joint radiographs. Exclusion criteria included polyarthritis, neurological disease, cervical neuropathy, cardiac disease, infection, coagulation disorder, and adhesive capsulitis secondary to shoulder dislocation, fracture, reflex sympathetic dystrophy and rotator cuff tear. Manual treatments were performed for one hour on a 3 times per week basis. Subjects in the modalities group received moist hot pack for 20 minutes followed by 20 minutes of short wave diathermy (220V/50 Hz at 27.12 MHz oscillation frequency). Both groups performed “active stretching and pendulum exercises” following their sessions and a HEP. Treatment was continued until patients had achieved at least 80% of the “normal” passive ROM of the shoulder which the authors defined as 180° for flexion and abduction, 70° internal rotation and 90° for external rotation. Ninety five percent (95%) of patients who received manual techniques had achieved the 80% milestone by the end of the second week of treatment compared to only 65% of the
group who received the heating modalities. The authors concluded that manual treatments were more efficacious than passive heating, but because no control group was included, it is difficult to conclude whether superficial and deep heating was any more effective versus simple home stretching in the treatment of patients with adhesive capsulitis.

II Leung and Cheing\textsuperscript{67} recently sought to answer whether superficial or deep heating modalities were useful adjunctive treatments to a self stretching program. The authors randomly assigned 30 patients in the stiffness phase of adhesive capsulitis, defined as having idiopathic pain and loss of motion in the shoulder of at least 8 weeks duration to 3 groups: hot pack and self stretching, short wave diathermy and stretching, and stretching alone. Patients were treated for 20 minutes 3 times per week for 4 weeks. The hot pack treatment utilized an electrical hot pack at 63\(^\circ\) C. Short wave diathermy was provided at a comfortable heating intensity via a 27.12 MHz wave through anterior and posterior electrodes. At the 4-week follow-up, all groups had improvements in ASES score and ROM measurements. Subjects treated with short-wave diathermy demonstrated significantly greater improvement in ROM compared to the other treatment groups and there were no significant differences between subjects treated with superficial heating and stretching versus stretching alone. In addition, most improvements were first noted in the first 2 weeks of treatment.

II Cheing and colleagues\textsuperscript{26} designed a study in which 70 patients were randomly assigned to receive electroacupuncture plus exercise, interferential electrotherapy plus exercise or no treatment for 4 weeks. The criteria for patients to be included in this study were localized pain over one shoulder, night pain, and restricted active and passive shoulder range of motion. Exclusion criteria for this study included a history of trauma, fractures, previous shoulder surgery, cervical or thoracic pain syndrome, malignancies, receiving anti-coagulant therapy, and had received acupuncture treatment to the painful surgery in the last 6 months. The exercise groups had 10 treatment sessions. After the intervention, both treatment groups improved significantly on the Constant Murley Assessment score and the pain VAS, while the control group did not change. These differences were maintained at the 6-month follow-up however, no significant differences were noted between the two intervention groups.

III In a non-randomized prospective study of 50 patients with adhesive capsulitis, Rizk et al\textsuperscript{109} demonstrated improved ROM with application of electrical stimulation (50-150 Hz x 10 minutes) with transcutaneous electrical nerve stimulation together with prolonged end range stretching with overhead pulleys. The criteria for patients to be included in this study were pain on resisted motions, exclusive restriction of glenohumeral motion, maximum passive range of motion not exceeding 110 in abduction (with external rotation), 50\(^\circ\) of external rotation, 70\(^\circ\) of internal rotation and 140\(^\circ\) of flexion. Patients with bone or neurological disorders or polyarthritis were excluded from the study. The cohort group received “standard PT” including superficial heating modalities, and a combination of active and passive mobilization. Significant improvement in overall ROM was found in the group treated with transcutaneous electrical nerve stimulation, however, this may be due to prolonged, end range stretching as that was a concurrent treatment.
Clinicians may consider using short-wave diathermy, ultrasound, or electrical stimulation combined with mobility and stretching exercises to reduce pain and improve shoulder range of motion in patients with adhesive capsulitis.

**JOINT MOBILIZATION**

Several studies have examined the effect of joint mobilization in patients with adhesive capsulitis and although there is evidence that it may be beneficial, there is little evidence to support superior efficacy over other interventions. Future research designs where patients are classified into 1) treatment groups with physical impairment that presumably best respond to joint mobilization, and 2) have the mobilization force best matched to the tissue irritability of the patient, may provide a clear indication of whether or not joint mobilization is beneficial for patients with adhesive capsulitis.

Vermullen performed a randomized prospective study (n=100) comparing high-grade mobilization (grade III and IV) techniques to low-grade mobilization techniques (grade I and II) without exercise performance. The criteria for patients to be included in this study were unilateral adhesive capsulitis defined as greater than 50% loss of passive movement of the shoulder joint in one or more directions and duration of complaints for over 3 months. Exclusion criteria for this study included previous manipulation of the affected shoulder under anesthesia, other conditions involving the shoulder, neurologic deficits affecting shoulder function, pain or disorders of the cervical spine, elbow, wrist, or hand, and an injection of corticosteroids in the affected shoulder in the previous 4 weeks. There was no control group and no modalities or HEP was performed. The patients were treated 2 times a week for 30 minutes for 12 weeks and assessed at 3, 6 and 12 months using the Shoulder Rating Questionnaire (SRQ), SDQ, SF-36, ROM and a pain VAS. Inferior, anterior and posterior glide techniques were used in addition to distraction techniques. They found significant improvement in both groups occurring in the first 3 months. The high-grade mobilization group did better but only a minority of comparisons reached statistical significance and the overall differences between the 2 interventions was small. After 3 months approximately 25% of the patients received other therapies (medication, injection) but there was no significant difference in long-term outcomes between these patients and those who were only treated with joint mobilization for the 3 month treatment period. Grade II mobilization (not tensioning the tissue to end range) was effective in not only improving pain but increasing ROM and function.

Bulgen et al compared 4 intervention groups: paired intra-articular and subacromial injections, joint mobilization, ice/proprioceptive neuromuscular facilitation, and no treatment (pendulums) in a prospective randomized study of 41 patients. The criteria for patients to be included in this study were pain in the shoulder for at least 1 month, night pain while sleeping, inability to lie on the affected shoulder, restriction in all active and passive shoulder motions, and a reduction in external rotation of at least 50%. Exclusion criteria included sensory symptoms in the affected arm, radiation of pain to the neck, arthritis, fractures or dislocations of the humerus, cervical spondylosis, and referred pain. They found that patients treated with joint mobilization and a HEP significantly improved in the first 4 weeks but slightly less than patients receiving intra-articular and subacromial injections. The group treated with joint mobilization did no
better than the other two groups (proprioceptive neuromuscular facilitation/ice/HEP and just pendulum exercises performed at home). At 6 months, the mobilization group significantly improved relative to initial ROM and pain measures but no difference was noted when compared to the other treatment groups.

II Nicholson90 compared a group of patients who received joint mobilization and active exercise (n=10) to group receiving just exercise (n=10). The criteria for patients to be included in this study were shoulder pain and limited passive motion of the glenohumeral joint. Exclusion criteria for this study included unstable fracture of the humerus, scapula or clavicle, recurrent dislocation or subluxation of the shoulder, rheumatic disease, advanced osteoarthritis, malignancy, history of extensive steroid therapy, severe pain that is not relieved by resting the joint and peripheral neurological involvement in the upper extremity. Following 4 weeks of treatment they found significantly improved ROM and pain in both groups but the mobilization group had a slightly greater improvement (7 degrees) in passive abduction only over the exercise group. Limitations of this study were limited measures of pain and ROM, and only a 4 week follow-up.

II Chen and colleagues27 studied a group of patients with shoulder pain and stiffness who received joint mobilization, exercise and advice (n=39) to a group receiving just exercise and advice (n=39). The criteria for patients to be included in this study were unilateral shoulder pain reproduced during shoulder motion, less than 140° of active shoulder flexion and abduction range of motion, greater than 10 cm hand-behind-back deficit compared to the unaffected side and pain and/or stiffness during accessory movements in the shoulder region joints. The criteria for excluding patients included trauma within the last 6 months, inflammatory joint disease, local neoplastic disorder, a feeling of instability at the glenohumeral joint, contraindications of passive joint mobilizations at the glenohumeral, acromioclavicular, or sternoclavicular joints, shoulder pain reproduced any neck motion or palpation. Participants received a maximum of ten 30-minute therapy sessions over an 8-week period. At 1 and 6 months there was no statistically significant differences in pain and disability, self-perceived global improvement, or active ROM between the 2 groups.

IV Vermulen et al128 presented a case series of 7 patients with a diagnosis of adhesive capsulitis using only intense end-range mobilization techniques (no exercise or modalities) over a 3 month duration. The diagnostic criteria adhesive capsulitis is this case series were a painful stiff shoulder for at least 3 months, a restriction of more than 50% in passive shoulder abduction, flexion in the sagittal plane, or lateral rotation compared to the opposite side, and maximal glenohumeral joint capacity of 15 cc. Patients were excluded from the study if they had diabetes mellitus, had suffered a severe trauma, or had osteoarthritis. Patients were treated 2-3 times a week and both ROM and joint volume (measured by arthrography) were used to determine outcomes. They reported significant improvement in active and passive ROM, pain and joint volume following treatment.

IV Yang and colleagues134 performed a multiple treatment trial using various combinations of end-range mobilization, mid-range mobilization and mobilization with movement in 28 patients with adhesive capsulitis. The diagnostic criteria were having a painful shoulder for at least 3
months with ROM losses of at least 25% in at least 2 directions. Patients were excluded from this study if they had diabetes mellitus, a history of shoulder surgery, rheumatoid arthritis, painful stiff shoulder after a severe trauma, fracture of the shoulder complex, rotator cuff rupture or tendon calcification. Each treatment was given for a 3 week period in different sequences for a total of 12 weeks. They found improved motion and function at 12 weeks. They concluded that end-range mobilization and mid-range mobilization were more effective than mobilization with motion in increasing motion and function.

II Tanaka et al\textsuperscript{122} attempted to identify the preferred management for limited glenohumeral motion focusing on frequency of sessions for joint mobilization and self exercise compliance. One hundred-ten patients (50 male, 58 female) having an average age of 63.7 years were enrolled in the study. Inclusion criteria consisted painful and limited shoulder motion with an unremarkable medical history and no clinical or radiological findings identifying shoulder pathology. Each patient was treated with a standardized intervention including shoulder joint mobilization, and instruction in a home exercise program. Mobilization's techniques were high intensity mobilization's performed at end range.\textsuperscript{128} Home exercise included pendulum and passive stretching exercise including but not limited to exercises such as wall climbs. Patients were randomly assigned to 3 frequency treatment groups. The high-frequency group was treated two times a week, moderate frequency group treated once a week and low-frequency group treated less than once a week. Measured outcomes were active abduction ROM and the time required (in months) to reach ROM plateaus. They also assessed the effect of age, gender, handedness, duration before rehabilitation intervention, frequency of sessions for joint mobilization, and self exercise compliance in home setting. Results showed no difference in improved motion based on gender, however, improved motion was seen in the involved dominant extremity versus the involved nondominant extremity. Frequency of joint mobilization by the therapist showed no relationship with improved motion or time to motion plateau. However, the improved motion was significantly better and time to plateau shorter in the group that performed a home exercise program every day. A relationship was seen between length of condition and smaller gains in range of motion. This study indicated that greater compliance with the home exercise program had greater influence on motion return and time to motion plateau then frequency of joint mobilization. A problem with this study is they do not clearly define the motion criteria limitations for inclusion in this study. A major limitation with this study is the exclusive use active abduction as the outcome measure versus other motion restrictions or an accepted outcome tool. Many of these patients could have had other pathologies causing limited motion that could not be identified by imaging. Patients may have gained motion in other planes is the different treatment groups that went undetected.

II Johnson investigated the effective of anterior versus posterior glide mobilization on external rotation range of motion in 20 patients (4 male and 16 female) with adhesive capsulitis.\textsuperscript{57} The following was inclusion criteria: unilateral idiopathic or primary frozen shoulder between the age of 37 and 66 with normal radiographic findings in the previous 12 months, no previous surgery or manipulation to the affected extremity, and external rotation restriction that increased with abduction. The pain VAS, a 5 item self-assessment function questionnaire, and external rotation range of motion in the highest degree of abduction measures were used for outcomes measures. Patients were initially treated with ultrasound to the anterior capsule or posterior capsule based on treatment with anterior or posterior mobilization, respectively. Mobilization was applied to
end range with the sustained stretch of one minute. No oscillatory motions were performed. Two positions for both anterior and posterior glide were chosen for total of 15 minutes of sustained stretch at each treatment session. Patients were treated for six sessions over 2 - 3 weeks. No home exercise program was performed. Patients treated with posterior mobilization demonstrated significant improvement in external rotation range of motion compared to those treated with anterior mobilization. This study compared the effect of two directions of mobilization on external rotation motion but did not compare mobilization to other forms of treatment or assessed the effect on other motions.

Clinicians may consider the use of joint mobilization procedures to reduce pain, and increase motion and function in patients with adhesive capsulitis.

STRETCHING EXERCISES

Stretching exercise appears to influence pain and improve ROM. However, results are inconsistent across multiple studies, demonstrating that stretching results in minimal or no difference in outcomes (at 3 - 6 months) in patients treated with a therapist directed HEP compared to other interventions. Only one study fully described the exercises performed while others grouped the program as active and/or passive exercises. No evidence exists to guide the optimal frequency, repetitions, or duration of stretching exercises. Stretching beyond painful limits may result in poorer outcomes. Therefore, stretching intensity that matches the given level of tissue irritability is indicated. As with joint mobilization, future research designs where 1) patients are classified into treatment groups with physical impairment that presumably best respond to stretching exercises, and 2) the mobilization forces are best matched to the tissue irritability of the patient, may provide a clear indication of whether or not stretching exercises are beneficial for patients with adhesive capsulitis.

Kivimaki compared a HEP to manipulation under anesthesia and HEP (n=125) in an RCT. The criteria for patients to be included in this study were gradually increasing shoulder pain and shoulder mobility of no more than 140° in elevation and 30° in external rotation. Patients were excluded if they had osteoarthritis, traumatic bone or tendon changes in the affected shoulder or a rotator cuff rupture. The HEP was instructed by a physiotherapist over 2 sessions and supplemented by a written daily program. The program included pendulum and stretching techniques for the shoulder. The SDQ and ROM were assessed at 6 weeks, 3, 6 and 12 months. At 6-weeks and 3-months the manipulation group demonstrated statistically significant increase in shoulder flexion ROM (8.0, 0-16, 95% CI) compared to HEP alone. The group performing just a HEP did not differ at any follow-up interval in pain or working ability. Shoulder symptoms had diminished and functional motion returned by 6 months after randomization. Complete information was obtained in greater than 81% of the participants up to 3 months, dropping to 63% at 12 months. The study demonstrated the equivalence of a therapist instructed HEP for the treatment of adhesive capsulitis compared to manipulation under anesthesia however, there was no control group for comparison.
Diercks et al\textsuperscript{39} prospectively followed 77 patients with idiopathic adhesive capsulitis to compare the effects of “intensive” PT to “supervised neglect.” The criteria for patients to be included in this study were more than a 50% motion restriction of the glenohumeral joint in all directions for a period of three months or more. Exclusion criteria included significant injury to the ipsilateral shoulder or arm, surgical procedures on the shoulder, arm, cervical spine, thorax, or breast within the past two years, intra-articular deformities, degenerative arthritis or inflammatory arthritis, diabetic patients, and secondary capsulitis due to rotator cuff tear, fractures, dislocations, and reflex sympathetic dystrophy. The Constant score was assessed every 3 months for 24 months. The intensive PT group performed active exercises up to and beyond the pain threshold, passive stretching, glenohumeral joint mobilization, and a HEP. The “supervised neglect” group was instructed not to exercise past their pain threshold, and was instructed to do pendulum exercises and active exercises within the painless range and to resume all activities as tolerated. Both groups had significant ROM and pain improvements, however, 89% of the “supervised neglect” group achieved a Constant score of greater than 80 compared to only 63% of the intense PT group. Interestingly, 64% of the “supervised neglect” HEP group achieved a Constant score of $\geq 80$ at 1 year while none of the intense PT group achieved this score. A conclusion of this study was that aggressive therapy can be detrimental to some patients, especially during the inflammatory stage. The frequency and length of care were not standardized.

Griggs et al\textsuperscript{45} patients classified with phase-II idiopathic adhesive capsulitis (n=75), demonstrated good outcomes with an exercise program in a prospective functional outcome study. Outcome measures were pain, ROM and function using the DASH, SST, and the SF-36. The mean duration of follow-up was 22 months (12-41 months). All patients performed a HEP of passive stretching exercises in forward elevation, external rotation, horizontal adduction and internal rotation. All patients were referred to PT for exercise performance and the therapist determined the number of visits. Ninety percent of the patients reported satisfactory outcomes, 10% were not satisfied with the outcome and 7% of these patients underwent manipulation and/or arthroscopic release. Interestingly, although the patients were satisfied, they continued to demonstrate restricted motion relative to their uninvolved side. Patients with the worst perceptions of pain and function of their shoulder before treatment tended to have the worst outcomes.

Lee et al\textsuperscript{65} investigated the effect of exercise with and without steroid injection to those patients just taking analgesics (n=65) over a 6 week course of treatment. The criteria for patients to be included in this study were not specified. They found all exercise groups (with and without corticosteroid injections) significantly improved in active abduction and external rotation ROM compared to the group taking analgesics alone. They found most of the improvement occurred in the first 3 weeks. However, neither the exercise program nor the analgesic medication was described.

The effect of adding specific scapulothoracic strengthening exercises to a physical therapy program was investigated in patients with adhesive capsulitis.\textsuperscript{34} Twenty-eight patients (7 males and 21 females) with an average age of 52.1 (32-65) were included. All patients were evaluated by an orthopedist and had both radiographs and magnetic resonance imaging (MRI) performed.
Inclusion criteria was at least 50% restriction of external rotation, abduction and flexion compared to the other side, normal anterior-posterior and lateral radiographs, secondary frozen shoulder with type II impingement based on clinical examination and MRI, and secondary frozen shoulder with MRI demonstrated small rotator cuff tear. Exclusion criteria were: radiculopathy, thoracic outlet syndrome, rheumatologic disorders, fractures and tumors of the upper extremity and neurologic disorders causing muscle weakness in the shoulder. Patients were randomly assigned to two groups and each group was treated with active and passive ROM exercises, manual stretching, proprioceptive neuromuscular facilitation, transcutaneous nerve stimulation, and ice. All patients performed a HEP. The experimental group also performed isolated scapular and glenohumeral/scapular muscle strengthening. Exercise intensity was progressed based upon pain status and patients were treated for 6 weeks (30 sessions). A modified Constant score, VAS and ROM were assessed at 6 and 12 weeks. Both groups significantly improved in all parameters and they found statistically greater active elevation ROM in the group treated with scapular strengthening at 12 weeks. The authors suggested the group treated with scapular strengthening improved because the scapulohumeral rhythm was “restored,” however, scapulohumeral rhythm was only visually assessed.

IV Levine et al\textsuperscript{68} reported a non-operative care retrospective case series that included a standard physical therapy program with non-steroidal anti-inflammatory medication with or without corticosteroid injection. End-points were satisfactory resolution of symptoms with non-operative care or choosing operative care. They found that 89.5\% of 98 of patients with adhesive capsulitis responded to non-operative management. Resolution of symptoms occurred in 52.4\% with PT and non-steroidal anti-inflammatory medication while 37.1\% resolved with non-steroidal anti-inflammatory medication, physical therapy, and one or more injection. The average time to successful treatment was 3.8 months. No specific program of exercise was described.

B Clinicians should instruct patients with adhesive capsulitis in stretching exercises. The intensity of the exercises should be determined by the patient's tissue irritability level.
CLINICAL GUIDELINES

SUMMARY OF RECOMMENDATIONS

Pathoanatomical features:
Clinicians should assess for impairments in the capsuloligamentous complex and musculotendinous structures surrounding the shoulder complex when a patient presents with shoulder pain and mobility deficits. The loss of passive motion, particularly external rotation with the arm in varying degrees if shoulder abduction, is a significant finding that can be used to guide treatment planning.

Risk Factors
Clinicians should recognize that 1) patients with diabetes mellitus and thyroid disease are at risk for developing of adhesive capsulitis, and 2) adhesive capsulitis is more prevalent in individuals who are over 40 years old, females, and have had previous episode of adhesive capsulitis in the contralateral arm.

Clinical Course
Clinicians should recognize that AC occurs as a continuum of pathology characterized by a staged progression of pain and mobility deficits. At 12-18 months, mild to moderate mobility deficits and pain may persist but many patients report minimal to no disability.

Diagnosis/Classification
Clinicians should recognize that patients with adhesive capsulitis present with a gradual and progressive onset of pain and loss of active and passive shoulder motion in both elevation and rotation. Utilizing the evaluation and intervention components described in this guideline will assist clinicians in medical screening, differential evaluation of common shoulder musculoskeletal disorders, diagnosing tissue irritability levels, and planning intervention strategies for patients with shoulder pain and mobility deficits.

Differential Diagnosis
Clinicians should consider diagnostic classifications other than adhesive capsulitis when the patient’s reported activity limitations or impairments of body function and structure are not consistent with the diagnosis/classification section of this guideline, or, when the patient’s symptoms are not resolving with interventions aimed at normalization of the patient’s impairments of body function.

Examination – Outcome Measures
Clinicians should use validated functional outcome measures, such as the Disabilities of the Arm, Shoulder and Hand, the American Shoulder and Elbow Surgeons Shoulder Scale, or the Shoulder Pain and Disability Index. These should be utilized before and after interventions intended to alleviate the impairments of body function and structure, activity limitations, and participation restrictions associated with adhesive capsulitis.

Examination – Activity Limitation and Participation Restriction Measures
Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patient’s shoulder pain to assess the changes in the patient’s level of shoulder function over the episode of care.

Examination – Physical Impairment Measures:
Clinicians should measure pain and active and passive shoulder ROM to assess the key impairments of body function and body structures in patients with adhesive capsulitis.

Intervention -- Corticosteroid Injections
Intraarticular corticosteroid injections combined with shoulder mobility and stretching exercises are more effective in providing short-term (4-6 weeks) pain relief and improved function compared to shoulder mobility and stretching exercises alone.

**Interventions – Patient Education**

Clinicians should utilize patient education that 1) describe the natural course of the disease, and 2) promote activity modification to encourage functional, pain-free range of motion, and 3) match the intensity of stretching to the patient's current level of irritability.

**Interventions – Modalities**

Clinicians may consider using short-wave diathermy, ultrasound, or electrical stimulation combined with mobility and stretching exercises to reduce pain and improve shoulder range of motion in patients with adhesive capsulitis.

**Interventions – Joint Mobilization**

Clinicians may consider the use of joint mobilization procedures to reduce pain, and increase motion and function in patients with adhesive capsulitis.

**Interventions – Stretching Exercises**

Clinicians should instruct patients with adhesive capsulitis in stretching exercises. The intensity of the exercises should be determined by the patient's tissue irritability level.
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