

Long-Term Outcomes After Arthroscopic Capsular Release for Idiopathic Adhesive Capsulitis

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Background: One management strategy for the treatment of idiopathic adhesive capsulitis, or frozen shoulder, is arthroscopic capsular release. While there are long-term data regarding nonoperative treatment and good short-term outcomes following a release for idiopathic adhesive capsulitis, little is known about the outcomes five years or more after arthroscopic capsular release.

Methods: Patients with idiopathic adhesive capsulitis treated with a circumferential arthroscopic capsular release of the glenohumeral joint by a single surgeon were assessed with use of patient-reported pain scores, shoulder functional scores with use of a Likert scale, and shoulder range of motion at the preoperative evaluation and at one, six, twelve, twenty-four, and fifty-two weeks and a mean of seven years after surgery.

Results: At a mean follow-up of seven years (range, five through thirteen years), forty-three patients (forty-nine shoulders) had significant improvement with regard to pain frequency and severity, patient-reported shoulder function, stiffness, and difficulty in completing activities compared with the findings at the initial presentation ($p < 0.001$) and the one-year follow-up evaluation ($p < 0.01$ to $p < 0.001$). Shoulder motion also improved ($p < 0.001$) and was comparable with that of the contralateral shoulder. There were no complications.

Conclusions: Patients with idiopathic adhesive capsulitis treated with an arthroscopic capsular release had early significant improvements in shoulder range of motion, pain frequency and severity, and function. These improvements were maintained and/or enhanced at seven years. In contrast to results reported for nonoperative treatment, shoulder range of motion at seven years was equivalent to that in the contralateral shoulder.

Level of Evidence: Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.

Idiopathic adhesive capsulitis, a painful, stiff shoulder of unknown etiology that is also referred to as a frozen shoulder, has a prevalence of 2% in the general population¹. It affects more women than men and is most common between the ages of thirty-five and sixty-five years. In idiopathic adhesive capsulitis, the joint capsule is thick and contracted and the collagen is packed more densely^{2,3}. There is a decrease in intra-articular volume and capsular compliance so that glenohumeral motion is limited in all planes⁴. Idiopathic adhesive capsulitis is characterized by pain and stiffness in the shoulder, passing through phases of pain, pain and stiffness, stiffness and resolution, and typically leading to a functional recovery after two to three years^{1,5-9}. Although there is a functional recovery, Shaffer et al.¹⁰ showed that up to 50% of

patients continued to have mild pain or stiffness seven years after the initial symptoms as well as a deficit in shoulder range of motion compared with the contralateral shoulder.

Treatment of idiopathic adhesive capsulitis is controversial. Nonoperative interventions that have been described include benign neglect, physical therapy, intra-articular steroid injections, and nonsteroidal anti-inflammatory drugs^{1,5,6,8,9,11}. There are few studies that have evaluated the long-term outcomes of any treatment.

Surgical interventions include an open release, manipulation under anesthesia, arthroscopic capsular release, and combinations of open or arthroscopic capsular release with manipulation under anesthesia^{1,6,8}. Arthroscopic capsular release was first described, as

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far as we know, in 1979 by Conti¹², and has been favored over manipulation under anesthesia as it is believed to allow a more controlled and complete release of the contracted capsule, to reduce the chance of fracture⁹, and to provide more immediate improvement¹⁰.

There are data that have suggested that patients have good short-term outcomes following arthroscopic capsular release for idiopathic adhesive capsulitis^{5,13-15}; however, there is little information on the long-term outcomes of this treatment. The aim of the present study was to determine the long-term outcomes of arthroscopic capsular release.

Materials and Methods

Study Design

Following ethics approval at our institution, a retrospective study was conducted on patients who had an arthroscopic capsular release for idiopathic adhesive capsulitis five years or more previously. The primary outcome measure was defined as the effect of arthroscopic capsular release on patient-reported frequency and magnitude of pain with activities five years or more after the surgery. Secondary outcomes were the long-term effect of arthroscopic capsular release on patient-reported pain frequency and magnitude of pain at rest and at night, difficulty reaching behind the back or above the head, level of activity at work and level of sport played, overall shoulder stiffness, overall patient satisfaction, complications, and shoulder motion compared with that at the preoperative evaluation and at one, six, twelve, twenty-four, and fifty-two weeks and five years or more postoperatively. A comparison was also made between the contralateral (nonoperatively treated) shoulder and the operatively treated shoulder with respect to shoulder motion at five years or more.

Inclusion and Exclusion Criteria

The criteria for a diagnosis of idiopathic adhesive capsulitis^{7,10,16-20} were (1) a painful stiff shoulder for at least four weeks; (2) restriction of passive external rotation of at least 50% compared with the contralateral shoulder; (3) difficulty using the affected arm, with restriction of movement and loss of function; and (4) pain at night causing a sleep disturbance and inability to lie on the affected side.

For inclusion in this study, patients were required to have undergone an arthroscopic capsular release for idiopathic adhesive capsulitis performed by the senior author (G.A.C.M.), and a minimum five-year follow-up period. The exclusion criteria included (1) evidence of glenohumeral joint arthritis at the primary procedure, (2) a full-thickness rotator cuff tear, (3) any fracture involving the shoulder girdle, (4) diabetes, (5) a history of a motor vehicle accident as a cause of the initial injury, (6) previous surgery to the involved shoulder, and (7) an unwillingness or inability to attend long-term follow-up evaluations.

An extensive effort was made to contact the patients who met the inclusion criteria, with use of the personal contact information on record, through a mailing, and by telephone. If patients could not be reached, the patient's referring medical practitioner or physical therapist was contacted by telephone and/or an online search was made of the national telephone directory. When attendance at the clinic was not possible, a standardized pain assessment was conducted by telephone or, if appropriate, a house visit was made.

Outcome Assessment

At each clinic visit (the preoperative evaluation; follow-up at one, six, twelve, twenty-four, and fifty-two weeks; and final study evaluation), patients completed a standardized questionnaire with scales for evaluating both pain and function (based on the Shoulder Rating Questionnaire [SRQ])²¹, with separately scored domains for global assessment, pain, daily activities, recreational and athletic activities, work and satisfaction; the final, nongraded domain of the

SRQ was not included in our study). Shoulder motion and strength were measured by examiners using previously validated techniques^{22,23}.

Patients responded to questions pertaining to frequency of pain during activity, frequency of night pain, frequency of extreme pain, intensity of resting pain, intensity of activity pain, intensity of night pain, and overall shoulder status, using Likert scales. Patient-determined pain severity was ranked as none, mild, moderate, severe, and very severe. Pain frequency was ranked as never, sometimes, monthly, weekly, and all of the time. Patients were also asked to state their level of activity at work (none, light, moderate, or strenuous labor) and current level of sport played (none, hobby, club, or national), as well as rank the difficulty they had in performing daily tasks such as reaching above the head and reaching behind the back (none, mild, moderate, severe, or very severe). At the final visit, patients were asked, "Would you be able to point to the word that best describes the impact that arthroscopic capsular release has had on your life, in terms of improving movement and reducing pain?" and they could choose excellent, good, average, or poor.

Range of Motion

In this study, isolated passive range of shoulder motion (internal rotation, external rotation, forward flexion, and abduction) was assessed visually with use of a previously described and validated protocol^{22,24}. At the final visit after long-term follow-up, the shoulder that had the capsular release was examined and then the contralateral shoulder was evaluated to facilitate a comparison between the two.

Operative Procedure and Rehabilitation

Following interscalene regional anesthesia, patients were positioned in the beach-chair position for arthroscopy. The passive shoulder motion was assessed as detailed above. After preparation and draping of the patient, an arthroscopic capsular release was initiated by inserting an arthroscope into the glenohumeral joint via a standard posterior portal. An anterior portal was established under direct vision with use of a spinal needle lateral to the coracoid process as previously described²⁵. The portal was established just superior to the superior border of subscapularis. A spinal needle was utilized to ensure that instruments could access the inferior capsule and, if possible, the posterior capsule. Through this opening, the anterior and inferior capsule were cut lateral to the glenoid labrum with use of a 3-mm suction wand (500 Suction, CoVac 50 ArthroWand; ArthroCare, Sunnyvale, California) or with a 4-mm arthroscopic punch. The tissue in the rotator interval was released to the anterior border of the long head of the biceps muscle and medially to the base of the coracoid process under direct vision. A portion of the intra-articular subscapularis tendon was also divided¹⁵ to improve shoulder motion outcomes⁵. Either through the same anterior portal, or more commonly from a posterior inferior portal, the inferior and posterior aspects of the capsule were released, to achieve a complete 360° release. After the release, the arthroscope was removed, a gentle manipulation was performed, and shoulder motion was assessed. The glenohumeral joint was injected with 10 mL of Depo-Medrol with Lidocaine (40 mg/mL of methylprednisolone acetate and 10 mg/mL of lidocaine hydrochloride, with 0.9% m/v benzyl alcohol [preservative]; Pfizer, New York, NY) for pain relief. The portals were closed, and the shoulder was dressed with a soft bulky dressing. The extent of the release and the shoulder motion were recorded by the operating surgeon on a specifically designed, standardized form. Patients were discharged on the day of the surgery without a sling. They were provided with an ice pack to use on the affected shoulder for twenty minutes every two hours during waking hours for two days.

Prior to surgery, all patients met with a physical therapist who emphasized the importance of postoperative exercises, and they were instructed to start range-of-motion exercise at the shoulder on the day they arrived home from surgery. Beginning on day 1, patients met with a therapist for the first of two supervised exercise sessions in the first postoperative week. The sessions focused on maintaining passive and active-assisted shoulder motion. They were instructed to perform assisted shoulder movements every two hours at home for the remainder of the week. At the second meeting, patients were instructed

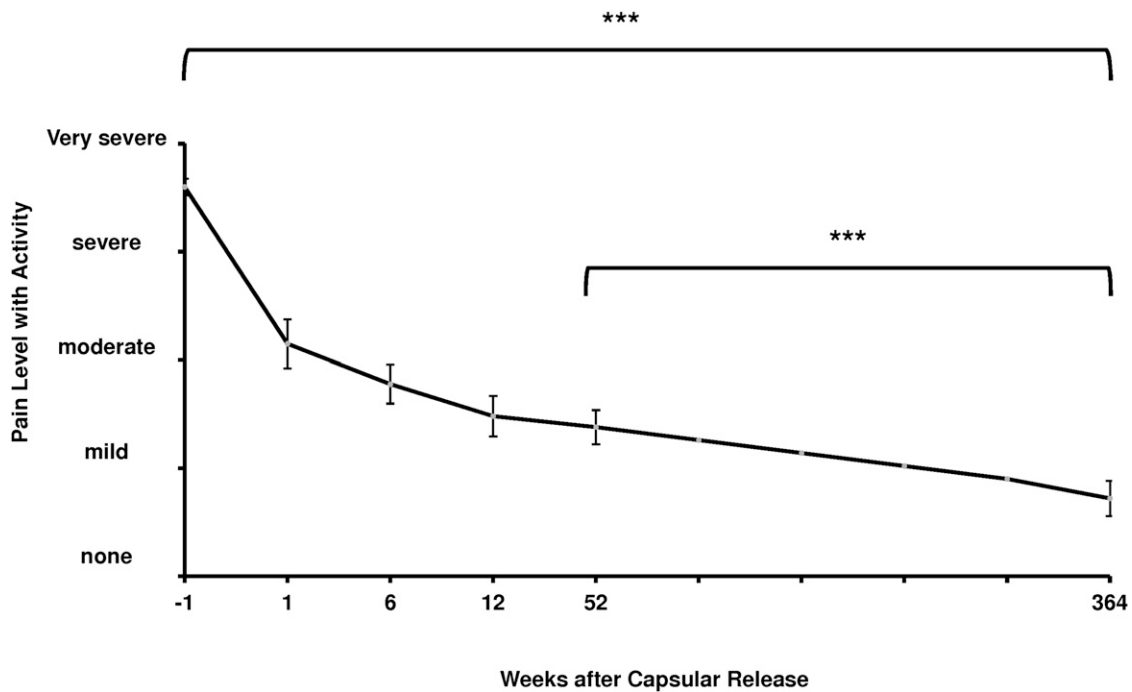


Fig. 1-A

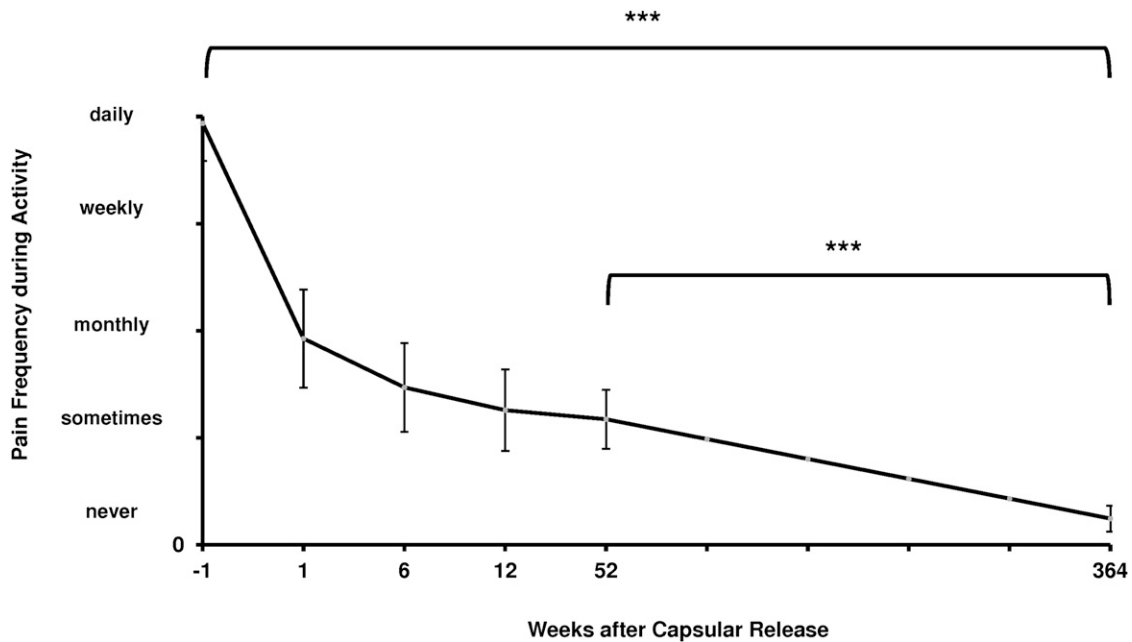


Fig. 1-B

Patient-determined ($n = 31$) scores for pain with activities (**Fig. 1-A**) and frequency of shoulder pain with activities (**Fig. 1-B**), with specific interest at the long-term follow up (mean, 364 weeks). Data are presented as the mean (and the standard error of the mean). Comparisons between groups were made with use of Mann-Whitney rank-sum tests. *** $p < 0.001$. -1 = clinic visit before surgery.

to perform ten repetitions of active-assisted external rotation of the shoulder with a broom handle. During the second postoperative week, exercises comprised three sets a day of ten repetitions each for resistive retraction with a Thera-Band (Hygenic, Akron, Ohio) for external rotation, internal rotation and adduction, and free-weight resistive flexion and abduction and five repetitions of ten-second duration stretches each for flexion, horizontal adduction, and external rotation (0° and 90° of abduction). Exercises to ensure early facilitation

of rotator cuff muscle strengthening were then introduced. Patients were encouraged to perform the same exercise regimen at home three times daily for the ensuing ten weeks.

Statistical Analysis

Comparisons were made between groups with continuous variables that had a normal distribution with use of two-way Student t tests, and those with

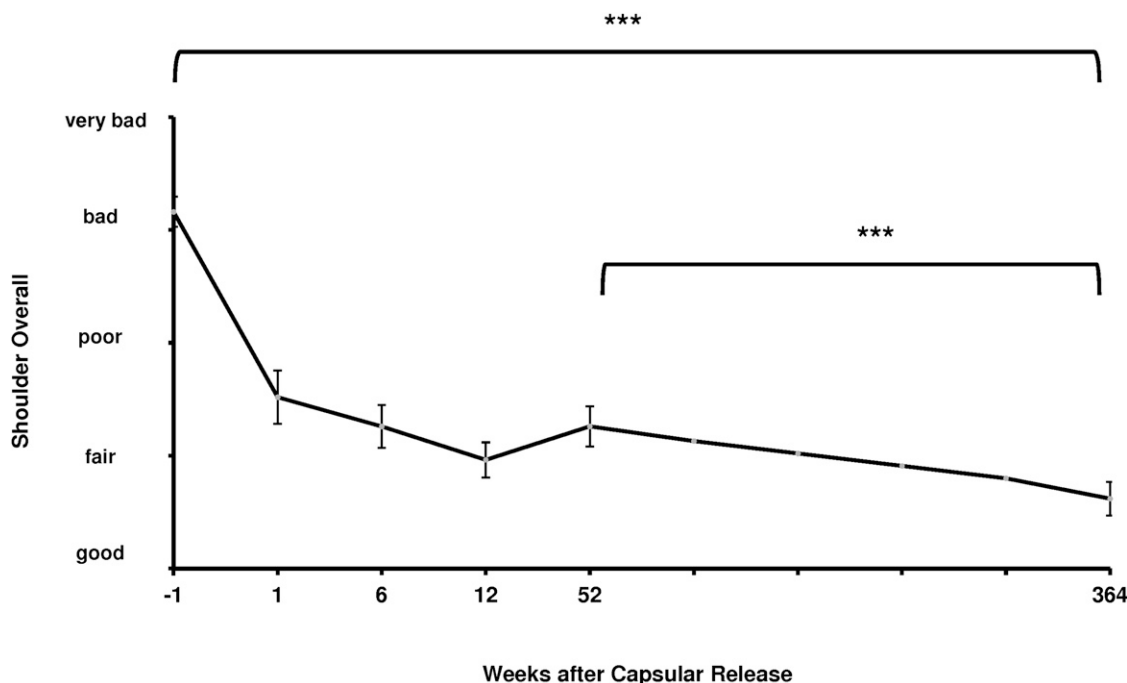


Fig. 2

Patient-determined ($n = 31$) scores for overall shoulder function, with specific interest at the long-term follow-up (mean, 364 weeks). Data are presented as the mean (and the standard error of the mean). Comparisons between groups were made with use of Mann-Whitney rank-sum tests. *** $p < 0.001$. -1 = clinic visit before surgery.

categorical data were compared with use of Mann-Whitney rank-sum tests. The level of significance was set at $p \leq 0.05$.

Source of Funding

The study was supported in part by the University of New South Wales (Independent Learning Project student support), the St George Hospital (research infrastructure support), and Premier Specialists (data collection).

Results

Study Group

Between April 1997 and December 2004, the senior author performed 121 arthroscopic capsular releases for idiopathic adhesive capsulitis in 115 patients. Of the 121 shoulders, thirty-seven were excluded because of concurrent rotator cuff injury and repair; ten, for glenohumeral osteoarthritis at the time of surgery; two, for a combination of these conditions; and one, for the presence of diabetes. Of the seventy-one surgical procedures remaining, twenty-two patients were unable to participate in the long-term follow-up (eight died and fourteen could not be contacted), leaving forty-nine shoulders in forty-three patients as the study group.

Cohort Demographics

Of the forty-three patients (forty-nine shoulders), nineteen (44%) were male and twenty-four were female (56%), with a mean age of sixty-one years (range, thirty-seven to eighty-seven years) and a mean follow-up period of seven years (range, five to thirteen years) since surgery. There were eight patients (19%) who indicated that they had bilateral idiopathic adhesive capsulitis at some point, with six requiring an arthroscopic

capsular release for both shoulders. Of the forty-nine shoulders, nineteen (39%) were on the right side and thirty (61%) were on the left.

Patient-Reported Pain Scores

Before surgery, most patients rated their pain with activity as severe to very severe, pain at rest and at night as moderate to severe (Figs. 1-A and 1-B; see Appendix), and overall stiffness as between moderate and quite stiff (Fig. 2; see Appendix). In addition, patients described the difficulty they experienced in reaching behind the back or over the head as severe to very severe (Fig. 2; see Appendix).

At one week after arthroscopic capsular release, patients reported relief in the severity and frequency of night pain, pain with activity, and pain at rest (Figs. 1-A and 1-B; see Appendix). Improvements were also seen immediately in relation to overall shoulder function, overall stiffness, and daily activities, such as reaching behind the back or above the head (Fig. 2; see Appendix).

These gains in the relief of shoulder pain severity and frequency continued for one to two years. Patients rated their pain severity (at night, at rest, and with activity) between moderate and mild, and the pain frequency (at night, at rest, and with activity) between monthly and sometimes (Figs. 1-A and 1-B; see Appendix). Daily activities, such as reaching behind the back, remained steady at the moderate level, and reaching above the head continued to improve to the mild level between weeks 6 and 52 after surgery (Fig. 2; see Appendix).

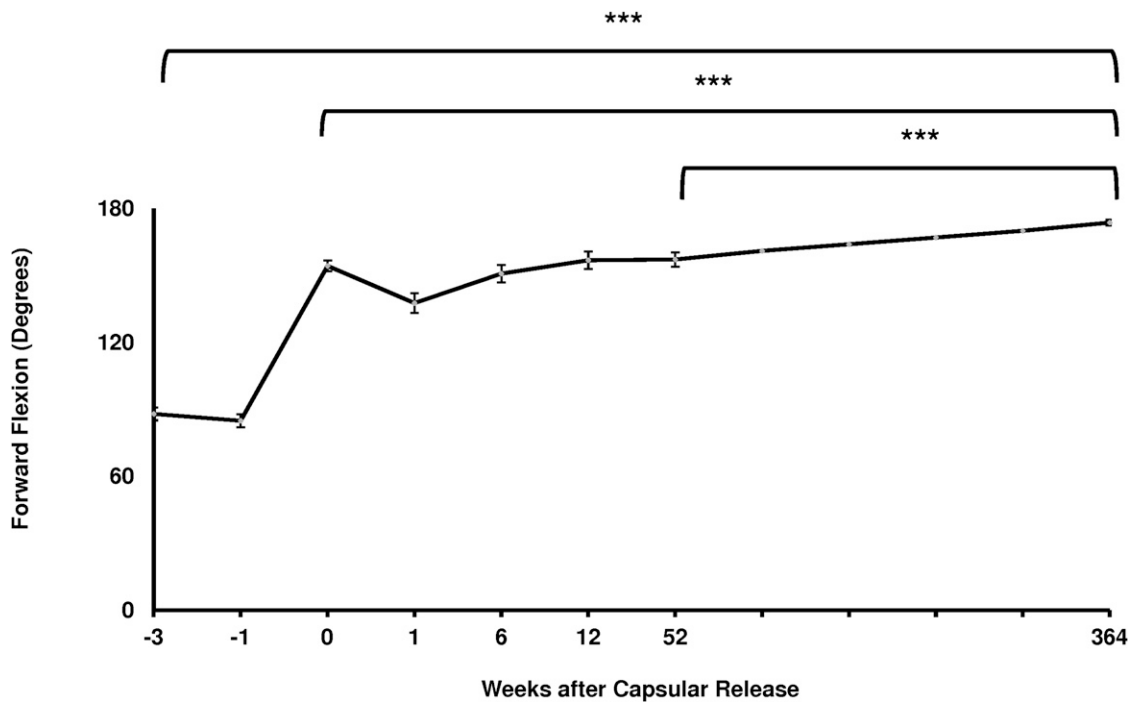


Fig. 3-A

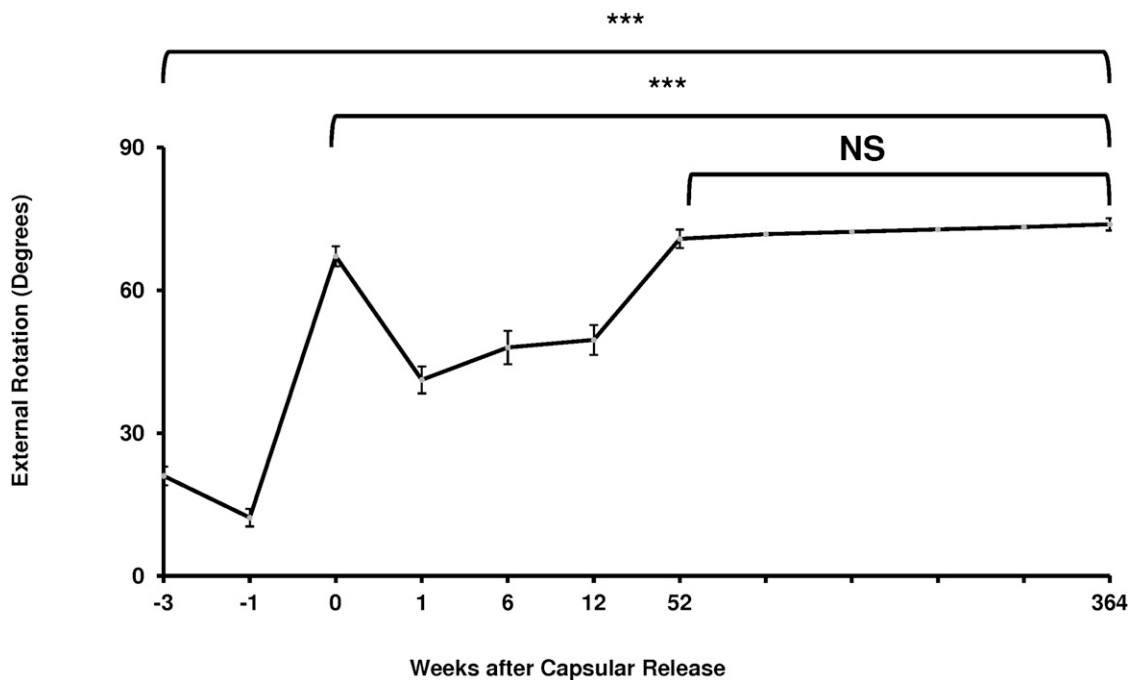


Fig. 3-B

Examiner-determined assessments of forward flexion (**Fig. 3-A**), external rotation (**Fig. 3-B**), and internal rotation (**Fig. 3-C**) before and after capsular release surgery ($n = 31$), with specific interest in the long-term follow-up evaluation (mean, 364 weeks). Data are presented as the mean (and the standard error of the mean). Comparisons between groups were made with use of Mann-Whitney rank-sum tests. *** $p < 0.001$. * $p \leq 0.05$. NS = not significant, -3 = clinic visit before surgery, -1 = intraoperative measurements before release, and 0 = intraoperative measurements after release.

Patient-reported pain scores at the time of the seven-year follow-up continued to improve to between mild and none ($p < 0.001$; Fig. 1-A; see Appendix). There was a significant

reduction in pain frequency: during activity ($p < 0.001$) and during sleep ($p < 0.01$), and the frequency of extreme pain levels ($p < 0.05$) decreased to between sometimes and never

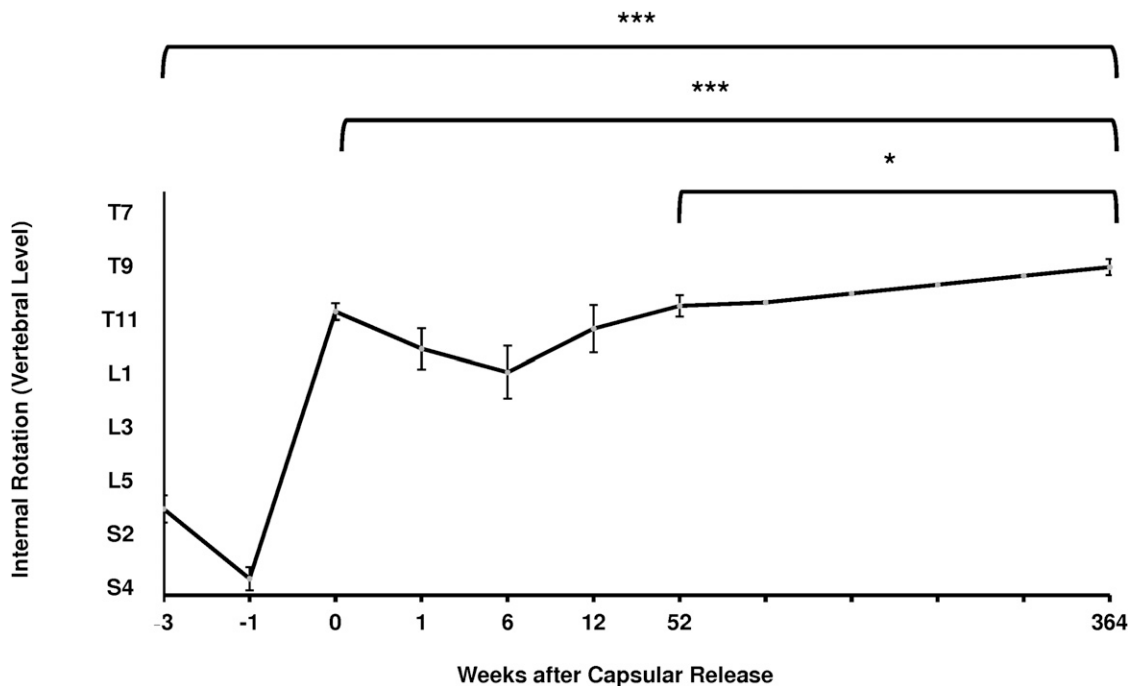


Fig. 3-C

(Fig. 1-B; see Appendix). Overall shoulder function was rated between fair and good ($p < 0.001$), and the severity of shoulder stiffness was between a little and none ($p < 0.001$; Fig. 2; see Appendix). Patient-reported difficulty with reaching behind the back ($p < 0.001$) and reaching above the head ($p = 0.01$) decreased to between mild and none (Fig. 2; see Appendix).

At the time of the long-term follow-up, patient-reported levels of activity at work were significantly better ($p \leq 0.05$) compared with preoperative rankings, and the current level of sports played was not significantly different compared with preoperative levels or those at short-term follow-up (Fig. 2; see Appendix).

When asked the question "Would you be able to point to the word that best describes the impact that arthroscopic capsular release has had on your life, in terms of improving movement and reducing pain?" 85% responded that it had been excellent or good; 12%, average; and only 3%, poor.

Range of Motion

Of the forty-three patients (forty-nine shoulders), twenty-five patients (thirty-one shoulders) were able to attend the seven-year follow-up evaluation to have both the shoulder that had capsular release and the contralateral shoulder examined. Old age (two patients), family commitments (three patients), work commitments (eight patients), and distance (five patients) were reasons cited by the patients as to why they could not return for shoulder examination.

There was a significant improvement in shoulder motion at seven years compared with the initial presentation ($p < 0.001$) and at the completion of the arthroscopic capsular release ($p < 0.001$; Figs. 3-A, 3-B, and 3-C; see Appendix).

In comparison with the results at the time of short-term follow-up, there were significant improvements in shoulder motion at the seven-year follow-up evaluation with regard to abduction ($p < 0.001$), forward flexion ($p < 0.001$), and internal rotation ($p = 0.05$). However, external rotation ($p = 0.6$) showed no significant difference with respect to the short-term follow-up, although there was no overall regression in shoulder movement (Figs. 3-A, 3-B, and 3-C; see Appendix).

At a mean of seven years after surgery, the contralateral shoulders (in the patients who had not had surgery bilaterally) had passive range of motion (a mean and standard deviation of $173^\circ \pm 8^\circ$ of abduction, $77^\circ \pm 6^\circ$ of external rotation, $174^\circ \pm 9^\circ$ of forward flexion, and internal rotation to $T9 \pm 1$) that was almost identical to that in the shoulders after capsular release (a mean of $172^\circ \pm 10^\circ$ of abduction, $74^\circ \pm 7^\circ$ of external rotation, $174^\circ \pm 7^\circ$ of forward flexion, and internal rotation to $T9 \pm 2$); the difference was not significant (Table I).

Complications

There were no intraoperative, postoperative, or long-term complications in the forty-three patients (forty-nine shoulders). Specifically, there was no osteoarthritis, recurrence requiring a rerelease, axillary nerve dysfunction, infection, or shoulder instability. Three patients were diagnosed as having so-called impingement in the shoulder that had the capsular release, which was treated with a corticosteroid and local anesthetic injection in the subacromial space at seventy-one, eighty-two, and ninety-five months, respectively, after the operation. One patient had osteoarthritis (which had not been noted at the index procedure) in the involved shoulder at eighty-nine months postoperatively, but this condition was also present in the contralateral shoulder, the neck, and both knees. Two patients had

TABLE I Examiner-Determined Shoulder Range of Motion for Shoulders That Had Capsular Release and Contralateral, Unaffected Shoulders After Long-Term Follow-up at a Mean of 364 Weeks

	Contralateral Shoulders (N = 25)		Shoulders That Had Capsular Release (N = 31)		P Value*
	Mean	Standard Deviation	Mean	Standard Deviation	
Forward flexion (deg)	174	9	174	7	NS
Abduction (deg)	173	8	172	10	NS
External rotation (deg)	77	6	74	7	NS
Internal rotation†	T9	1	T9	2	NS

*Comparison between groups made with use of two-way unpaired Student *t* tests. NS = not significant. †The values are given as the vertebral level that the patient could reach with the thumb.

undergone a rotator cuff repair at forty-three and fifty-six months postoperatively for injuries that had occurred after the capsular release.

Discussion

This study confirmed that arthroscopic capsular release resulted in significant reduction in pain severity and frequency at one, six, twelve, and fifty-two weeks after surgery and that these improvements persisted, and were even more pronounced at a mean of seven years (range, five to thirteen years) after capsular release, with no short or long-term complications. At a mean of seven years (range, five to thirteen years) after the operation, there were also no deficits in shoulder motion compared with the contralateral, noninvolved shoulder, and the improvements in shoulder movement gained as a result of the surgery and maintained at fifty-two weeks persisted and even improved over the long term.

To our knowledge, no other studies have evaluated the outcomes of arthroscopic capsular release for idiopathic adhesive capsulitis at more than two years after the index procedure. We found that patients continued to benefit from the arthroscopic capsular release at a mean of seven years postoperatively, with continued significant improvement in overall shoulder function, relief of shoulder stiffness, and relief of difficulty in reaching behind the back or above the head. Another important finding was the continued significant relief in terms of the severity and frequency of pain with activity, at rest, and when trying to sleep. These data are consistent with short-term outcome studies on arthroscopic capsular release for adhesive capsulitis^{26,27}.

A number of studies²⁸⁻³³ have evaluated the short-term results of nonoperative management of adhesive capsulitis. At two years, most patients who had nonoperative treatment had significant improvement, but the shoulders were not normal^{10,16}. There have been few studies evaluating the long-term natural history of adhesive capsulitis^{10,34}.

Other studies have offered insights into the functional and shoulder motion outcomes after arthroscopic capsular release for shoulder stiffness. Ide and Takagi¹⁹ evaluated thirty patients with primary adhesive capsulitis and twelve with secondary ad-

hesive capsulitis who had undergone an arthroscopic capsular release accompanied by a subacromial decompression and used a continuous passive motion machine postoperatively. The patients continued to have improved shoulder movement and functional outcomes at a mean follow-up of 7.5 years, a finding consistent with our results.

Hand et al.⁷ studied a cohort of 223 patients with a diagnosis of idiopathic adhesive capsulitis who were treated with a variety of options, including benign neglect, steroid injection, physiotherapy, manipulation under anesthesia, and arthroscopic capsular release, and were followed for an average of 4.4 years (range, two to twenty years). With a focus on functional outcomes associated with the Oxford Shoulder Score, their results revealed that patients who had reported unbearable symptoms in the first six months had a significantly worse outcome compared with those who reported severe, moderate, or mild symptoms at presentation. However, the plurality of treatments made it difficult to compare the intervention strategies. One of the interesting findings in our study was the absence of limited shoulder motion in the operatively treated shoulder compared with the contralateral shoulder at seven years. This is in contrast to the study by Shaffer et al.¹⁰, who reported that 50% of the patients who had been treated nonoperatively for adhesive capsulitis continued to have mild pain or stiffness seven years after the initial symptoms and to have, on the average, limited shoulder motion compared with the contralateral shoulder and study-generated controls.

Potential complications of this arthroscopic capsular release include axillary nerve injury, infection, and iatrogenic chondral injury from the insertion of the arthroscope³⁵. In the present study, these complications were not observed. No patient had iatrogenic arthritis, and only one patient had arthritis in the involved shoulder, but that patient also had arthritis in other joints.

It is difficult to determine if the long-term outcomes after capsular release are better than the results after manipulation with the patient under anesthesia. Farrell et al.¹⁸, who examined eighteen patients after they had had manipulation under anesthesia for idiopathic adhesive capsulitis, reported significant improvements in the range of motion in >90% of patients, with 85% of patients without pain at an average of fifteen years

(range, 8.1 to 20.6 years) after treatment. Weber et al.³⁶ also showed that 73% of patients showed a perfect recovery 4.7 years after they had manipulation under anesthesia for adhesive capsulitis, which is consistent with our results.

In a study with an average follow-up period of 13.5 months, Segmüller et al.³⁷ conducted a patient satisfaction survey in relation to the overall satisfaction with arthroscopic capsular release among twenty-four patients. A total of 88% of the patients were very satisfied with the procedure. We used a similar visual scale when we asked the patients to evaluate the impact that an arthroscopic capsular release had had on their life at the time of the long-term follow-up evaluation, and most patients (85%) reported their outcome as "good or excellent."

The strengths of our study are the relatively long follow-up period, the precise inclusion and exclusion criteria for idiopathic adhesive capsulitis, the fact that both patient-reported and examiner-reported data had been regularly collected during the treatment process, and that a single surgeon with extensive experience in arthroscopic shoulder surgery performed all of the procedures. However, this may also imply that the results of this study cannot necessarily be extended to other forms of painful, stiff shoulders or to other surgeons. Weaknesses of the study include an absence of a control group, and the fact that the examiner, while independent, was not blinded with respect to the nature of the index procedure. In addition, a substantial number of the originally treated patients were not available for the final study evaluation. It is possible that the improvements noted by the examiners and the patients between the evaluation at one year and that at a mean of seven

years may represent a perception on the part of the patients and the examiners.

In conclusion, this study shows that, after five to thirteen years, patients with an arthroscopic capsular release for idiopathic adhesive capsulitis had a continued, complication-free, significant improvement, with restoration of overall shoulder function, relief of shoulder stiffness, and relief of difficulty in reaching behind the back and above the head. There was continued significant relief in the severity and frequency of shoulder pain with activity, at rest, and when trying to sleep. Shoulder motion was comparable with that of the contralateral shoulder.

Appendix

eA Figures showing patient-determined scores for shoulder pain at rest, with activities, and when trying to sleep; shoulder stiffness severity; difficulty with overhead activities; difficulty reaching behind the back; level of activity at work; highest level of sport played, before and after capsular release; as well as examiner-determined shoulder abduction are available with the electronic version of this article as a data supplement at jbjs.org. ■

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CLINICAL PRACTICE 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

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Recommendations

PATHOANATOMICAL FEATURES: Clinicians should assess for impairments in the capsuloligamentous complex and musculo-tendinous structures surrounding the shoulder complex when a patient presents with shoulder pain and mobility deficits (adhesive capsulitis). The loss of passive motion in multiple planes, particularly external rotation with the arm at the side and in varying degrees of shoulder abduction, is a significant finding that can be used to guide treatment planning. (Recommendation based on theoretical/foundational 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 40 to 65 years of age, female, and have had a previous episode of adhesive capsulitis in the contralateral arm. (Recommendation based on moderate evidence.)

CLINICAL COURSE: Clinicians should recognize that adhesive capsulitis occurs as a continuum of pathology characterized by a staged progression of pain and mobility deficits and that, at 12 to 18 months, mild to moderate mobility deficits and pain may persist, though 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 these guidelines 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 these guidelines, 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 (DASH), the American

Shoulder and Elbow Surgeons shoulder scale (ASES), or the Shoulder Pain and Disability Index (SPADI). 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, active shoulder range of motion (ROM), and passive shoulder ROM to assess the key impairments of body function and body structures in patients with adhesive capsulitis. Glenohumeral joint accessory motion may be assessed to determine translational glide loss. (Recommendation based on theoretical/foundational evidence.)

INTERVENTION – CORTICOSTEROID INJECTIONS: Intra-articular 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. (Recommendation based on strong evidence.)

INTERVENTION – PATIENT EDUCATION: Clinicians should utilize patient education that (1) describes the natural course of the disease, (2) promotes activity modification to encourage functional, pain-free ROM, and (3) matches the intensity of stretching to the patient's current level of irritability. (Recommendation based on moderate evidence.)

INTERVENTION – MODALITIES: Clinicians may utilize short-wave diathermy, ultrasound, or electrical stimulation combined with mobility and stretching exercises to reduce pain and improve shoulder ROM in patients with adhesive capsulitis. (Recommendation based on weak evidence.)

INTERVENTION – JOINT MOBILIZATION: Clinicians may utilize joint mobilization procedures primarily directed to the glenohumeral joint to reduce pain and increase motion and function in patients with adhesive capsulitis. (Recommendation based on weak evidence.)

Recommendations *(continued)*

INTERVENTION – TRANSLATIONAL MANIPULATION: Clinicians may utilize translational manipulation under anesthesia directed to the glenohumeral joint in patients with adhesive capsulitis who are not responding to conservative interventions. (Recommendation based on weak evidence.)

INTERVENTION – 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 GUIDELINES

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).¹³⁷

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 internation-

ally 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

These guidelines are 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 of identifying 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 on 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 Related Health Problems (ICD)¹³⁶ 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 these guidelines independently performed a systematic search of 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. These guidelines were issued in 2013, based on publications in the scientific literature prior to September 2011. These guidelines will be considered for review in 2017, or sooner if new evidence becomes available. Any updates to these guidelines 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 were graded according to criteria described by the Centre for Evidence-Based Medicine, Oxford, UK (<http://www.cebm.net>) for diagnostic, prospective, and therapeutic studies.¹⁰⁰ An abbreviated version of the grading system is provided as follows.

I	Evidence obtained from high-quality diagnostic studies, prospective studies, or randomized controlled trials
II	Evidence obtained from lesser-quality diagnostic studies, prospective studies, or randomized controlled trials (eg, weaker diagnostic criteria and reference standards, improper randomization, no blinding, less than 80% follow-up)
III	Case-controlled studies or retrospective studies
IV	Case series
V	Expert opinion

GRADES OF EVIDENCE

The overall strength of the evidence supporting recommendations made in these guidelines was graded according to guidelines described by Guyatt et al,⁴⁸ as modified by MacDermid et al⁷³ 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.

GRADES OF RECOMMENDATION BASED ON		STRENGTH OF EVIDENCE
A	Strong evidence	A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study
B	Moderate evidence	A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation
C	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
D	Conflicting evidence	Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies
E	Theoretical/foundational evidence	A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic science/bench research supports this conclusion
F	Expert opinion	Best practice based on the clinical experience of the guidelines development team

Methods (*continued*)

REVIEW PROCESS

The Orthopaedic Section, APTA also selected consultants from the following areas to serve as reviewers of the early drafts of these clinical practice guidelines:

- 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

Comments from these reviewers were utilized by the authors to edit these clinical practice guidelines prior to submitting them for publication to the *Journal of Orthopaedic & Sports Physical Therapy*.

CLASSIFICATION

The terms *adhesive capsulitis*, *frozen shoulder*, and *periarthritis* have been used for patients with shoulder pain and mobility deficits. Adhesive capsulitis will be used in these guidelines 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 vas-

cular 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 United States, is **726.0**.

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 and fasciae 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**, and **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 dwelling and furnishings**, **d6600 assisting others with self-care**, and **d9201 sports**.

CLINICAL GUIDELINES

Impairment/Function-Based Diagnosis

PREVALENCE

The prevalence of shoulder pain has been reported to be between 2.4% and 26%.^{25,69} Primary adhesive capsulitis is reported to affect 2% to 5.3% of the general population.^{5,17,71,97} The prevalence of secondary adhesive capsulitis related to diabetes mellitus and thyroid disease is reported to be between 4.3% and 38%.^{5,7,17,71,97} Milgrom et al⁷⁷ compared 126 patients (76 women; mean $\pm$ SD age, 55.0 $\pm$ 8.4 years; 50 men; mean $\pm$ SD age, 54.7 $\pm$ 8.7 years) with idiopathic adhesive capsulitis to prevalence data and found a significantly higher prevalence of diabetes among both women (23.7% versus 4.7%) and men (38.0% versus 6.5%) with adhesive capsulitis as compared to the age-matched population. The type of diabetes, type 1 or 2, was not identified. A significantly higher prevalence of hypothyroidism among women (21.1% versus 7.9%) with idiopathic adhesive capsulitis was found compared to the age-matched regional population.⁷⁷

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 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 and 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 around the glenohumeral joint.^{28,99}

II Cadaver studies demonstrate the restricting influence of the subscapularis and selected capsuloligamentous complex portions.^{95,125} The proximal portion of the capsuloligamentous complex and the subscapularis were found to limit external rotation when the glenohumeral joint was positioned up to 45° of abduction. Turkel et al¹²⁵ found that the subscapularis limited external rotation the most with the arm at 0° of abduction. It has been suggested that a greater loss of external rotation at 45° versus 90° of abduction indicates subscapularis restriction.⁴⁴

II The rotator cuff interval forms a triangular-shaped tissue bridge between the anterior supraspinatus tendon edge and the 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 an anterior limb but also a posterior limb containing the previously unrecognized posterosuperior glenohumeral ligament.¹⁰³

IV Adhesive capsulitis is marked by the presence of multiregional synovitis, consistent with inflammation,^{50,83,84,88,133} yet focal vascularity and synovial angiogenesis (increased capillary growth) rather than synovitis are described by others.^{20,55,134,135} 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 of the synovial pathology being 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.^{55,82,83,92,94,96,126,127,134} 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 adhesive capsulitis resulted in a dramatic increase in shoulder external rotation motion.^{50,82,92,94,96} Others have noted significant subacromial scarring,^{55,85} loss of the subscapular recess,^{71,86} inflammation of the long head of the biceps tendon and its synovial sheath,¹³³ and musculotendinous contracture.⁸⁵

E 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 (adhesive capsulitis). The loss of passive motion in multiple planes, particularly external rotation with the arm at the side and in varying degrees of shoulder abduction, is a significant finding that can be used to guide treatment planning.

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 as causing or resulting in a sustained intense and protracted inflammatory/fibrotic response affecting the synovial lining and capsuloligamentous complex in patients with adhesive capsulitis.^{21,54,113} To date, the relationship between cytokines and the causative factor, whether it is insidious or related to minor trauma, is unknown.

III Individuals with type 1 or 2 diabetes mellitus have a greater propensity of developing adhesive capsulitis.^{7,20,77,78,97} Patients with Dupuytren's disease or type 1 diabetes mellitus for 10 or more years have a greater incidence of primary adhesive capsulitis.^{5,7,20}

II Milgrom et al,⁷⁷ in a prospective study, identified risk factors associated with idiopathic adhesive capsulitis by comparing the prevalence of diabetes in new cases ($n = 126$) to age-matched controls over a 2.5-year period. Of the 126 new cases, 29.3% had diabetes mellitus. Patients with adhesive capsulitis had a higher rate of diabetes mellitus compared to an age-matched population, as indicated by the risk ratios of 5.9 (95% confidence interval [CI]: 4.1, 8.4) in men and 5.0 (95% CI: 3.3, 7.5) in women. Balci et al⁷ evaluated patients with type 2 diabetes mellitus ($n = 297$; 60% female) to determine the presence of adhesive capsulitis and other conditions. They found that 29% (men, 33.6%; women, 25.9%) had adhesive capsulitis, as defined by having at least 1 month of shoulder pain, an inability to lie on the affected side, and restricted active and passive shoulder motion in 3 or more planes. Additionally, they found a significant relationship between adhesive capsulitis and Dupuytren's contracture. Adhesive capsulitis was associated with age (mean $\pm$ SD, 59.23 ± 8.24 years) and the duration of diabetes. Aydeniz et al⁵ compared 102 patients (mean $\pm$ SD age, 58.0 ± 9.1 years) with type 2 diabetes mellitus to an age- and sex-matched control group and found that 14.7% had adhesive capsulitis, compared to 3.9% of the controls. The incidence of 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 (ie, Dupuytren's contracture, trigger finger).

II Thyroid disease is a risk factor associated with adhesive capsulitis. Milgrom et al⁷⁷ reported that 13.4% of patients with adhesive capsulitis had thyroid dysfunction. The majority of the patients with thyroid disease who developed adhesive capsulitis were women (16 of 17). Milgrom et al⁷⁷ reported an increased prevalence of thyroid dysfunction in patients with adhesive capsulitis compared to an age-matched regional population, as demonstrated by risk ratios of 7.3 (95% CI: 4.8, 11.1) in women and 2.6 (95% CI: 0.4, 17.0) in men.

II Cakir et al²² performed physical examinations on 137 patients (111 females, 26 males) with hyperthyroidism or 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.²²

II Age can be considered a risk factor because adhesive capsulitis more commonly occurs in individuals between 40 and 65 years of age, with the reported peak incidence occurring, on average, between 51 and 55.^{71,84,87,89,97} Females appear to be affected more commonly than males.^{5,12,50,71,77,120} However, a greater proportion of males (33.6%) than females (25.9%) had adhesive capsulitis in an identified group of patients with diabetes mellitus.⁷ Having adhesive capsulitis on 1 side places an individual at risk (5%-34%) for opposite-arm involvement in the future, and adhesive capsulitis can occur bilaterally simultaneously up to 14% of the time.^{18,45,71,119}

IV Other associated risk factors include prolonged immobilization, myocardial infarction, trauma, and autoimmune disease.^{16,18,104,111,140}

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 40 to 65 years of age, female, and have had a previous episode of adhesive capsulitis in the contralateral arm.

CLINICAL COURSE

Four stages of adhesive capsulitis, reflecting a continuum, have been described.^{50,83,89} Stage 1 may last up to 3 months, and during this stage patients describe sharp pain at end ranges of motion, achy pain at rest, and sleep disturbance. During this stage, arthroscopic examination reveals diffuse synovial reaction without adhesions or contracture.^{50,83,89} Subacromial shoulder impingement is often the suspected clinical diagnosis early in this stage because there are minimal to no ROM restrictions.^{83,89} Early loss of external rota-

tion motion with an intact rotator cuff is a hallmark sign of adhesive capsulitis and may be seen in this stage.^{37,83} Stage 2, known as the “painful” or “freezing” stage, presents with a gradual loss of motion in all directions due to pain and can last from 3 to 9 months. Arthroscopic examination reveals aggressive synovitis/angiogenesis and some loss of motion under anesthesia.^{50,83,89} Stage 3, known as the “frozen” stage, is characterized by pain and loss of motion and lasts from 9 to 15 months. In stage 3, the synovitis/angiogenesis lessens but the progressive capsuloligamentous fibrosis results in loss of the axillary fold and ROM when tested under anesthesia.^{50,83,89} Stage 4, known as the “thawing” stage, is characterized by pain that begins to resolve, but significant stiffness persists from 15 to 24 months after onsets of symptoms.^{50,89,90} This stage often progresses to pain resolution, but motion restrictions may persist that are unchanged even when examined under anesthesia. Arthroscopy reveals capsuloligamentous complex fibrosis and receding synovial involvement.^{83,89} Although adhesive capsulitis was initially considered a 12- to 18-month self-limited process, mild symptoms may persist for years, depending on the extent of fibroplasia and subsequent resorption.^{11,19,30,31,45,119} Patients with diabetes mellitus may have a protracted recovery and worse outcomes.⁴⁵

II Binder et al¹¹ performed a prospective study (n = 40) on patients with adhesive capsulitis. Patients were classified as having adhesive capsulitis if they had shoulder pain for at least 1 month, sleep disturbance due to pain, an inability to lie on the affected shoulder, restriction in all active and passive shoulder movements, and at least a 50% reduction in external rotation motion. The investigators did not state whether the 50% loss of external rotation was compared to established norms or compared to the uninjured extremity. The authors noted that at 6 months and at a minimum of 3 years after the diagnosis, 90% and 40% of the patients, respectively, had not regained normal 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 al⁴⁵ assessed 75 patients who fit the criteria for stage 2 adhesive capsulitis. In addition, the patients had a history of no or only trivial shoulder trauma; loss of active and passive shoulder ROM (more than a 50% loss of external rotation), especially with the shoulder abducted at 90°; pain at the extremes of all shoulder motions; globally limited glenohumeral joint translation; and normal glenohumeral joint radiographic findings. The investigators found that 27% of these 75 patients continued to have mild pain with activity and that 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 an average $\pm$ SD score of 9.7 ± 13.6 points on the DASH questionnaire (range of score from 0 to 100, with 0 representing no disability). However, ROM did not correlate with patient-rated outcome scores on the simple shoulder test (SST) and the 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 were eventually treated with manipulation under anesthesia and/or capsular release. A history of prior rehabilitation and workers' compensation or pending litigation was associated with being treated with manipulation and/or capsular release.

IV Shaffer et al¹¹⁹ retrospectively examined patients with adhesive capsulitis (n = 62) who were treated conservatively. The criteria for inclusion were a minimum of 1 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. In an average of 6 months, pain resolved and motion returned to normal or within 10° to 15° of normal. At an average of a 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 deficits.

IV Levine et al⁶⁸ performed a retrospective review of 98 patients (105 shoulders) with the diagnosis of idiopathic adhesive capsulitis. The criteria for inclusion were diagnosis of adhesive capsulitis and treatment by 1 of 4 shoulder surgeons. The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), the ASES, and the SST were used as patient-rated outcome measures, and ROM as the impairment measure. The average duration of treatment was 4.7 months, and 18.1% of the patients had diabetes mellitus. Symptoms resolved in 89.5% of the patients who were managed with physical therapy, nonsteroidal anti-inflammatory drugs, intra-articular corticosteroid injections, or some combination of the 3. 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 ROM both initially and preoperatively. Therefore, those who required surgery had less shoulder ROM at the time of diagnosis, and their ROM continued to decrease during the course of nonoperative treatment.

C Clinicians should recognize that adhesive capsulitis occurs as a continuum of pathology characterized by a staged progression of pain and mobility defi-

cits and that, at 12 to 18 months, mild to moderate mobility deficits and pain may persist, though many patients report minimal to no disability.

DIAGNOSIS/CLASSIFICATION

Diagnosis

V 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 ranges of movements. Patients also present with painful and restricted active and passive ROM in both elevation and rotation that occurs for at least 1 month and has either reached a plateau or worsened.¹¹ Functional activities such as reaching overhead, behind the back, or out to the side become increasingly difficult due to pain and/or stiffness.

III The primary purpose for diagnosis/classification of shoulder pain is to direct intervention and inform prognosis. Traditionally, a patho-anatomic model has been used to identify the symptomatic tissue(s) and distinguish among various pathologies. A proposed classification scheme¹⁴⁰ suggests that 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 3 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 with a cerebral vascular accident, intrathoracic conditions (eg, myocardial infarction and chronic obstructive pulmonary disease), intra-abdominal conditions (eg, chronic liver disease), 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 tendinopathy, biceps tendinopathy, calcific tendinitis, acromioclavicular or glenohumeral joint arthropathy, or proximal humeral or scapular fracture.¹⁴⁰ Loss of shoulder ROM and pain that is associated with postoperative stiffness should not be considered adhesive capsulitis. These categorizations present a theoretical framework; however, there is a lack of evidence with regard to their ability to drive treatment decision making and to prognosticate outcome.

Classification

V Patients with adhesive capsulitis present with a number of impairments, but most characteristically have a global loss of both active and passive shoulder ROM.⁵⁰ Generally, ROM loss of greater than 25% in at least 2 planes and passive external rotation loss that is greater than 50% of the uninvolved shoulder or less than 30° of external rotation have been used to define adhesive capsulitis.^{12,19,20,23,37,45,61,82,85,106,110,119,131,132} The capsular pattern described by Cyriax,³⁷ where external rotation motion loss is proportionally greater than loss of abduction, which is more limited than internal rotation, is not consistently found when objective measurements are taken. Rundquist et al¹¹⁶ found varying patterns of restriction in patients with adhesive capsulitis, but the most common pattern was a loss of external rotation with the arm at the side followed by a loss of abduction and internal rotation. A consistent finding was a greater loss of internal rotation versus external rotation when the arm was positioned as close as possible to 90° of frontal plane abduction.¹¹⁶ Cyriax³⁷ 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 strength with isometric testing,^{58,66,121} specifically weakness of the internal rotators,^{58,66} elevators,^{66,121} and external rotators. Special tests, such as impingement signs and the Jobe 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.

V A medical diagnosis of adhesive capsulitis may be helpful in describing the tissue pathology, but it 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, the current guidelines include a proposed model for diagnosis, examination, and treatment 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 and mobility deficits

This model is depicted in the **FIGURE**.

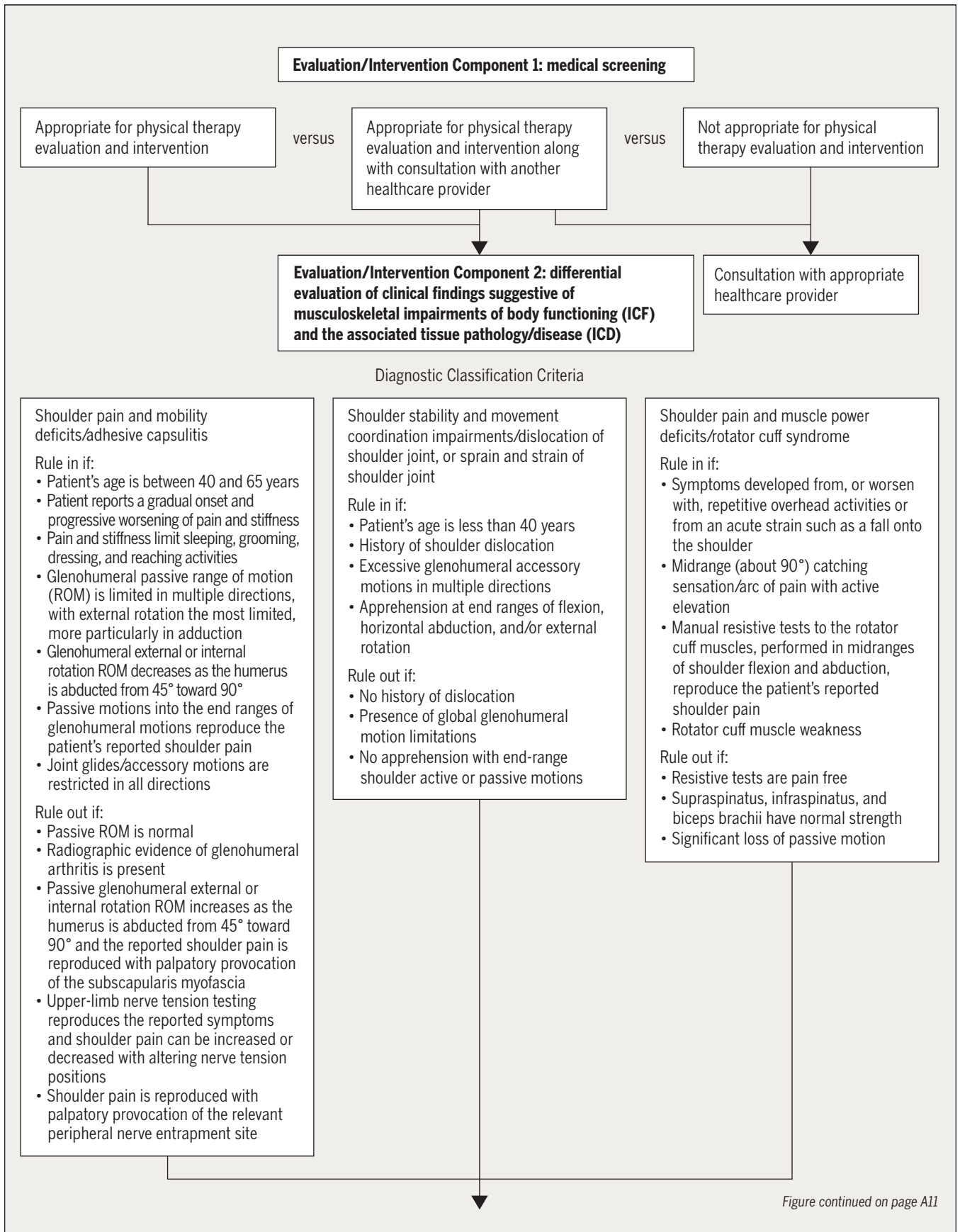


Figure continued on page A11

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 ROM is significantly less than passive ROM due to pain

versus

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 ROM similar to passive ROM

versus

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 ROM same as passive ROM

Evaluation/Intervention Component 4: intervention strategies for shoulder pain and 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
- Mobility 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 posttreatment tissue inflammation and associated pain
- Stretching exercises:
- Gentle to moderate stretching exercises, progressing the intensity and duration of the stretches into tissue resistance without producing posttreatment tissue inflammation and associated pain
- Neuromuscular re-education:
- 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
- Stretching exercises:
- Stretching exercises, progressing the duration of the stretches into tissue resistance without producing posttreatment tissue inflammation and associated pain
- Neuromuscular re-education:
- 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 incorporates the findings of the history and physical examination to determine whether the patient's

symptoms originate from a more serious pathology, such as a tumor or infection, rather than from a common shoulder musculoskeletal disorder.^{80,139} In addition to serious medi-

cal conditions, clinicians should screen for the presence of psychosocial issues that may affect prognostication and treatment decision making for rehabilitation. For example, elevated scores on the Tampa Scale of Kinesiophobia or the Fear-Avoidance Beliefs Questionnaire have been associated with a longer recovery, chronic symptoms, and work loss in patients with shoulder pain.^{42,59,79} Accordingly, 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 patient's reported activity limitations and medical diagnosis. Clusters of these clinical findings, which commonly coexist in patients, are described as impairment patterns in the physical therapy literature¹ 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, which in turn improves the movement and function of the patient and lessens or alleviates the activity limitations commonly reported by the patients who 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 the **FIGURE**. 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 1 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 re-evaluation 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 physical status and the extent of inflammatory activity that is present. Three levels of irritability

are operationally defined in the **FIGURE**. The primary clinical finding that determines the level of tissue irritability is the relation between pain and active and passive movements. Other clinical findings that characterize the level of tissue irritability are pain level, frequency of pain, and 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 level of irritability.⁶⁰ Patients with a high level of tissue irritability are not ready for significant physical stress being applied to the affected tissues, and therefore the treatment should emphasize activity modification and appropriate modalities, medication, and manual therapy to relieve pain and inflammation. In addition, only low levels of glenohumeral exercises should be performed while encouraging motion at adjacent regions. Patients with a moderate level of irritability should be able to tolerate controlled physical stress in the form of progressive manual therapy, mild stretching, and strengthening activities. They should also be able to perform basic functional activities. In comparison, patients with low irritability should be able to tolerate progressive physical stress in the form of stretching, manual therapy, resistive exercise, and higher-demand physical activities.

F 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 these guidelines 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 the Diagnosis/Classification section of these clinical guidelines—adhesive capsulitis; sprain and strain of shoulder joint/dislocation; and rotator cuff syndrome/tendinopathy of the supraspinatus, infraspinatus, and biceps brachii—the following conditions, using ICD-10 terminology,¹³⁶ should be considered in the differential diagnosis when a patient presents with shoulder pain:

- Acute calcific tendonitis/bursitis
- Arthrosis of the shoulder, primary
- Arthrosis of the shoulder, secondary
- Bursitis of the shoulder

- Cervicalgia
- Cervical disc disorders
- Cervicobrachial syndrome
- Contusion of shoulder and upper arm
- Diseases of the digestive system
- Fibromyalgia
- Fracture of clavicle
- Fracture of scapula
- Fracture of shaft of humerus
- Fracture of upper end of humerus
- 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
- Osteoarthritis of the acromioclavicular joint
- Osteoarthritis of the cervical spine
- Osteoarthritis of the glenohumeral joint
- Osteoporosis with pathological fracture
- Pain in thoracic spine
- Persistent somatoform pain disorder
- Psychological and behavioral factors associated with disorders or diseases
- Pyogenic arthritis
- Radiculopathy
- Rheumatoid arthritis
- Somatoform autonomic dysfunction
- Sprain and strain of acromioclavicular joint
- Sprain and strain of sternoclavicular joint

F 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 these guidelines, 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 typically normal with adhesive capsulitis but can identify osseous abnormalities, such as glenohumeral osteoarthritis. Arthrographic findings associated with adhesive capsulitis include a joint capsule capacity of less than 10 to 12 mL and variable filling of the axillary and subscapular recess.^{71,86,105}

Magnetic resonance imaging (MRI) may help with the differential diagnosis by identifying soft tissue and bony abnormalities.^{9,128} MRI has identified abnormalities of the capsule and rotator cuff interval in patients with adhesive capsulitis.^{33,41,75} Mengiardi et al⁷⁵ performed magnetic resonance arthrograms on 122 patients who were treated with arthroscopic capsular release and compared the findings with those of an age- and sex-matched control group; findings included a thickened coracohumeral ligament and joint capsule in the rotator cuff interval and 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 have been observed in patients with adhesive capsulitis.^{33,41}

A recent study⁶⁴ 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. Homsí et al⁵² performed ultrasound examinations of the coracohumeral ligament on 306 individuals with painful shoulders, 121 asymptomatic shoulders, and 17 shoulders with arthrographic evidence of adhesive capsulitis. The average thickness of the coracohumeral ligament was 3 mm in the adhesive capsulitis group, 1.34 mm in the asymptomatic group, and 1.39 mm in the non-adhesive capsulitis painful-shoulder group. Coracohumeral ligament thickness was significantly greater ($P = .0001$) in the adhesive capsulitis group compared to the asymptomatic group and the non-adhesive capsulitis painful-shoulder group.

CLINICAL GUIDELINES

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,³⁴ the DASH,⁵³ the SPADI,^{14,112} and the ASES.¹⁰⁷

The Constant score is the most widely used scale in Europe. It has 2 sections, a patient self-report section and a clinician-report section, and scores can range from 0 to 100, with 100 indicating maximum use of the shoulder. The self-report section contains a single pain question (15 points) and 4 questions assessing work, sport, sleep, and position of arm use (20 points), for a maximum total of 35 points. Measurement properties of the Constant score self-report section have been investigated.^{15,32,34} However, because there are only 4 items to assess patient-rated function, it is not clear if the Constant score items comprehensively represent the construct of shoulder use, and therefore this outcome measure is not recommended for use.

Two recent systematic reviews^{15,115} indicated that the ASES, DASH, SPADI, and SST have been the most studied shoulder outcome tools for psychometric properties. The ASES, DASH, and SPADI have demonstrated acceptable psychometric properties, whereas the SST has only limited or no evidence as to the error in the measure and clinically meaningful change. Therefore, the ASES, DASH, and SPADI are recommended for clinical use.^{15,115}

The ASES is a patient self-report scale that has a range of scores from 0 to 100, with 100 indicating maximum shoulder use, consisting of 50 points maximum for pain (1 question) and 50 points maximum for activities/participation questions (10 questions). Studies of the ASES indicate adequate measurement properties.^{15,35,62,76,115,122} The minimal detectable change (MDC), the change in scores that is considered greater than measurement error at the 90% confidence level, for the ASES has been reported to be 9.4 points, and the minimal clinically important difference has been reported to be 6.4 points.^{76,115}

The DASH is a 30-question patient self-report questionnaire. The scores range from 0 to 100, with 0 indicating no disability. The measurement properties of the DASH have been extensively investigated.^{2,8,15,43,47,53,72,118} The MDC has been reported to be between 6.6 and 12.2 points (weighted average, 10.5 points),^{8,43,118} and the minimal clinically important difference has been reported to be 10.2 points.^{115,118}

The SPADI¹¹² is a 13-item patient self-report 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 to 100, with 0 indicating no pain or difficulty. Studies of the SPADI have indicated adequate measurement properties.^{15,115} The MDC at the 90% confidence level has been reported to be 18.1,¹¹⁸ the MDC at the 95% confidence level has been reported to be 18.0,³ and the minimal clinically important difference has been reported to be 8.0⁹⁸ and 13.1¹¹⁵ points. Most recently, Staples et al¹²³ concluded that the SPADI had superior responsiveness when compared to the DASH in patients with adhesive capsulitis.

A

Clinicians should use validated functional outcome measures, such as the DASH, the ASES, or the SPADI. 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 for the patient 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

F

Clinicians should utilize easily reproducible activity limitation and participation restriction measures associated with their patients' 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 ROM

- ICF category: measurement of impairment of body function: mobility of a single joint
- Description: the amount of active or passive ROM of the glenohumeral joint as measured with a standard goniometer. Motion can be performed supine or in the upright position

Measurement Methods

Glenohumeral External Rotation in Adduction

To measure external rotation ROM with the shoulder adducted, the patient is positioned in supine with the upper arm comfortably by the side and the elbow flexed to 90°. 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 vertical position. The movable arm is aligned with the ulnar styloid process. Alternatively, the patient can be asked to actively externally rotate the shoulder 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 is similar to what is used with the adducted position.

Glenohumeral Internal Rotation in Abduction

Internal rotation ROM is measured with the patient positioned in supine, the shoulder abducted to 90°, and the elbow flexed to 90°. If glenohumeral abduction is less than 90°, a 45° abduction angle can be used. 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 vertical position. The movable arm is aligned with the ulnar

styloid process. Alternatively, the patient can be asked to actively internally rotate the shoulder to end range.

Shoulder Flexion

To measure flexion ROM, the patient is positioned in supine with the arm comfortably by the side. The examiner passively flexes the shoulder until end range is reached (with no compensatory movements from the thorax and the lumbar spine). ROM is measured by placing the axis of the goniometer on the greater tuberosity. The stationary arm is aligned with the midline of the trunk. The movable arm is aligned with the lateral epicondyle. Alternatively, the patient can be asked to actively flex the shoulder to end range.

Shoulder Abduction

To measure abduction ROM, the patient is positioned in supine with the arm comfortably by the side. The examiner passively abducts the shoulder until end range is reached (shoulder must remain 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 movable arm is aligned with the midshaft of the humerus. Alternatively, the patient can be asked to actively abduct the shoulder 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 ranging from 0.80 to 0.99.¹⁰⁸ Specifically, measures of passive shoulder external rotation ROM in patients with adhesive capsulitis have yielded intraclass correlation coefficients ranging from 0.98 to 0.99 (95% CI: 0.95, 0.99).⁵⁷

E Clinicians should measure pain, active shoulder ROM, and passive shoulder ROM to assess the key impairments of body function and body structures in patients with adhesive capsulitis. Glenohumeral joint accessory motion may be assessed to determine translational glide loss.

CLINICAL GUIDELINES

Interventions

Multiple interventions have been described for the treatment of adhesive capsulitis, and there is emerging evidence from high-quality randomized clinical trials regarding both short- and long-term efficacy of these interventions. Successful treatment does not require the patient to achieve full ROM. Instead, a successful outcome may be defined as a significant reduction of pain, improved function, and high levels of patient satisfaction.⁶⁰ These are often the short-term outcomes of conservative treatment. A successful long-term outcome could be defined as a continual improvement in shoulder motion and improved function over months as tissue remodels from thickened fibrotic tissue to more normal collagen tissue. In contrast, patients who present with shoulder pain and mobility deficits but have a relatively immediate significant return of motion and reduced symptoms after receiving corticosteroid injections, soft tissue or joint mobilization, and/or mobility or stretching exercises likely did not have adhesive capsulitis. Therefore, at times, the response to treatment helps determine the diagnosis.

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 intra-articular 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. The following studies implicate pain and muscle guarding, as opposed to fibrosis or adhesions, as the initial barrier to joint motion because the results of all studies demonstrate significant improvements in motion immediately following steroid injections.

I Carette et al²³ performed a randomized controlled prospective study of 93 patients with adhesive capsulitis. Patients were classified as having adhesive capsulitis and included in this study if they had symptoms for more than 1 year, shoulder pain with limitation of both active and passive movements of the glenohumeral joint of more than 25% in at least 2 directions compared to the contralateral shoulder, and a total score of more than 30 on the SPADI. This study compared 4 different interventions. Group 1 was treated with a fluoroscopy-guided glenohumeral joint intra-articular corticosteroid injection. Group 2 received a combination of the fluoroscopy-guided glenohumeral joint intra-articular corticosteroid injection and

supervised physical therapy. Group 3 received a fluoroscopy-guided glenohumeral joint intra-articular saline injection and supervised physical therapy. Group 4, the placebo group, had only a saline injection. 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 using ROM, the SPADI, and the SF-36 as outcome measures. Supervised physical therapy consisted of 12 one-hour sessions over a 4-week period. The interventions were based on whether the patient was in a 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 mobilizations, and active ROM exercises. Those in the chronic group were treated with therapeutic ultrasound, high-grade joint mobilizations, active and active assisted ROM exercises, as well as isometric exercises. At 6 weeks, the corticosteroid injection/physical therapy group demonstrated the largest change in the SPADI score; however, the scores were not statistically different from the corticosteroid injection-only group. Moreover, both corticosteroid injection groups improved significantly more than the 2 noncorticosteroid injection groups. At 6 months, the SPADI scores were similar among all 4 groups; however, active and passive ROM were better in the corticosteroid injection/physical therapy group. There were no differences in outcomes among the 4 groups at 12 months. This study concluded that at 6 weeks, intra-articular injection alone or with supervised therapy is more effective than 12 sessions of supervised physical therapy or a HEP. Although this study was well controlled, the placebo group (intra-articular saline injection and a HEP) is considered by others to be an effective treatment for adhesive capsulitis.^{19,61}

I Ryans et al¹¹⁷ also investigated the effect of steroid injections and physiotherapy, performing both glenohumeral joint intra-articular and subacromial injections. Patients were classified as having adhesive capsulitis and included in this study if they had a painful shoulder in the fifth cervical nerve root dermatome distribution of more than 4 weeks and less than 6 months in duration, and a limitation of active and passive range of movement greater than 25% in abduction and external rotation compared to the uninvolved, contralateral shoulder. Patients (n = 80) were assessed in a randomized, blinded, placebo-controlled study, and randomly assigned to 4 groups as per the study by Carette et al,²³ except that in this study they did

not use fluoroscopy-guided injections, and only 8 sessions of physiotherapy over a 4-week period were delivered. The physiotherapy program included proprioceptive neuromuscular facilitation, mobilization, interferential electrical stimulation, and exercise. The Shoulder Disability Questionnaire (SDQ), a 16-item functional disability questionnaire; active and passive ROM; 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 the placebo group can be considered the HEP group. At 6 weeks, the 2 injection groups significantly improved in the SDQ compared to the other 2 groups; however, patients treated in supervised physiotherapy gained significantly more external rotation motion. All groups significantly improved by 16 weeks, and no difference was noted among groups. A limitation of 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/HEP group. The authors recommended the use of intra-articular and subacromial corticosteroid injections to provide short-term improvements (6 weeks) for relieving shoulder disability and physiotherapy for improving external rotation ROM.

II Bulgen et al¹⁹ compared 4 intervention groups: paired intra-articular and subacromial injections, joint mobilization, ice/proprioceptive neuromuscular facilitation, and no treatment (pendulum exercise performed at home) in a prospective randomized study of 41 patients. Criteria for inclusion 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 ROM of at least 50%. Pain, using a VAS, and shoulder ROM were used for outcome measures. Pain was significantly reduced and ROM was significantly improved by the fourth week of treatment for all groups, and improvement continued until 6 months. Improvement was greatest in the injection group, reaching statistical significance for improved motion, but not pain, at 4 weeks. No significant differences in outcomes were seen among the groups at 6 months. The study concluded that there is little long-term advantage of one treatment over the other; however, steroid injections improve ROM and, to a lesser extent, pain in the first 4 weeks.

II van der Windt et al¹²⁹ compared intra-articular injections (average of 2.2 per patient) to physical therapy in a prospective randomized controlled trial on 109 patients with a stiff, painful shoulder (capsular syndrome). The inclusion criterion for this study was painful, restricted glenohumeral passive mobility. In this study population, external rotation was more limited than abduction and internal rotation. Physical therapy consisted of twelve

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 on symptom severity. Outcome assessment included the SDQ, a VAS for pain, and ROM. At 7 weeks, 77% of the patients treated with injections were considered treatment "successes," compared to only 46% of those treated with physical therapy. Treatment success was based on the patient's self-rating of having made complete recovery or much improvement. Statistically significant differences between groups were found in nearly all outcome measures. At 26 and 52 weeks, there were no differences noted between the 2 groups for any of the outcome measures.

II Arslan and Çeliker⁴ randomly allocated 20 patients with adhesive capsulitis to receive either an intra-articular glenohumeral joint steroid injection or a combination of physical therapy and a nonsteroidal anti-inflammatory drug. Patients were classified with adhesive capsulitis and included in the study if they had less than 50% of normal motion. Physical therapy consisted of hot packs, ultrasound (3.5 W/cm² for 5 minutes), passive glenohumeral stretching exercises, and wall climb. The mean duration of physical therapy was 2 weeks, and both groups performed a HEP. ROM and pain outcome measures revealed similar improvements in both groups at 2 weeks and 12 weeks. The authors concluded that steroid injections alone were as effective as physical therapy for improving ROM and reducing pain.

II de Jong et al³⁸ 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. Patients were classified with adhesive capsulitis and included in the study if they had a spontaneous onset of shoulder pain or the shoulder pain was caused by a minor trauma; restriction of passive ROM of the glenohumeral joint, described as a 45° or more reduction of external rotation; and disruption of sleep while lying on the affected shoulder. Thirty-two patients were given the low-dose injection, whereas 25 received the high-dose injection. Three injections were given at weekly intervals, with no concurrent intervention used. Outcomes included a pain VAS, passive ROM, disturbances of sleep, and functional shoulder and arm ability measured using a 4-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. While this study did not provide information that steroid injections were more efficacious than other interventions, it demonstrated that higher-dose

corticosteroids (40 mg compared to 10 mg) had greater effect on relieving symptoms related to adhesive capsulitis.

I Jacobs et al⁵⁶ randomized 53 patients with frozen shoulder to a group that received manipulation under anesthesia or a group that received an intra-articular steroid injection with distention. The criteria for patients to be included in this study were not clearly defined. Exclusion criteria included additional or alternative pathologies (diabetes types 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 at the 2-year follow-up, the authors found no difference between the 2 groups in the Constant score, a pain VAS, and the SF-36. The authors, therefore, recommended intra-articular steroid injection with distention over manipulation under anesthesia, because the clinical outcome was the same but with less risk.

II Bal and colleagues⁶ examined the difference between intra-articular corticosteroid injections and intra-articular serum physiologic injections, both followed by a 12-week HEP, for patients with adhesive capsulitis. Inclusion criteria were the presence of shoulder pain with at least 25% limitation of both active and passive movements of the glenohumeral joint in at least 2 directions, between 6 weeks and 6 months of symptom duration, and no treatment other than analgesics in the previous 6 months. At the second week, changes in abduction ROM, SPADI total score, and SPADI pain score and medians of University of California, Los Angeles end-result scores were statistically better in the corticosteroid group. However, none of the differences between groups remained significant at 12 weeks.

I Seventy-one patients with primary frozen shoulder were randomly assigned to receive glenohumeral joint versus subacromial corticosteroid injections.⁹³ All injections were performed under diagnostic ultrasound-guided conditions. Both groups were treated with nonsteroidal anti-inflammatory medication and a HEP consisting of gentle active assisted and passive flexion, abduction, external rotation, adduction, and sleeper stretch exercises. The instructions for the HEP consisted of performing each exercise for 10 repetitions with a 5- to 10-second hold time to tolerance, 3 to 5 times daily. Strengthening exercises were not performed until shoulder pain subsided. Patients were diagnosed with primary frozen shoulder and included in this study if they had limitations of both active and passive motion in at least 2 directions (abduction and forward flexion less than 100°, external rotation less than 20°, or internal rotation less than reaching behind the back to the spinous process of the third lumbar vertebra). Patients demonstrating

secondary frozen shoulder due to rotator cuff tendinopathy, calcific tendinitis, or osteoarthritis based on diagnostic ultrasound and radiography were excluded from the study. Data were collected at preinjection and at 3, 6, and 12 weeks after the injection. A pain VAS, the Constant score, and ROM were used as outcome measures. The authors determined that both groups had marked improvement in all parameters, with only the pain VAS at 3 weeks demonstrating a statistically significant difference favoring the intra-articular injection group. No differences between groups were noted at 6 and 12 weeks. The Constant score and ROM measures were not statistically different at any time frame postinjection. 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 had secondary frozen shoulder stemming from rotator cuff tendinopathy. The authors also recognized that they did not use any control group that only performed exercise. The study highlighted the idea that because subacromial tissue may be involved in primary frozen shoulder, subacromial injections may be added as a potential intervention strategy. This study also highlighted the diagnostic difficulty of distinguishing primary from secondary frozen shoulder.

IV Lorbach et al⁷⁰ reported on the effectiveness of fluoroscopic-guided intra-articular corticosteroid injections. Twenty-five patients (9 male, 16 female) with a mean age of 49 years and stage 2 adhesive capsulitis were included in this study. Patients were included if their clinical findings were consistent with stage 2 Reeves classification criteria.⁷⁰ Patients with diabetes mellitus, previous intra-articular injections, or signs of glenohumeral joint osteoarthritis were excluded from the study. Treatment consisted of 3 fluoroscopically guided intra-articular cortisone injections, with a 4-week interval between injections. Physical therapy was started after 4 weeks and consisted of joint mobilization twice a week and instruction in a daily stretching exercise program in pain-free ranges of movement. Outcome measures were ROM, ASES score, and the SF-36 administered at pretreatment and at 4, 8, 12, 24, and 52 weeks. The results demonstrated significant improvement in all outcome measures at 4 weeks and further progress being made through 1 year. The most significant gains were noted in the first 4 weeks following the first injection. Interestingly, ROM measures compared to the uninvolved side at 1 year still demonstrated significant relative restrictions of 24° for flexion, 25° for abduction, and 15° for external rotation. Internal rotation ROM was not found to be different from side to side at 1 year. The ASES score, although dramatically improved at 1 year, still only averaged 73 of 100 possible points. This study demonstrated the short-term benefit of intra-articular ste-

roid injections in patients with primary adhesive capsulitis. Although 90% of the patients were satisfied at 1-year follow-up, approximately 25% still had significant ROM restrictions when compared to the uninvolved extremity.

I Blanchard et al¹³ performed a systematic literature review assessing the effectiveness of corticosteroid injections compared to physiotherapy interventions for adhesive capsulitis. Six studies were determined eligible for inclusion. The authors reported that at 6 to 7 weeks there was a medium effect in favor of corticosteroid injections when compared to physiotherapy interventions. Small effects were also present in the time range from 12 to 52 weeks. Their conclusion was that corticosteroid injections were more beneficial than physiotherapy interventions in the treatment of adhesive capsulitis at short term and to a lesser extent at long term. The review also showed that physiotherapy interventions led to a better outcome than when patients did not receive any intervention (control group) and therefore offer a positive alternative for patients who declined injection.

A Intra-articular 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.

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 serious medical conditions. Patients generally experience exquisite pain in the early stages of adhesive capsulitis, yet their recovery follows a fairly predictable course. Describing the pathology (synovitis/angiogenesis progressing to fibrosis) can allay fears and prepare them for the staged progression of the condition and recovery. 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 and Stevens³⁹ investigated the use of “supervised neglect” compared to aggressive therapy in 77 patients with adhesive capsulitis. Patients were classified as having adhesive capsulitis and included in this study if they had more than 50% motion restriction of the glenohumeral joint in all directions for a period of 3 months or more. The group of patients defined as receiving “supervised neglect” was 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. These patients were also encouraged to perform a HEP of maximal reaching. At 24-month follow-up, 89% of the patients in the “supervised neglect” group achieved a Constant score of 80 or greater out of 100, versus 64% of those in the aggressively mobilized group, indicating that the “supervised neglect” treatment approach was superior to more aggressive therapy.

B Clinicians should utilize patient education that (1) describes the natural course of the disease, (2) promotes activity modification to encourage functional, pain-free ROM, and (3) matches the intensity of stretching to the patient’s current level of irritability.

MODALITIES

Heating 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 al⁴⁰ conducted a randomized controlled trial analyzing the effects of therapeutic ultrasound for the treatment of adhesive capsulitis in 49 patients. The criteria to be included in this study were shoulder pain for a minimum of 3 months with no major trauma, greater than 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. Ten ultrasound treatments (3-MHz frequency for 10 minutes at 1.5 W/cm²) were performed to the affected shoulder over a 2-week period. The control group was treated with sham ultrasound using an inactive unit. Both groups of patients also received superficial thermotherapy provided via an electrical hot pack at 60°C for 20 minutes, followed by pendulum and active ROM exercises. SF-36 scores, SPADI scores, pain with motion, and ROM measurements for flexion, external rotation, and internal rotation were taken at the end of the 10th treatment session and again 3 months after entering the study. ROM improvements were greater in the ultrasound versus the sham group, reaching statistical significance for internal and external rotation immediately posttreatment and at the 3-month follow-up, and for flexion and abduction immediately posttreatment. 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 12 patients with adhesive capsulitis treated with deep heating modalities as adjunctive treatments to passive mobilization and a home program. Half of the 12 participants received ultrasound (1 MHz, continuous, 0.8-1.2 W/cm² for 8 minutes), whereas the other patients received continuous shortwave diathermy for 20 minutes. Study inclusion criteria were a history of pain and stiffness in the shoulder for more than 1 month, shoulder pain elicited at end range of all planes of motion, and shoulder ROM limited to less than 140° of flexion, 120° of abduction, 70° of internal rotation, and 50° of external rotation. Treatments were performed 2 to 3 times per week for 4 to 6 weeks. The authors found that an increase in capsular volume was associated with an increase in 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 2 forms of deep heating are also unknown, as no analysis was performed.

II

Guler-Uysal and Kozanoglu⁴⁶ conducted a prospective, randomized trial of 42 patients with adhesive capsulitis, comparing the use of moist hot pack and continuous shortwave diathermy to Cyriax-inspired manual techniques such as joint mobilizations and transverse friction massage. Patients were classified as having adhesive capsulitis and included in this study if they had shoulder pain for a minimum of 2 months with no major precipitating shoulder trauma, loss of active and passive shoulder ROM, pain with shoulder motion, and a minimum VAS pain score of 30 mm. Manual treatments were performed for 1 hour 3 times per week. Patients in the modalities group received moist hot pack for 20 minutes followed by 20 minutes of shortwave diathermy (220 V/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° of flexion and abduction, 70° of internal rotation, and 90° of external rotation. Ninety-five percent of patients who received manual techniques achieved the 80% milestone by the end of the second week of treatment, compared to only 65% of those who received the heating modalities. The authors concluded that manual therapy 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 than simple home stretching in the treatment of patients with adhesive capsulitis. Because the majority of patients had a rapid response, it also appears that the adhesive capsulitis diagnosis was loosely applied to patients presenting with shoulder pain and that true adhesive capsulitis was likely not present in many of the patients included in the study.

II

Leung and Cheing⁶⁷ recently sought to answer whether superficial and deep heating modalities were useful adjunctive treatments to a self-stretching program. The authors randomly assigned 30 patients in the stiffness stage 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, shortwave 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°C. Shortwave 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 the ASES score and ROM measurements. Patients treated with shortwave diathermy demonstrated significantly greater improvement in ROM compared to the other treatment groups, and there were no significant differences between groups treated with superficial heating and stretching versus stretching alone. In addition, most improvements were noted in the first 2 weeks of treatment.

II

Cheing and colleagues²⁶ designed a study in which 70 patients with frozen shoulder were randomly assigned to receive electroacupuncture plus exercise, interferential electrotherapy plus exercise, or no treatment for 4 weeks. Patients were included in this study if they had pain in 1 shoulder, night pain, and restricted active and passive shoulder ROM. The exercise groups received 10 treatment sessions. After the intervention, both treatment groups improved significantly on the Constant-Murley assessment score and the pain VAS, whereas the control group did not change. These differences were maintained at the 6-month follow-up, with no significant differences noted between the 2 intervention groups.

III

In a nonrandomized prospective study of 50 patients with adhesive capsulitis, Rizk et al¹⁰⁹ investigated the application of transcutaneous electrical nerve stimulation (50-150 Hz for 10 minutes) together with prolonged end-range stretching performed with overhead pulleys. Patients were classified as having adhesive capsulitis and included in this study if they had pain on resisted motions, exclusive restriction of glenohumeral joint motion with maximum passive ROM not exceeding 110° of abduction (with external rotation), 50° of external rotation, 70° of internal rotation, and 140° of flexion. The comparison group received "standard physical therapy," 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 have been due to the prolonged end-range stretching that was concurrently provided.

C Clinicians may utilize shortwave diathermy, ultrasound, or electrical stimulation combined with mobility and stretching exercises to reduce pain and improve shoulder ROM 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.^{19,57,91,130,131} Future research designs where patients are classified into (1) treatment groups with physical impairments that presumably best respond to joint mobilization¹³¹ and (2) where the mobilization force is best matched to the tissue irritability of the patient⁶⁰ may provide a clear indication of whether joint mobilization is beneficial for patients with adhesive capsulitis.

II Vermeulen et al¹³¹ performed a randomized prospective study (n = 100) comparing high-grade (grades III and IV) to low-grade (grades I and II) mobilization techniques without the inclusion of exercises. Patients were included in this study if they had unilateral adhesive capsulitis, defined as greater than 50% loss of passive movement of the shoulder joint in 1 or more directions and duration of complaints for more than 3 months. There was no control group, and no modalities or HEP were 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, SDQ, SF-36, ROM, and a pain VAS. Inferior, anterior, and posterior glide techniques were used in addition to distraction techniques. The authors 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 difference 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. This study demonstrates that grade I and II mobilization (not tensioning the tissue to end range) can be effective in not only improving pain but also increasing ROM and function.

II Bulgen et al¹⁹ compared 4 intervention groups: paired intra-articular and subacromial injections, joint mobilization, ice/proprioceptive neuromuscular facilitation, and no treatment (pendulum exercises) in a prospective randomized study of 41 patients. The criteria for patients to be included 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 motion of at least 50%. 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 2 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 Nicholson⁹¹ compared a group of patients with adhesive capsulitis who received joint mobilization and active exercise (n = 10) to a 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. Following 4 weeks of treatment, they found significantly improved ROM and reduced pain in both groups, with the only difference between groups being a slightly greater improvement (7°) in passive abduction for the mobilization group. Limitations of this study were limited measures of pain and ROM and only a 4-week follow-up.

II Chen and colleagues²⁷ compared 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 ROM, a greater than 10-cm hand-behind-back deficit compared to the unaffected side, and pain and/or stiffness during accessory movement testing of the joints in the shoulder region. Participants received a maximum of ten 30-minute therapy sessions over an 8-week period. At 1 and 6 months, there were no statistically significant differences in pain and disability, self-perceived global improvement, or active ROM between the 2 groups.

IV Vermeulen et al¹³⁰ presented a case series of 7 patients with a diagnosis of adhesive capsulitis treated solely with intense end-range mobilization techniques (no exercise or modalities) over a 3-month duration. The diagnostic criteria for adhesive capsulitis 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, 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, sustained a severe trauma, or had osteoarthritis. Patients were treated 2 to 3 times a week, and both ROM and joint volume (measured by arthrography) were used to determine out-

comes. They reported significant improvement in active and passive ROM, pain, and joint volume following treatment.

IV Yang and colleagues¹³⁸ performed a multiple-treatment trial using various combinations of end-range mobilization, midrange mobilization, and mobilization with movement in 28 patients with adhesive capsulitis. Patients were classified as having adhesive capsulitis and included in this study if they had a painful shoulder for at least 3 months with ROM losses of at least 25% in at least 2 directions. Each treatment was given for a 3-week period in different sequences for a total of 12 weeks. They found improved active mobility and self-reported levels of function at 12 weeks. They concluded that end-range mobilization and midrange mobilization were more effective than mobilization with movement in increasing motion and function.

II Tanaka et al¹²⁴ 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 (52 male, 58 female) with an average age of 63.7 years were enrolled in the study. Study inclusion criteria were 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 HEP. Mobilization techniques were high-intensity mobilizations performed at end range.¹³⁰ The HEP consisted of pendulum and passive stretching exercises, including but not limited to exercises such as wall climbs. Patients were randomly assigned to 1 of 3 frequency-of-treatment groups. The high-frequency group was treated 2 times a week, the moderate-frequency group was treated once a week, and the low-frequency group was treated less than once a week. Measured outcomes were active abduction ROM and the time required (months) to reach ROM plateaus. They also assessed the effect of age, gender, handedness, duration of symptoms before rehabilitation intervention, frequency of sessions for joint mobilization, and self-exercise compliance in a home setting. The results showed no difference in improved motion based on gender; however, better improvement in motion was seen in the involved dominant extremity versus the involved nondominant extremity. The frequency of use of joint mobilization 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 HEP every day. A relationship was seen between longer symptom duration and smaller gains in ROM. This study indicated that greater compliance with the HEP had greater influence on motion return and time to motion plateau than frequency of joint mobilization. A limitation of this study is that the motion cri-

teria limitations for inclusion in this study were not defined. Another limitation is the exclusive use of active abduction as the outcome measure, as opposed to assessing changes in other shoulder motions and/or an accepted outcome tool. Patients may have gained motion in other planes in the different treatment groups that went undetected.

II Johnson et al⁵⁷ investigated the effectiveness of anterior versus posterior glide mobilization on external rotation ROM in 20 patients (4 male and 16 female) with adhesive capsulitis. Patients were classified as having adhesive capsulitis and included in this study if they had external rotation motion restriction and if restriction in external rotation increased as the shoulder was moved toward greater abduction. The pain VAS, a 5-item self-assessment function questionnaire, and external rotation ROM in the highest degree of abduction were used for outcome 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 a sustained stretch of 1 minute. No oscillatory motions were performed. Two techniques for both anterior and posterior glides were chosen, for a total of 15 minutes of sustained stretch at each treatment session. Patients were treated for a total of 6 sessions over 2 to 3 weeks. No HEP was performed. Patients treated with posterior glide mobilization demonstrated significantly greater improvement in external rotation ROM compared to those treated with anterior glide mobilization. This study compared the effect of 2 directions of mobilization on external rotation motion, but did not compare mobilization to other forms of treatment or assess the effect on other motions.

C Clinicians may utilize joint mobilization procedures primarily directed to the glenohumeral joint to reduce pain and increase motion and function in patients with adhesive capsulitis.

TRANSLATIONAL MANIPULATION

IV Roubal et al¹¹⁴ described an alternative treatment method to standard shoulder manipulation for patients with unresponsive adhesive capsulitis. A single session of translational manipulations was performed on 8 patients with recalcitrant adhesive capsulitis following an interscalene brachial plexus block administered by an anesthesiologist. Patients were excluded if they had a history of cancer, significant osteoporosis, MRI or clinically demonstrated rotator cuff tear, or inappropriate cardiovascular history to undergo an interscalene brachial plexus block. A 2-person manipulative technique was used so that 1 clinician could stabilize the scapula while the other performed the translational manipulation. For treatment, an inferior glide

manipulation was followed by a posterior glide manipulation. Initially, all manipulations were preceded by Kaltenborn grade III mobilizations, and if no increased motion was noted after 3 trials, then a Maitland grade V manipulation was performed. Six of 8 patients experienced a significant immediate increase in passive ROM in all directions posttreatment. Two patients demonstrated no change in motion. Following the manipulation, all patients were instructed to perform passive forward flexion for 5 minutes every hour while the interscalene brachial plexus block was in effect. They were subsequently treated in physical therapy daily for 1 week and 3 times a week for 1 to 5 weeks. Therapy consisted of ice, high-volt galvanic electrical stimulation, ultrasound, joint mobilization, and stretching and strengthening exercises. A HEP was used in the first week, consisting of ROM stretching for 5 repetitions of 20 seconds' duration in all directions every 1 to 2 hours. The HEP continued to emphasize stretching in the second week and included strengthening with elastic bands in all directions. On the day of the manipulation, a Medrol (methylprednisolone 4 mg) 1-week dose pack (Pfizer Inc, New York, NY) was initiated for 4 of the patients. The 6 patients who responded to the manipulation had sustained increased function and active and passive motion. No shoulder-specific outcome tool was used in this study. This study provides an alternative option to commonly performed manipulation, but the therapist must carefully screen appropriate patients, have a close relationship with an anesthesiologist, and recognize that not all patients will respond to translational manipulation performed in this manner.

IV Placzek et al¹⁰¹ reported on using the identical manipulative procedure as described by Roubal et al¹¹⁴ in 31 patients (32 shoulders). The average duration of symptoms was 7.8 months and the average number of previous physical therapy treatment sessions was 7.7. Inclusion criteria were decreased function, painful active and passive motion, pain-free resisted testing, and passive mobility deficits with total ROM loss greater than 40% (flexion, abduction, external rotation, internal rotation) while measured under anesthesia. Inclusion criteria also included greater than 2 months' duration of symptoms and no medical contraindications to undergo an interscalene brachial plexus block. Exclusion criteria included a history of cancer, significant osteoporosis, MRI or clinically demonstrated rotator cuff tear, rheumatic disease, prolonged steroid use, recent fracture, upper extremity neurologic deficits, or inappropriate cardiovascular history to undergo an interscalene brachial plexus block. All patients were successfully manipulated. All patients, except the 4 with diabetes mellitus, started the use of oral steroid medication the day before manipulation. Each began a postmanipulation ROM and physical therapy program identical to that described in the study by Roubal et al.¹¹⁴ ROM was assessed premanipulation, immediately post-

manipulation, at discharge from physical therapy (5.3 ± 3.2 weeks), and at a long-term follow-up visit (14.4 months ± 7.3 months). A VAS for pain and a functional outcome measure (Wolfgang Scale) were assessed at initial evaluation, at discharge, and at the long-term follow-up. Significant increased motion was reported immediately postmanipulation, which was maintained or improved at both physical therapy discharge and long-term follow-up. Both pain and function significantly improved at discharge and at long-term follow-up. The authors felt that the inferior translation techniques stretched or disrupted the adhesions within the inferior fold, leading to regaining elevation motion. The posterior translation was felt to restore both external and internal rotation motion by stretching the posterior capsule and rotator cuff interval. The authors concluded that translational gliding could be performed in an outpatient setting and without the potential complications experienced with standard rotatory manipulative techniques typically performed under anesthesia.

C Clinicians may utilize translational manipulation under anesthesia directed to the glenohumeral joint in patients with adhesive capsulitis who are not responding to conservative interventions.

STRETCHING EXERCISES

Stretching exercises appear to influence pain and improve ROM, but not necessarily more than other interventions. 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 or other interventions.^{19,23,61,117} There is only 1 study⁴⁵ for which the authors fully described the exercises performed, with the other studies simply describing the program as active and/or passive exercises. No evidence exists to guide the optimal frequency, number of 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 impairments that presumably best respond to stretching exercises¹³¹ and (2) the forces applied are best matched to the tissue irritability of the patient⁶⁰ may provide a clearer indication of whether stretching exercises are beneficial for patients with adhesive capsulitis.

II Kivimäki et al⁶¹ performed a randomized controlled clinical trial ($n = 125$) comparing a HEP to a combination of manipulation under anesthesia and a HEP. The criteria for patients to be included in this study were gradually increasing shoulder pain and shoulder mobility of no more than 140° of elevation and 30° of external

rotation. Patients were excluded if they had osteoarthritis, traumatic bone or tendon changes in the affected shoulder, or a rotator cuff tear. The HEP, which included pendulum exercises and stretching techniques for the shoulder, was instructed by a physical therapist over 2 therapy sessions and supplemented by a written daily program. The SDQ and shoulder ROM were assessed at 6 weeks and at 3, 6, and 12 months. At 6 weeks and at 3 months, the manipulation group demonstrated statistically greater increase in shoulder flexion ROM (mean, 8°; 95% CI: 0°, 16°). There was no difference in outcomes between groups at any follow-up interval for pain or working ability. Shoulder symptoms had diminished and functional motion had returned by 6 months after randomization. Complete information was obtained for more than 81% of the participants at 3 months and 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 combined with a HEP; however, there was no control group for comparison.

II Diercks and Stevens³⁹ prospectively followed 77 patients with idiopathic adhesive capsulitis to compare the effects of “intensive” physical therapy to “supervised neglect.” The criterion for patients to be included in this study was more than a 50% motion restriction of the glenohumeral joint in all directions for a period of 3 months or more. The Constant score was assessed every 3 months for 24 months. The intensive physical therapy 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, to do pendulum exercises and active exercises within the painless range of movement, and to resume all activities as tolerated. Both groups had significant ROM and pain improvements; however, 89% of the patients in the “supervised neglect” group achieved a Constant score of greater than 80, compared to only 63% of those in the intense physical therapy group, at 2 years. Interestingly, 64% of the patients in the “supervised neglect” HEP group had achieved a Constant score of at least 80 at the 1-year follow-up, in contrast to none of those in the intense physical therapy group. 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.

II Griggs et al⁴⁵ performed a prospective functional outcome study that included 75 patients classified with stage 2 idiopathic adhesive capsulitis. Outcome measures were pain, ROM, and function using the DASH, the SST, and the SF-36. The mean duration of follow-up was 22 months (12–41 months), and 4 patients were not available for follow-up. All patients performed a HEP of passive stretching

exercises in forward elevation, external rotation, horizontal adduction, and internal rotation. All patients were referred to physical therapy for exercise performance, and the therapist determined the number of visits. Ninety percent (64/71) of the patients reported satisfactory outcomes, 10% (7/71) were not satisfied, and 5 of these 7 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 prior to treatment tended to have the worst outcomes.

II Lee et al⁶⁵ investigated the effect of exercise with and without steroid injection compared to the outcomes of patients who were 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 that both 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 that most of the improvement occurred in the first 3 weeks. However, neither the exercise program nor the analgesic medication was described.

II The effect of adding specific scapulothoracic strengthening exercises to a physical therapy program was investigated in patients with adhesive capsulitis.²⁴ Twenty-eight patients (7 males and 21 females) with an average age of 52.1 (range, 32–65) years were included. All patients were evaluated by an orthopaedist and had both radiographs and MRI performed. Inclusion criteria were 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 demonstrated small rotator cuff tear on MRI. Patients were randomly assigned to 2 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 on pain status, and patients were treated for 6 weeks (30 sessions). A modified Constant score, pain VAS, and ROM were assessed at 6 and 12 weeks. Both groups significantly improved in all outcome measures, with the group treated with scapular strengthening showing statistically greater active elevation ROM at 12 weeks. The authors suggested that the group treated with scapular strengthening improved because the scapulohumeral rhythm was “restored”; however, scapulohumeral rhythm was only visually assessed.

IV Levine et al⁶⁸ reported on a nonoperative-care, retrospective case series that included a standard physical therapy program with nonsteroidal anti-inflammatory medication with or without corticosteroid injection. End points were satisfactory resolution of symptoms with nonoperative care or choosing operative care. They found that 89.5% of 98 patients with adhesive capsulitis responded to nonoperative management. Resolution of symptoms occurred in 52.4% of patients with a combination of physical therapy and nonsteroidal anti-inflammatory

medication, and in an additional 37.1% of patients with a combination of nonsteroidal anti-inflammatory medication, physical therapy, and 1 or more injections. 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

E 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 (adhesive capsulitis). The loss of passive motion in multiple planes, particularly external rotation with the arm at the side and in varying degrees of shoulder abduction, is a significant finding that can be used to guide treatment planning.

C 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 40 to 65 years of age, female, and have had a previous episode of adhesive capsulitis in the contralateral arm.

B CLINICAL COURSE

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

F 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 these guidelines 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.

F 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 these guidelines, or when the patient's symptoms are not resolving with interventions aimed at normalization of the patient's impairments of body function.

A EXAMINATION – OUTCOME MEASURES

Clinicians should use validated functional outcome measures, such as the DASH, the ASES, or the SPADI. 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.

F 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.

E EXAMINATION – PHYSICAL IMPAIRMENT MEASURES

Clinicians should measure pain, active shoulder ROM, and passive shoulder ROM to assess the key impairments of body function and body structures in patients with adhesive capsulitis. Glenohumeral joint accessory motion may be assessed to determine translational glide loss.

A INTERVENTIONS – CORTICOSTEROID INJECTIONS

Intra-articular 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.

B INTERVENTIONS – PATIENT EDUCATION

Clinicians should utilize patient education that (1) describes the natural course of the disease, (2) promotes activity modification to encourage functional, pain-free ROM, and (3) matches the intensity of stretching to the patient's current level of irritability.

C INTERVENTIONS – MODALITIES

Clinicians may utilize shortwave diathermy, ultrasound, or electrical stimulation combined with mobility and stretching exercises to reduce pain and improve shoulder ROM in patients with adhesive capsulitis.

C INTERVENTIONS – JOINT MOBILIZATION

Clinicians may utilize joint mobilization procedures primarily directed to the glenohumeral joint to reduce pain and increase motion and function in patients with adhesive capsulitis.

C INTERVENTIONS – TRANSLATIONAL MANIPULATION

Clinicians may utilize translational manipulation under anesthesia directed to the glenohumeral joint in patients with adhesive capsulitis who are not responding to conservative interventions.

B 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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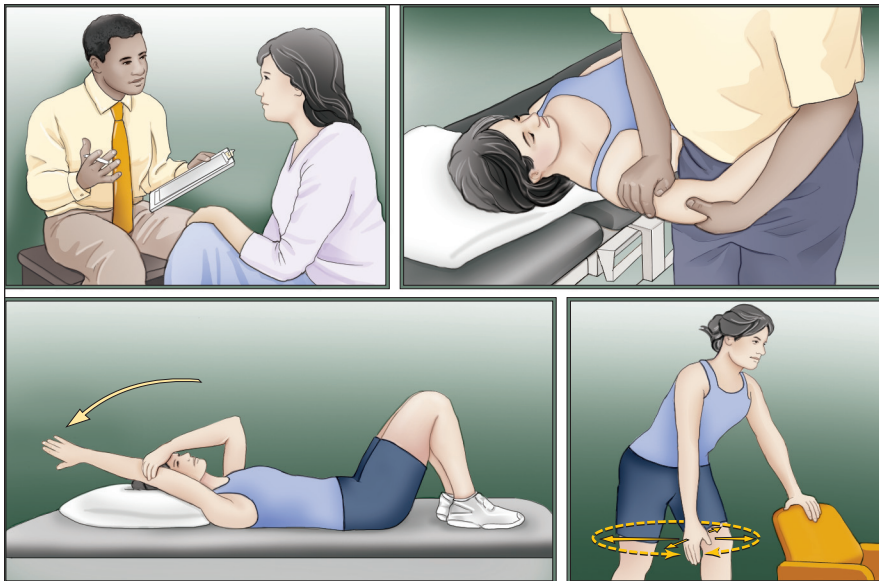
Frozen Shoulder

What Can a Physical Therapist Do for My Painful and Stiff Shoulder?

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Frozen shoulder, also known as adhesive capsulitis, refers to a condition where the shoulder becomes painful and stiff. It may occur following a relatively minor injury to the shoulder but most often develops without a clear reason. Frozen shoulder can also be linked to other health problems such as diabetes and thyroid disease. With this condition, the pain and stiffness can limit your ability to do simple everyday activities like getting dressed, brushing your hair, or reaching into a cabinet. The condition affects between 2% and 5% of the population at some point in their lives, and typically occurs in adults between 40 and 65 years of age. The problem usually lasts 1 to 2 years.

People with frozen shoulder usually experience an initial period characterized by an achy shoulder at rest, severe pain with movement, and difficulty sleeping because of shoulder pain. This leads to a progressive loss of motion (“freezing”) and limited function of the shoulder over several months, a time when there is often less pain but greater difficulty performing daily tasks. Eventually, the condition starts to “thaw” and shoulder motion and function gradually return. Recently, a panel of experts developed a set of treatment guidelines for improving the quality of care for people with frozen shoulder. These guidelines are published in the May 2013 issue of *JOSPT*.



FROZEN SHOULDER TREATMENTS. Several treatment options are available to address frozen shoulder. A thorough evaluation will help define the right treatment approach for your shoulder. In addition to education on the condition, your physical therapist will help determine the right combination of stretching and mobility exercises and joint mobilizations to get you on the road to recovery.

For this and more topics, visit *JOSPT Perspectives for Patients* online at www.jospt.org.

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NEW INSIGHTS

The expert panel recommends that patients learn about the symptoms that suggest they have frozen shoulder, what to expect as the condition progresses, and the timeline for recovery. They also urge that patients continue to use the affected shoulder during daily activities. In addition, participation in a good treatment program that combines education, mobility and stretching exercises, and joint mobilizations performed by your physical therapist can help manage symptoms and lead to faster recovery of your shoulder motion and function. Heat and other treatments applied to the shoulder can also make mobility and stretching exercises more effective. Finally, your physician may suggest a corticosteroid injection for your shoulder. The combination of an injection with joint mobilizations followed by mobility and stretching exercises has been found to be helpful.

PRACTICAL ADVICE

If you have frozen shoulder, making sure you continue to move your shoulder the proper amount is key to your recovery. There are a number of treatment options performed by physical therapists—joint mobilization or manipulation, exercise, and heat, among them—to help speed up your healing. Your physical therapist can help you better understand the condition and, after a thorough evaluation, customize a treatment program that will include exercises for you to perform at home to decrease the pain and improve the motion and function of your shoulder. For more information on the treatment of frozen shoulder, contact your physical therapist specializing in musculoskeletal disorders.



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