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ORIGINAL ARTICLE

Short-term outcomes after arthroscopic capsular release for adhesive capsulitis

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Background: Little is known about the short-term temporal outcomes of an arthroscopic capsular release for adhesive capsulitis (frozen shoulder). Specifically, it is not known how immediate the improvements are and how quickly patients return to normal function after an arthroscopic release.

Methods: The study included 140 shoulders in 133 patients with idiopathic adhesive capsulitis who underwent a complete arthroscopic release of the shoulder capsule, performed by a single surgeon in a day surgery setting. Patient-reported pain and shoulder function were evaluated with the use of Likert scales, and an independent examiner assessed shoulder strength and range of motion preoperatively and at 1 week, 6 weeks, 12 weeks, and 24 weeks postoperatively.

Results: Arthroscopic capsular release resulted in immediate improvements in pain, functional outcomes, and range of motion ($P < .0001$). External rotation increased from $21^\circ \pm 17^\circ$ (mean \pm standard deviation) to $76^\circ \pm 17^\circ$ at 1 week. Passive range of shoulder motion improved at 1 week, deteriorated slightly at 6 weeks, and then continued to improve at 12 and 24 weeks. Before surgery, 38% of patients reported that they “always” experienced extreme pain. This proportion reduced to 30% ($P < .0001$) at 1 week postoperatively and 2% ($P < .0001$) at 24 weeks postoperatively. There were no complications.

Conclusions: Patients who underwent an arthroscopic capsular release for idiopathic adhesive capsulitis experienced significant reductions in pain, improvements in range of motion, and improvements in overall shoulder function in the first postoperative week. These immediate improvements in pain and function continue to improve at 6, 12, and 24 weeks postoperatively.

Level of evidence: Level IV; Case Series; Treatment Study

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Keywords: Adhesive capsulitis; arthroscopic release; shoulder; arthroscopy; pain measurement; recovery of function

The Human Ethics Research Committee, NSW Health South Eastern Sydney Local Health District, approved this study: HREC 14/013 (LNR/14/POWH/023).

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Adhesive capsulitis of the shoulder, also referred to as frozen shoulder, is a condition characterized by the spontaneous onset of worsening shoulder pain and the global limitation of both active and passive ranges of shoulder motion.^{10,21} Adhesive capsulitis has a prevalence ranging from 2% to 5% in orthopedic clinics.¹¹ The etiology of the condition is unknown. Women are affected more than men, and the peak age at onset is about 55 years (although this may range anywhere from 35 to 70 years).

Adhesive capsulitis tends to occur in 3 consecutive clinical stages.¹⁶ The first stage is characterized by pain and stiffness in and around the shoulder, which is generally worse at night. During the second stage, patients experience a gross reduction in all glenohumeral movements, most significantly in external rotation.¹⁶ The final recovery stage involves spontaneous improvement in range of movement. The entire process will often resolve after approximately 2 years; however, pain and a limitation in range of motion may persist indefinitely.^{16,20}

Nonoperative treatments of adhesive capsulitis include benign neglect, physical therapy, and intra-articular steroid injections.¹⁴ Although these treatments may reduce pain, they have not been shown to accelerate recovery.⁸ Surgical options include an open release, manipulation under anesthesia, or an arthroscopic capsular release. Some authors have speculated that an arthroscopic release is safer than a manipulation because of the controlled nature of the release.^{5,9,20}

We have previously shown that an arthroscopic release for idiopathic frozen shoulder resulted in a persistent reduction in pain severity and frequency as well as in improvements in shoulder range of motion as many as 7 years after arthroscopic release (range, 5-13 years).¹⁴ Several other studies have shown good outcomes more than 1 year after capsular release for adhesive capsulitis.^{14,19} Capsular release can, however, result in iatrogenic instability.⁸

It is not known how quickly shoulder range of motion improves after surgery. Hence, the aim of this study was to determine the short-term outcomes of arthroscopic capsular release for idiopathic adhesive capsulitis and specifically to determine the rate and extent of restoration of shoulder function after this surgery. We elected to evaluate short-term recovery because there was little information available concerning how quickly patients recover after an arthroscopic release.

Materials and methods

Study design

Our hypothesis was that capsular release would provide a rapid reduction in pain and improvement in shoulder range of motion in patients with idiopathic adhesive capsulitis.

A retrospective study was conducted of patients who had had an arthroscopic capsular release for adhesive capsulitis by the senior author (G.A.C.M.). The aim of this study was to assess the functional recovery of the shoulder joint in the short term (up to 6 months). The primary outcome measured was passive external rotation of the shoulder at 6 months after arthroscopic release. Secondary outcomes included examiner-determined range of motion (forward flexion, abduction, and internal rotation) and strength (internal rotation, external rotation, supraspinatus, subscapularis, and adduction). Patient-reported outcomes included changes in frequency of activity pain, resting pain, and extreme pain; magnitude

of rest pain, overhead pain, and sleep pain; difficulty with activities behind the back or above the head; shoulder stiffness; overall shoulder satisfaction; and level of activity at work and level of sport played at 1 week, 6 weeks, 12 weeks, and 24 weeks after surgery.

Inclusion and exclusion criteria

The criteria used for a clinical diagnosis of idiopathic adhesive capsulitis were a painful, stiff shoulder for a duration of at least 4 weeks; restriction of passive range of motion with a loss of function; and pain that disturbed sleep or made it difficult to lie on the affected side in the absence of other causes for the pain and restricted motion of the shoulder.^{4,6,9,20}

Patients included in this study must have been admitted to surgery for an arthroscopic capsular release performed by the senior author and they must have attended a minimum of 1 follow-up clinic. Patients were excluded if the affected shoulder had had a previous fracture, a previous or concurrent rotator cuff tear or repair, calcific tendinitis, prior surgery to the shoulder, evidence of moderate or grade II or more glenohumeral joint arthritis, or previous sepsis.

Outcome assessment

Before each consultation (preoperative evaluation and 1 week, 6 weeks, 12 weeks, and 24 weeks of follow-up), each patient was required to complete a standardized questionnaire evaluating shoulder pain and function (based on the Shoulder Rating Questionnaire).¹⁵ Specifically, patients used a Likert scale to answer questions about frequency of activity pain, sleep pain, and extreme pain (never, monthly, weekly, daily, always) and magnitude of resting pain, activity pain, and sleep pain (none, mild, moderate, severe, very severe). Patients also used this scale to rank difficulty with overhead activities and activities behind the back. Further Likert scales were used to rank shoulder stiffness (not at all, a little, moderately, quite, very), overall shoulder satisfaction (good, fair, poor, bad, very bad), and current levels of work (none, light activity, moderate activity, strenuous labor) and sport (none, hobby sport, club sport, national sport).

Trained assessors used a previously validated protocol to measure strength and passive range of motion at each consultation (except 1 week postoperatively).^{12,13} Passive range of motion (abduction, forward flexion, external rotation, internal rotation) was assessed visually. Strength (internal rotation, external rotation, supraspinatus, subscapularis, adduction) was assessed using a hand-held force gauge (HFG-110; Transducer Techniques, Temecula, CA, USA).

Operative procedures and rehabilitation

Arthroscopic release was performed in a day surgery setting, using a previously described protocol.¹ Patients undergoing

the procedure received interscalene regional anesthesia before being positioned in the beach chair position (the routine position for shoulder arthroscopy). Passive shoulder range of motion was assessed and recorded, the patient was prepared and draped, and a posterior glenohumeral arthroscopy portal was established. The arthroscope was then introduced through the posterior portal and the glenohumeral joint was examined. After this, an anterior portal was established under direct vision using a spinal needle just lateral to the coracoid process. The spinal needle ensured that the instruments could access the inferior and posterior aspects of the joint capsule. The anterior portal was then made just superior to the upper border of the subscapularis tendon. Using the anterior portal, the tissues in the rotator cuff interval, from the anterior border of the long head of the biceps to the base of the coracoid, were released (using a CoVac 50 ArthroWand; ArthroCare, Sunnyvale, CA, USA). The intra-articular portion of the subscapularis tendon was also divided. The anterior-inferior aspect of the capsule was then cut completely, approximately 2 mm lateral to the glenoid labrum. After this, an appropriate location for a posterior-inferior portal was established using a spinal needle. After the portal was made, the posterior-inferior portion of the capsule was released. This ideally resulted in a complete 360° capsular release. The arm was then manipulated and the new range of motion assessed; 10 mL of Depo-Medrol with lidocaine (40 mg/mL methylprednisolone acetate and 10 mg/mL lidocaine hydrochloride, with 0.9% m/v benzyl alcohol [preservative]; Pfizer, New York, NY, USA) was injected into the joint. The portals were closed, and a soft bulky dressing was then applied.

Patients were not provided with a sling as they underwent a strict and intense postoperative rehabilitation regimen. Patients met with a physiotherapist on the day after their surgery, with the session focusing on maintaining passive and active shoulder movements. Patients were instructed to perform the given exercises every 2 hours for the remainder of the week. Patients were instructed to meet the physiotherapist a second time in the first postoperative week, when they were required to perform 10 repetitions of active assisted external rotation movements using a broom handle. In the second week, patients were required to perform 3 sets of exercises per day using a TheraBand (Hygenic, Akron, OH, USA). After these exercises, patients began rotator cuff strengthening exercises. Patients were encouraged to perform the TheraBand and rotator cuff exercises 3 times per day for 10 weeks.

Statistical analysis

Outcomes using parametric data that had a normal distribution were analyzed using 2-way unpaired Student *t* tests. Outcomes using nonparametric data were analyzed with the use of Wilcoxon signed rank tests and Mann-Whitney rank sum tests. A Spearman rank correlation test was also performed. Results were considered significant if $P \leq .05$.

Results

Study group

From January 2001 to May 2014, the senior author performed 238 arthroscopic capsular releases for adhesive capsulitis of the shoulder in 222 patients. Of these 238 shoulders, 13 operations were excluded because of concurrent rotator cuff repair surgery, another 25 patients failed to attend a minimum of at least 1 follow-up clinic, and 60 patient records could not be located, leaving 140 operations in 133 patients. Seven patients had arthroscopic releases on both shoulders at different times. These 140 procedures formed the study cohort.

Cohort demographics

The study included 88 women (66%) and 45 men (34%), with a mean age of 56 ± 8 (mean \pm standard deviation) years (range, 32-80 years). The mean duration of symptoms was 7 months (range, 1-60 months). Eight patients were scheduled to receive an arthroscopic release, but once the patient was on the operating table, the surgeon determined that a manipulation was sufficient to gain an adequate range of motion. Of the 140 shoulders operated on, 77 (55%) were on the left side and 63 (45%) were on the right. The mean operation time was 30 minutes (range, 3-120 minutes).

Range of motion

As previously indicated, the hallmark sign of adhesive capsulitis is a severe restriction in all ranges of shoulder motion, specifically external rotation. After an arthroscopic release, patients experienced an immediate, significant ($P < .0001$), and continued improvement in all ranges of shoulder motion. External rotation had a mean preoperative range of $21^\circ \pm 17^\circ$ (mean \pm standard deviation), increasing to $76^\circ \pm 17^\circ$ immediately postoperatively. External rotation then regressed to $49^\circ \pm 23^\circ$ at 12 weeks, where it remained steady (Fig. 1). A similar pattern was seen in all other ranges of motion. Forward flexion, abduction, and internal rotation each increased from preoperative means of $96^\circ \pm 33^\circ$, $74^\circ \pm 31^\circ$, and $S2 \pm 4$ to $156^\circ \pm 29^\circ$, $144^\circ \pm 38^\circ$, and $T11 \pm 4$ vertebral levels, respectively, at 24 weeks (Figs. 2 to 4). Although some regression in range of motion occurred between the immediate postoperative range and the range at subsequent follow-up, the ranges of motion at 6 weeks, 12 weeks, and 24 weeks were still all significantly better than preoperatively ($P < .0001$) (Table I).

Furthermore, significant improvements in strength were observed in all 5 movements at 24 weeks compared with preoperative means.

Although the surgical procedure involved sectioning the intra-articular portion of subscapularis, there was no reduction in internal rotation and lift-off strength at any time point.

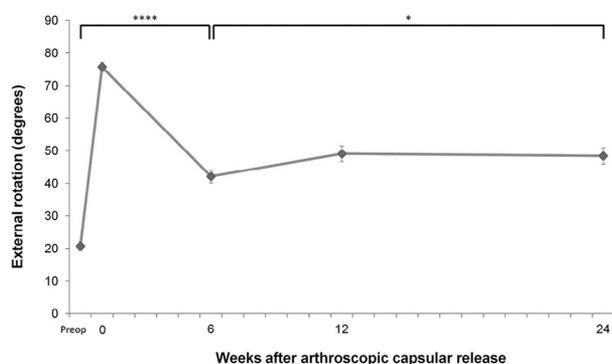


Figure 1 Improvement in glenohumeral external rotation after arthroscopic capsular release. Explanation: Examiner-determined assessment of external rotation before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made with 2-way unpaired Student *t* tests. * $P < .05$; **** $P < .0001$; 0, intraoperative measurements taken at time of release.

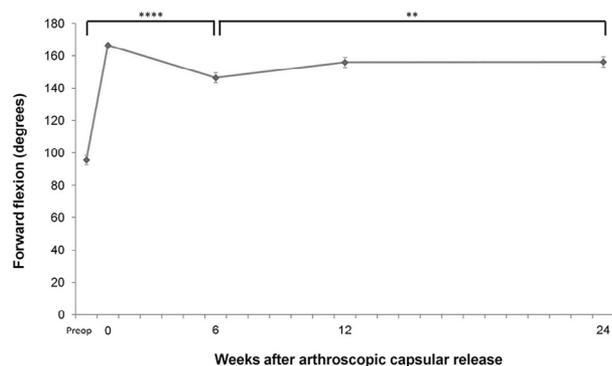


Figure 2 Improvement in glenohumeral forward flexion after arthroscopic capsular release. Explanation: Examiner-determined assessment of forward flexion before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made with 2-way unpaired Student *t* tests. ** $P < .01$; **** $P < .0001$; 0, intraoperative measurements taken at time of release.

Patient-reported pain scores

Before their operation, most patients reported a high frequency (daily to always) of activity pain, sleep pain, and extreme levels of pain. Preoperatively, 64% of patients indicated that they “always” had activity pain, which reduced to 41% at 1 week ($P < .0001$) and 22% at 24 weeks ($P < .0001$) of follow-up (Table II). Similarly, 65% of patients “always” experienced pain during sleep preoperatively, reducing to 30% and 16% at 1 week ($P < .0001$) and 24 weeks ($P < .0001$) of follow-up, respectively. In addition, 38% of patients “always” experienced extreme pain preoperatively, reducing to 30% and 2% at 1 week ($P < .0001$) and 24 weeks ($P < .0001$) of follow-up, respectively; 2% of patients still had extreme pain always at 24 weeks postoperatively.

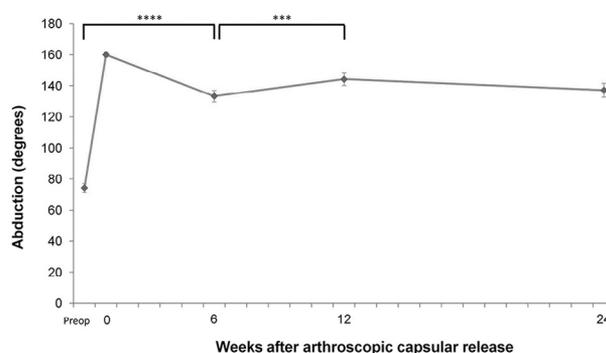


Figure 3 Improvement in glenohumeral abduction after arthroscopic capsular release. Explanation: Examiner-determined assessment of abduction before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made with 2-way unpaired Student *t* tests. *** $P < .001$; **** $P < .0001$; 0, intraoperative measurements taken at time of release.

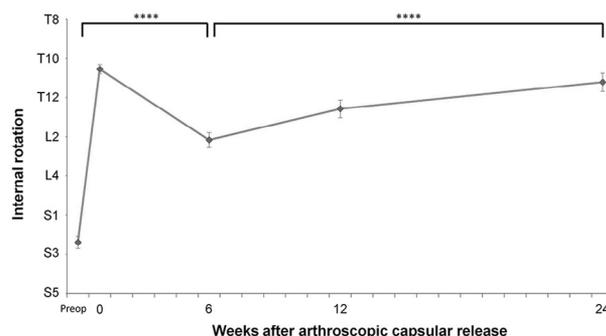


Figure 4 Improvement in glenohumeral internal rotation after arthroscopic capsular release. Explanation: Examiner-determined assessment of internal rotation before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made using Wilcoxon signed rank tests. **** $P < .0001$; 0, intraoperative measurements taken at time of release.

Preoperatively, most patients also reported experiencing a high magnitude of resting, overhead, and sleep pain; 42% of patients reported “moderate” levels of resting pain preoperatively, reducing to 24% and 21% at 1 week ($P < .0001$) and 24 weeks ($P < .0001$) of follow-up, respectively. The absence of resting pain after surgery also increased, with 6% of patients indicating no resting pain preoperatively, increasing to 26% and 38% of patients at 1 week ($P < .0001$) and 24 weeks ($P < .0001$) of follow-up, respectively. Similar patterns were observed for levels of overhead pain and sleep pain at all points after surgery.

All patients experienced severe to very severe difficulty with activities over the head or behind the back preoperatively. At 1-week follow-up, patients reported significantly decreased frequency of pain, magnitude of pain, and difficulty with activities over the head or behind the back ($P < .0001$) (Figs. 5 to 8). These improvements were maintained at each subsequent follow-up clinic (preoperatively vs.

Table I Examiner-determined preoperative glenohumeral joint range of motion compared at each follow-up clinic after an arthroscopic capsular release for adhesive capsulitis

	Preoperative ROM (n = 135)		6-week follow-up ROM (n = 104)			12-week follow-up ROM (n = 90)			24-week follow-up ROM (n = 75)		
	Mean	STD	Mean	STD	P value*	Mean	STD	P value*	Mean	STD	P value*
FF	96	33	146	31	<.0001	156	29	<.0001	156	27	<.0001
Abd	74	31	133	39	<.0001	144	38	<.0001	137	39	<.0001
ER	21	17	42	20	<.0001	49	23	<.0001	48	22	<.0001

	Preoperative ROM (n = 131)		6-week follow-up ROM (n = 103)			12-week follow-up ROM (n = 88)			24-week follow-up ROM (n = 74)		
	Mean	STD	Mean	STD	P value†	Mean	STD	P value†	Mean	STD	P value†
IR‡	S2	4	L2	4	<.0001	L1	4	<.0001	T11	4	<.0001

ROM, range of motion; STD, standard deviation; FF, forward flexion (degrees); Abd, abduction (degrees); ER, external rotation (degrees); IR, internal rotation.

* Comparison made using 2-way unpaired Student *t* tests. Significance set at $P \leq .05$.

† Comparison made using Wilcoxon signed rank tests. Significance set at $P \leq .05$.

‡ The values are given as the vertebral level that the patient could reach with the thumb.

6 weeks, preoperatively vs. 12 weeks, and preoperatively vs. 24 weeks).

Duration of symptoms before an arthroscopic release was not correlated with any variable concerning pain at any time follow-up point.

Preoperatively, most patients indicated that their shoulder was “quite” stiff. Significant improvements ($P < .0001$) in patient-ranked stiffness were seen at 1 week postoperatively, with the majority of patients indicating only “moderate” stiffness of the shoulder (Fig. 9). Stiffness continued to improve for the remainder of the follow-up period, and at 24 weeks, most patients experienced only “a little” shoulder stiffness. Improvements in patient-reported stiffness correlated with a more complete surgical release at the time of surgery ($P < .045$).

In addition to these improvements in shoulder stiffness, patients who underwent an arthroscopic release for adhesive capsulitis also experienced significant ($P < .0001$) improvements in shoulder satisfaction at each follow-up clinic postoperatively (Fig. 10). Preoperatively, most patients deemed their shoulder function “bad” to “very bad.” At 1-week follow-up, the majority of patients considered their overall shoulder function to be “fair,” which was maintained and showed mild improvement at 24 weeks of follow-up.

Patient-reported stiffness and overall shoulder function were not correlated with duration of symptoms before an arthroscopic release.

Discussion

This study showed that an arthroscopic capsular release for patients with idiopathic adhesive capsulitis resulted in improvements in shoulder pain, function, and range of motion within the first few days after their operation. Patients experienced reduction in the frequency and magnitude of pain as

well as in shoulder stiffness in as little as 1 week after an arthroscopic release. On average, patients recorded a 10-fold decrease in the frequency of extreme pain just 1 week after surgery. Furthermore, patients experienced increases in all shoulder ranges of motion in as little as 6 weeks, which continued to improve up to 6 months. Most notably, external rotation was, on average, twice the preoperative range of motion at 6 months.

What was perhaps most interesting was the rapidity of improvement in patient-ranked shoulder pain and function. Frequency of pain, magnitude of pain, difficulty with activities over the head or behind the back, stiffness, and overall shoulder satisfaction all were reduced by at least 50% by 1-week follow-up. This return to function was much more rapid than we expected. Patients considering undergoing this procedure may be interested to know how quickly their pain can be relieved and how quickly some degree of shoulder function can be returned.

Adhesive capsulitis is characterized by a thickened shoulder capsule containing many nerves.^{11,22} When patients with adhesive capsulitis reach out suddenly, they often complain of severe shooting pain. We speculate that by cutting the shoulder capsule, not only is shoulder motion restored, but also the nerves in the capsule are less likely to be activated when the shoulder is moved.

Most patients who do not receive treatment for adhesive capsulitis experience significant functional recovery after at least 2 years.^{5,16,17} However, approximately 60% of patients still experienced some level of pain or stiffness^{16,20} after 2 years. The results of our study suggest that an arthroscopic release is an extremely beneficial procedure as it can reduce pain and restore function rapidly. We also evaluated the long-term outcomes of arthroscopic release in another study and found significant improvements in pain and range of motion that persisted and improved at a mean of 7 years (range, 5-13 years) of follow-up.¹⁴

Table II Proportion of patients reporting each outcome for pain frequency, pain magnitude, difficulty with activities, stiffness, and overall shoulder function preoperatively and at 1 week and 24 weeks of follow-up after an arthroscopic release for adhesive capsulitis

	Always (%)	Daily (%)	Weekly (%)	Monthly (%)	Never (%)
Frequency of activity pain					
Preoperatively (n = 129)	64	34	1	0	1
1 week (n = 94)	41	48	4	2	5
24 weeks (n = 72)	22	28	18	19	13
Frequency of sleep pain					
Preoperatively (n = 132)	65	30	3	1	1
1 week (n = 88)	30	41	11	2	16
24 weeks (n = 71)	16	35	13	8	28
Frequency of extreme pain					
Preoperatively (n = 126)	38	52	4	3	3
1 week (n = 70)	30	41	11	2	16
24 weeks (n = 55)	2	9	11	7	71
	Very severe (%)	Severe (%)	Moderate (%)	Mild (%)	None (%)
Magnitude of rest pain					
Preoperatively (n = 132)	7	23	42	22	6
1 week (n = 95)	2	11	24	37	26
24 weeks (n = 71)	0	4	21	37	38
Magnitude of overhead pain					
Preoperatively (n = 131)	53	35	10	1	1
1 week (n = 80)	19	29	32	15	5
24 weeks (n = 83)	6	11	29	39	15
Magnitude of sleep pain					
Preoperatively (n = 134)	19	34	33	10	4
1 week (n = 90)	8	17	27	29	20
24 weeks (n = 74)	0	8	26	39	27
Difficulty behind back					
Preoperatively (n = 137)	74	20	5	1	0
1 week (n = 87)	29	33	24	13	1
24 weeks (n = 78)	8	13	37	32	10
Difficulty over the head					
Preoperatively (n = 137)	60	28	11	1	0
1 week (n = 84)	19	31	29	19	2
24 weeks (n = 75)	7	13	31	33	16
	Very (%)	Quite (%)	Moderate (%)	A little (%)	Not at all (%)
Shoulder stiffness					
Preoperatively (n = 135)	36	35	18	7	4
1 week (n = 100)	9	18	30	31	12
24 weeks (n = 77)	3	8	23	51	15
	Very bad (%)	Bad (%)	Poor (%)	Fair (%)	Good (%)
Overall shoulder function					
Preoperatively (n = 138)	39	41	15	4	0
1 week (n = 100)	3	13	16	44	24
24 weeks (n = 78)	3	6	15	31	45

Several authors have also demonstrated the substantial impact that an arthroscopic release for adhesive capsulitis can have on pain and range of motion. Berghs et al¹ evaluated 51 patients who underwent an arthroscopic release, observing dramatic improvements in pain and function in 88% of patients 2 weeks postoperatively. Segmüller et al¹⁹ observed significant improvements in pain and range of motion in 24 patients at an average of 13.5 months of follow-up. Dattani et al⁴

showed significant improvements in range of motion in a cohort of 100 patients at a median follow-up of 6 months. Our current study is consistent with the results of Berghs, Segmüller, and Dattani and adds even more detail with respect to the magnitude, extent, and temporal improvement in signs and symptoms of adhesive capsulitis after arthroscopic capsular release.^{1,4,19}

Studies have also been undertaken to evaluate the benefits of nonoperative treatments. A systematic review performed

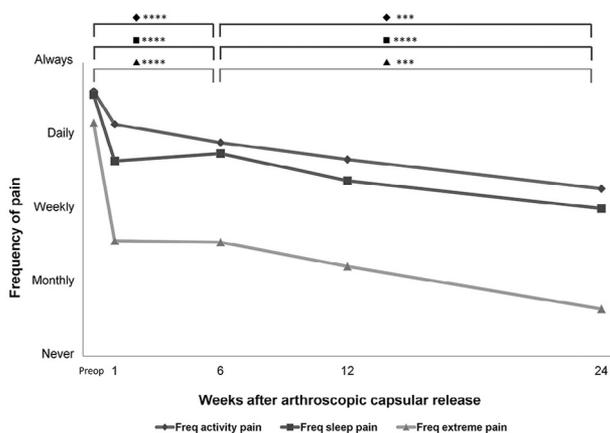


Figure 5 Frequency of activity pain, sleep pain, and extreme pain after arthroscopic capsular release. Explanation: Patient-reported frequency of pain with activity, pain during sleep, and extreme pain before and after arthroscopic capsular release. Data presented as the mean. Comparisons between groups were made using Wilcoxon signed rank tests. *** $P < .001$; **** $P < .0001$.

by Favejee et al⁸ investigated the effects of oral steroids, corticosteroid injections, physiotherapy, arthrographic distention of the shoulder capsule, acupuncture, and a suprascapular nerve block to reduce pain and to restore function in adhesive capsulitis. Varying levels of improvement were observed in all treatment modalities; however, the temporal nature of these results was often not reported. Corticosteroid injections have been shown to improve pain in the short term (weeks to months), but they provided little

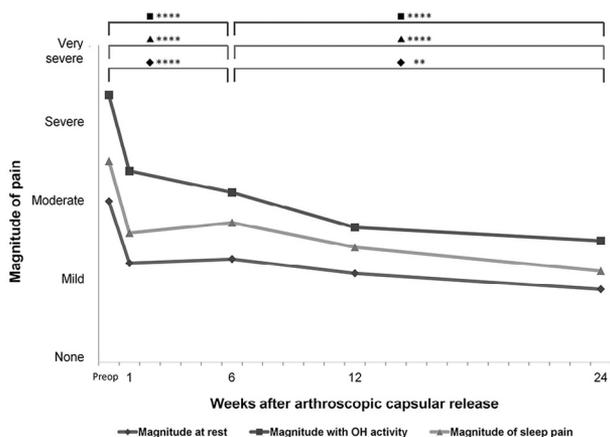


Figure 6 Magnitude of resting pain, pain with overhead (OH) activity, and sleep pain after arthroscopic capsular release. Explanation: Patient-reported magnitude of pain at rest, with overhead activity, and during sleep before and after arthroscopic capsular release. Data presented as the mean. Comparisons between groups were made using Wilcoxon signed rank tests. ** $P < .01$; **** $P < .0001$.

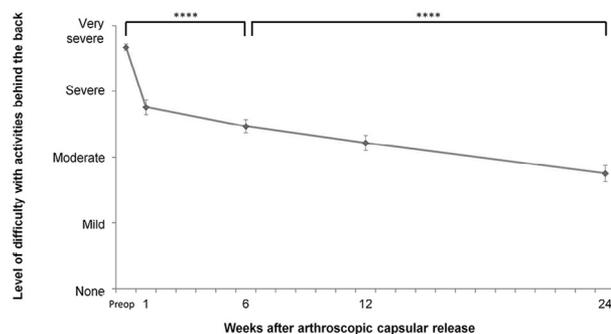


Figure 7 Level of difficulty with activities behind the back after arthroscopic capsular release. Explanation: Patient-reported difficulty with activities behind the back before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made using Wilcoxon signed rank tests. **** $P < .0001$.

in terms of long-term improvement.^{2,3,18} Diercks and Stevens⁶ compared intense physiotherapy and “supervised neglect.” They found that 89% of participants in the supervised neglect group compared with 63% in the physiotherapy group reached Constant scores (a functional shoulder score given as an aggregate of various shoulder outcomes) of 80 or more by 2 years of follow-up.

As mentioned, Favejee et al⁸ performed a systematic review of treatment methods for idiopathic adhesive capsulitis with respect to pain and range of motion. One difficulty the authors encountered was that most improvements in pain and shoulder function were reported as aggregate scores (such as a Constant score) from a combination of outcomes, which fails to highlight discrete functional improvements. Our study specifically analyzed numerous individual functional outcomes and presented independent

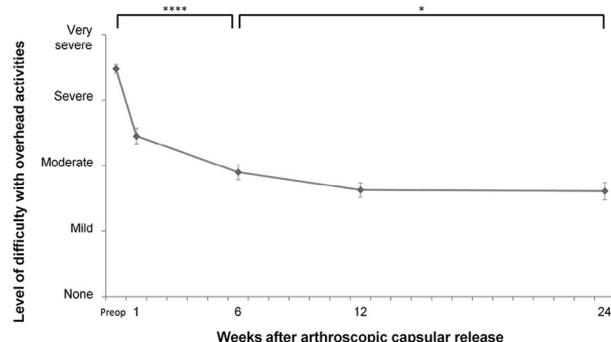


Figure 8 Level of difficulty with overhead activities after arthroscopic capsular release. Explanation: Patient-reported difficulty with overhead activities before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made using Wilcoxon signed rank tests. * $P < .05$; **** $P < .0001$.

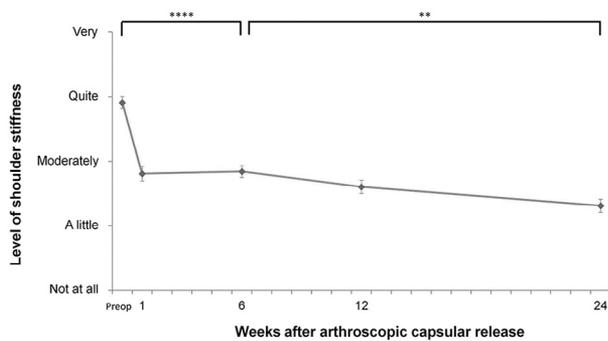


Figure 9 Level of shoulder stiffness after arthroscopic capsular release. Explanation: Patient-reported level of shoulder stiffness before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made using Wilcoxon signed rank tests. $**P < .01$; $***P < .0001$.

results for each outcome, allowing us to observe specific improvements in shoulder function.

In this study, we observed no iatrogenic instability, although case reports of iatrogenic instability have been noted.⁷ In addition, no patients required any form of revision surgery. Similarly low rates of intraoperative and postoperative complications have been observed previously.^{4,14,19,22}

One of the strengths of this study lies in its large sample size. To our knowledge, no other papers have attempted to evaluate short-term improvements in such a large cohort. Other strengths, such as regularly collected data and having one single surgeon perform all 140 procedures, helped to increase the reliability of the results. However, having one single surgeon is also a limitation, as the positive results may not occur with less experienced surgeons. A further limitation is the lack of a control group. We were not able

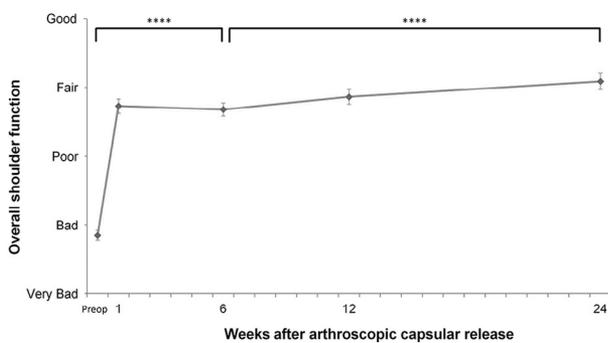


Figure 10 Overall shoulder function after arthroscopic capsular release. Explanation: Patient-reported level of overall shoulder function before and after arthroscopic capsular release. Data presented as the mean (and standard error of the mean). Comparisons between groups were made using Wilcoxon signed rank tests. $***P < .0001$.

to directly compare the results of capsular release with benign neglect.

Conclusion

This study has shown that an arthroscopic capsular release for adhesive capsulitis results in significant reductions in pain, improvements in range of motion, and improvements in overall shoulder function in the first postoperative week. These immediate improvements in pain and function continue to improve at 6, 12, and 24 weeks postoperatively.

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