# Biceps Tenotomy In Frozen Shoulder

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## Abstract

**Background**
Arthroscopic release of shoulder capsule in refractory cases of frozen shoulder is established as an option that leads to a faster recovery. Nevertheless, light was not shed on the outcome of the addition of biceps tenotomy on the postoperative outcome.

**Purpose**
The aim of this prospective study is to evaluate the results of arthroscopic capsular release in frozen shoulder with and without biceps tenotomy.

**Methods**
Sixty patients with primary frozen shoulder not responding to conservative medical treatment, physiotherapy and/or local steroid injection were included in the study. Arthroscopic release of shoulder capsule was performed in all cases. Whereas group 1 (30 patients) had the standard anterior and posterior release only, group 2 (30 patients) included an additional tenotomy of the long head of biceps. Constant-Murley and UCLA functional scores as well as the Satisfactory Outcome Score were used to assess the overall outcome and patient satisfaction.

**Results**
The age of the patients range from 41 to 65 years, with no statistical difference between the 2 groups. The follow-up period range from 12 to 26 months. At the end of follow up, there was a significant postoperative improvement in the functional scores ($P < .001$) of both groups. A similar finding was noted in the overall range of motions ($P < .001$). However, Group 2 experienced a 4 to 6 month postoperative anterior shoulder pain localized at the bicepital groove.

**Conclusion**
A global significant rapid improvement in the range of motion and patient satisfaction has been shown following arthroscopic capsular release for resistant frozen shoulder. However, there is no significant difference in the overall results with the addition of a biceps tenotomy.

**Key Words**
Biceps Tenotomy - Frozen shoulder- Capsular release- Arthroscopic.

## Introduction

Frozen shoulder (Adhesive capsulitis) is a condition of unknown etiology that typically occurs between the age of 35 and 65 years and is known by severe pain and progressive restriction of range of motion (ROM) of the shoulder. Several conservative measures like physical therapy, anti-inflammatory drugs, and steroid local injection are usually effective for pain control. However, multiple studies in literature have reported less optimistic outcomes with a protracted course and incomplete recovery. Therefore, resistance to non-surgical treatment with persistent pain and motion restriction warrants operative intervention. [1-4]

Manipulation under anesthesia (MUA) has been a long standing treatment for resistant frozen shoulder. However, not only is it a blind method of disrupting the shoulder capsule, but it is also accompanied with documented complications including proximal humeral fracture, brachial plexus palsy, labral and rotator cuff tears.[5,6]

Treatment of resistant adhesive capsulitis with an arthroscopic release allowed a more precise and controlled release of the capsular contractures, and therefore it avoids the possible iatrogenic complications encountered by forceful manipulation maneuvers.[7-9]

Clinically, the pathology of the long head of the biceps (LHB) tendon is a common cause of anterior shoulder pain. Moreover, it is also well documented that shoulder functions depend partly on the sliding movement of LHB tendon, especially for external rotation. Arthroscopically, adhesions between LHB tendon and rotator interval were identified in frozen shoulders, and hence overcoming this problem may

result in better postoperative outcomes.[10]

Furthermore, Laurent Lafosse and his collegues described an all-arthroscopic technique in which they performed biceps tenotomy with a complete 360° release of the capsule for all patients suffering from primary frozen shoulder.[11]

The purpose of our work is to evaluate the results of capsular arthroscopic release patient suffering from refractory frozen shoulder with and without biceps tenotomy. To our knowledge, no previous comparative studies before discussing the same topic. Our study hypothesis is that adding a biceps tenotomy to the capsular release will improve the results.

## Patients and Methods

All patients presented with primary idiopathic frozen shoulder resistant to conservative management (medical, intraarticular steroid injection and/or physiotherapy) for at least three months were considered eligible to the study. However, cases with cuff tears, glenohumeral arthritis, symptomatic acromioclavicular arthritis and previous manipulation under anesthesia were dismissed from the study. A written informed consent was obtained from all patients, and the study was accepted by the local Ethical Committee.A total of sixty cases were split up into two groups; each group included 30 patients.

Whereas patients in group 1 had complete arthroscopic capsular release only, patients of group 2 underwent LHB tenotomy in addition to the capsular release. Closed envelopes were used to allocate patients to either group. There were 26 men and 34 women, with 45 right and 15 left shoulders. The groups were matched for gender, age and operated side. The mean follow-up in both groups was 19.2±6.22 months (range 12- 26 months).The demographic and clinical detaof the cases in both groups are shown in (Table I).

**Table I:** Characteristic feature of the studied patients in the two studied groups

| | **Group I "n=30"** | **Group II "n=30"** | **Total "n=60"** | **P** |
|---|---|---|---|---|
| **Sex** | | | | |
| Male | 14 | 12 | 26 | 0.62 |
| Female | 16 | 18 | 34 | |
| **Age (years)** | | | | |
| Range | 41-64 | 43-65 | 41.0-65.0 | 0.71 |
| Mean±S.D. | 51.6±8.65 | 53.8±10.6 | 52.6±9.64 | |
| **BMI** | | | | |
| Range | 26.8-34.2 | 25.9-35.1 | 25.9-35.1 | 0.58 |
| Mean±S.D. | 30.6±4.22 | 30.98±5.01 | 30.8±5.36 | |
| Side | | | | |
| Rt | 23 | 22 | 45 | 0.425 |
| Lt | 7 | 8 | 15 | |
| **Duration of follow up (months)** | | | | |
| Range | 12-24 | 12-26 | 12-26 | 0.361 |
| Mean±S.D. | 18.3±5.6 | 20.1±6.98 | 19.2±6.22 | |

All patients underwent thorough clinical examination followed by radiological evaluation with plain X-ray and MRI .Examinations were performed preoperatively in outpatient clinic, 1 day before the operation, during anesthesia (passive motion), and the follow up period. Outcome assessments were standardized and conducted by 1 blinded and independent examiner.

Pre- and postoperative subjective pain was assessed with the visual analog scale (VAS). The VAS was utilized to measure the patients' pain, with 0 signifying no pain and 10 signifying enormously severe pain. Passive shoulder ROM including abduction, forward flexion, external rotation and internal rotation was measured with the patient during anesthesia and postoperatively after 2, 6 weeks, 3, 6 and 12 months and at the final follow-up.

Constant-Murley and the UCLA functional scores were utilized to evaluate the overall outcome. Patient satisfaction was evaluated using the Satisfactory Outcome Score at the end of follow up in which the patients were asked via questionnaire to rate how satisfied they were with the surgical procedure on ten point scale with one being unhappy and ten being happy.

## Operative Techniques

At the time of surgery, the patients were operated under general anesthesia and in semi-sitting position. In all patients with the arthroscope in the posterior portal, standard anterior release of the rotator interval and capsule was done using motorized shaver and radiofrequency (RF) ablation device. Then the scope was shifted to the anterior portal to start the procedure of posterior capsular release that begins from the glenoid level down to six o'clock position using the RF device and shaver inserted through the posterior portal.

In group 2, in addition to the complete capsular release described before, arthroscopic tenotomy of LHB was done just lateral to its insertion in the superior labrum using the RF ablation device.

## Postoperative Rehabilitation

A postoperative sling is applied in both groups for comfort; the rehabilitation program was the same in both groups and consisted of immediate postoperative passive and active assisted exercises followed by strengthening exercises.

## Statistical analysis

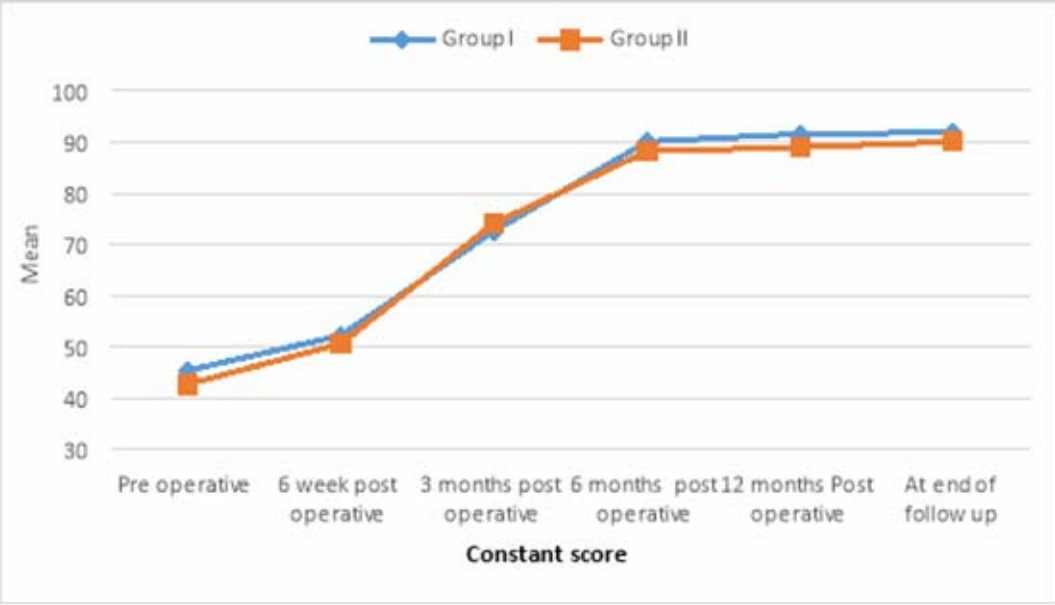
The Data were collected and introduced to the computer. Statistical analysis was done using Statistical Package for Social Sciences (SPSS/version 20) software. The statistical test used consisted of mean, standard deviation and t-test comparing between the mean values of measurement before and after treatment. The level of significance was 0.05.

## Results

The demographic and the preoperative data were investigated (Table I). Between both groups regarding the age, sex, site, BMI, preoperative pain, ROM and functional scores no statistically significant differences were found.

Significant improvement in the Constant score postoperatively (P<0.001) was found in both groups.Group 1, the mean preoperative Constant score improved from 45.36±7.52 points preoperatively (range, 32- 60 points) to 91.6±5.25 points postoperatively (range, 79- 96 points). Group 2, the mean score was 44.66 ±6.98points preoperatively (range, 33- 61 points) and improved to 90.8±5.01 points postoperatively (range, 80- 95 points). No statistically significant difference was found between both groups (P =0.365). Figure (1)

**Figure 1:** Comparison between the two studied groups regarding pre and post operative Constant score




Similarly, the mean of the UCLA score improved significantly at the final follow-up from a mean of 15.5±3.69 points preoperatively (range, 10- 22) to 33.1±1,07 points postoperatively (range from 30- 35 points) (p <0.001) in group 1. The significant improvement was also noticed in group 2 as the mean score improved from 14.8±1.98 points preoperatively (range, 12- 19) to 33.5±1.85 points postoperatively (range from 29- 34 points) (p <0.001). Again no statistically significant difference was found between both groups (P =0.285).

At the final follow up, the patients of both groups were satisfied with the surgical procedure with mean

Satisfactory Outcome Score of 8.50±1.04 (range, 5-10) and 7.81±1.15 (range, 5-10) in group 1 and 2 respectively.

Concerning the pain, the mean VAS score at final follow up improved significantly in group 1 from 7.62±1.82 points preoperatively (range, 5 to 9 points) to 1.7±0.95 points postoperatively (range, 0 to 3 points) ($p < 0.01$). Similarly, group 2 improved from 8.01±1.95 points preoperatively (range, 6 to 9 points) to 1.91±0.72 points postoperatively (range, 0 to 3 points) ($p < 0.01$). Although no postoperative statistically significant difference was found between both groups ($P = 0.089$), Group 2 patients continued to experience a 4 to 6 month postoperative localized anterior shoulder pain at the bicepital groove which required a longer time medication, local physical therapy, and/or steroid local injection.

Finally, the ROM improved significantly in both groups, but statistically no difference was found. Table II.

**Table II:** Comparison between the two studied groups regarding pre- and post operative range of motion

| | **Group I** | | **Group II** | |
|---|---|---|---|---|
| | **Pre operative** | **Post operative** | **Pre operative** | **Post operative** |
| **passive forward flexion** | | | | |
| Range | 125-155 | 166-182 | 120-160 | 164-183 |
| Mean±S.D. | 140.3±8.9 | 175±8.2 | 142.3±10.3 | 173.0±7.6 |
| P1 | 0.001* | | 0.001* | |
| P2 | | | 0.266 | 0.311 |
| **abduction** | | | | |
| Range | 125-165 | 160-178 | 125-162 | 160-182 |
| Mean±S.D. | 144.6±12.1 | 170±7.99 | 142.6±10.6 | 172±8.25 |
| P1 | 0.001* | | 0.001* | |
| P2 | | | 0.204 | 0.311 |
| **External rotation at the side** | | | | |
| Range | 30-45 | 44-65 | 31-45 | 44-66 |
| Mean±S.D. | 38.2±5.2 | 55.0±7.1 | 37.9±4.62 | 52.0±6.82 |
| P1 | 0.0026* | | 0.013* | |
| P2 | | | 0.421 | 0.365 |
| **external rotation in 90° abduction** Range | 60-95 | 80-113 | 62-93 | 77-111 |
| Mean±S.D. | 75.2±8.1 | 95.0±6.2 | 76.1±7.58 | 92.0±7.6 |
| P1 | 0.015* | | 0.011* | |
| P2 | | | 0.251 | 0.107 |
| **internal rotation in 90° abduction** | | | | |
| Range | 20-28 | 25-38 | 22-29 | 27-42 |
| Mean±S.D. | 26.2±5.1 | 35.0±2.71 | 27.1±2.6 | 37.0±3.2 |
| P1 | 0.012* | | 0.023* | |
| P2 | | | 0.236 | 0.226 |

P1 comparison between pre operative and post operative
P2 comparison between the two groups at the same time

## Discussion

Painful shoulder stiffness can negatively affect daily activities and subsequently impair quality of life. Although frozen shoulder, or adhesive capsulitis, is considered a self-limiting disease that cures in approximately 1 to 3 years, more than 50% of patients usually have persisting symptoms that necessitate further intervention. [12]

Manipulation under anesthesia (MUA), which depends on aggressive shoulder motion, has been widely used for management of resistant frozen shoulder. Reported incidence of hemarthrosis, labral tear, brachial plexus palsy, and humeral or glenoid fracture following MUA, although it was considered as a safe procedure. [13-15] On the other hand, arthroscopic capsular release has been defined as safe and effective method for management of resistant adhesive capsulitis.[16] Not only does it avoid the hazards encountered with MUA, but also it has the advantages of performing diagnostic arthroscopy to confirm the diagnosis and direct inspection of the

contracted tissues to confirm precise and accurate release.[17]

The impact of the LHB tendon to shoulder kinematics in normal and diseased states is not clearly understood. The LHB tendon has been assumed to act as a dynamic control to both glenohumeral (GH) rotation and translation. Additional studies have also confirmed that the longhead of biceps depress the humeral head.[18-20]

Despite these proposed functions, controversy about the exact function of the LHB persists; a study by Giphart et al evinced that LHB tenodesis did not significantly change GH dynamics in comparison to the healthy shoulders.[21] Moreover, the common use of biceps tenotomy and tenodesis with great results suggests that the LHBT is not important in an otherwise normal shoulder.[22]

In 1944, Lippmann studied the biomechanics of the LHBT and described that when the humerus is taken through full ROM, it moved 2 to 5 cm alongside the tendon.[23] Braun et al reported excursion of the LHBT during shoulder ROM up to 25 mm .[24] McGahan et al reported 19.4 mm of excursion when the arm moved from $0^o$ to $90^o$ abduction and maximum ER. Due to multiple centimeter excursion of the humerus on the LHBT, any stop to this motion may result in decreased ROM and poorer functional outcomes. Clinically, this could take the form of fibrosis and stiffness of the LHBT within the groove. [25]

Kanbe et al stated that with release of fibrosed LHB tendon during standard arthroscopic capsular release in cases with frozen shoulder the functional scores and ROM improved.[10] In two studies evaluating anterior shoulder pain after shoulder arthroplasty, Hersch et al and Tuckman et al reported that debridement, tenodesis, or both of LHBT adhesions resulted in improved functional scores and ROM.[26,27]

Boileau et al, concluded a significant improvement of the functional outcomes and ROM have been encountered with excision and tenodesis of an ‘‘hourglass’’ biceps tendon that functions as a mechanical stop to tendon gliding.[28]

Furthermore, Lafosse et al, conducted a study upon 10 patients with adhesive capsulitis in which release of the rotator interval, a circumferential capsular release, and biceps tenotomy were done for all cases. No complications were reported, and no MUA were needed, which may result in soft-tissue injury, fractures, or dislocations. They recommend 360° complete capsular release technique for releasing stiff shoulders. [11]

In the current study, there was a significant improvement in patient function and satisfaction following arthroscopic release in both groups. Although our study hypothesis was that the addition of biceps tenotomy to capsular release would improve the results, we, unfortunately, did not find any statistically significant difference between both studied groups. Moreover, the tenotomy caused pain along the bicepital groove that persisted in some cases for up to six months in addition to increasing the duration of the surgical process.

In conclusion, a global rapid significant improvement in the ROM and patient satisfaction has been shown following arthroscopic capsular release for resistant frozen shoulder. However, there is no significant difference in the overall results with the addition of a biceps tenotomy.

A limitation of this study is the relative small sample size with the lack of randomization and blinding for better evaluation of the results.

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