Journal of Orthopaedics 15 (2018) 761–764

Contents lists available at ScienceDirect

Journal of Orthopaedics

journal homepage: www.elsevier.com/locate/jor

# Functional outcome of open acromioclavicular joint stabilization for instability following distal clavicle resection

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ARTICLE INFO

*Keywords:*
Acromioclavicular joint
Stabilization
Instability
Arthroscopic resection
Distal clavicle
Coracoclavicular ligaments

ABSTRACT

*Background:* Acromioclavicular joint instability following distal clavicle resection can result in considerable pain and dysfunction.
*Method:* We present a review of 13 patients who underwent ACJ stabilization following one or more distal clavicle resection procedures.
*Results:* The mean Quick DASH and CM scores were 26(0–57) and 73(46–100) respectively. All but one patient reported an improvement in the pain component of their CM score and in the work component of the Quick DASH score.
*Discussion:* Open ACJ stabilization to treat instability following distal clavicle resection resulted in improved functional scores, pain scores and facilitated return to work in most patients.
Level of evidence IV.

## 1. Introduction

Arthroscopic distal clavicle resection is a common procedure for the management of refractory pain arising from the acromioclavicular joint (ACJ) due to degenerative arthritis. Clinical results are good to excellent in over 85% of patients,[1] however a small subset of patients may experience persistent post-operative discomfort arising from the ACJ. The cause may be inadequate resection, incorrect pre-operative diagnosis, other co-existing shoulder pathology or over-resection leading to instability. Biomechanical studies have demonstrated that the ACJ capsular ligaments, in particular the superior and posterior components, are responsible for up to 50% of the restraint to anterior translation and 90% restraint to posterior translation of the distal clavicle.[2,3] At higher loads, the conoid ligament contributes 60% resistance to superior translation with the trapezoid ligament providing the primary restraint to axial compression of the clavicle on the acromion. When performing distal clavicle resection, greater than 10mm excision may violate the superior ACJ capsular ligaments,[4] that can lead to excessive AP motion of the distal clavicle and encroach on the trapezoid ligament.[5] A significant increase in anterior, horizontal translation of the distal clavicle can be seen following a 10mm resection and is further exacerbated by sectioning the ACJ capsular ligaments, whereas posterior translation significantly increases following a 10mm resection only after sectioning of the ACJ ligaments.[6]

Gross instability from over aggressive distal clavicle resection may be diagnosed on physical and radiographic examination but more subtle instability in the presence of conservative resection margins is difficult to diagnose clinically. As such symptomatic ACJ instability following distal clavicle resection may be an underappreciated entity, which is reflected by the paucity of data regarding this condition.

The aim of this study was to describe the results of open ACJ stabilization in patients with symptomatic instability following distal clavicle resection, in order to highlight the existence of this uncommon condition and provide data on the clinical outcome following stabilization.

## 2. Materials and methods

Thirteen patients (8 male, 5 female) were prospectively followed up having undergone open ACJ stabilization for chronic pain and dysfunction following one or more (range one to three) prior distal clavicle resection procedures. Mean age was 41 years old (range 18–64). Mean follow-up was 28 months (12–62 months).

All patients had a preceding arthroscopic distal clavicle resection. Four patients had a second procedure (arthroscopic or open distal clavicle resection), and two of these patients had a third procedure, which was an open distal clavicle resection in both cases. Nine patients reported a history of a preceding traumatic shoulder injury prior to their

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https://doi.org/10.1016/j.jor.2018.05.013
Received 18 February 2018; Accepted 6 May 2018
Available online 07 May 2018

initial presentation and before any surgery had been performed. Mean time to stabilization from the original procedure was 25 months (6–80 months). All patients underwent a period of non-operative management including analgesia and physiotherapy. Diagnostic local anesthetic injections were performed in all patients and one patient underwent a period of pain team management prior to operative intervention.

Diagnosis of ACJ instability was made on clinical examination and a combination of injections, radiographs, MRI and dynamic ultrasound scan (USS). Instability was defined as painful, clinically reproducible increased translation of the distal clavicle as compared to the opposite shoulder in horizontal and/or vertical directions clinically and on dynamic ultrasound scanning, where possible. Residual bony impingement was excluded with further imaging. Six of thirteen patients had pre-operative MRI scans available for review. One was reported as normal whilst five reported increased signal or edema in the lateral clavicle, acromion or acromioclavicular joint in general. Five patients underwent dynamic USS assessment in clinic by the senior author. Increased mobility of the distal clavicle was found relative to the contralateral side in four patients whilst in one case no difference was found.

### 2.1. Surgical technique

Surgery was performed in the beach chair position through a bra-strap incision. The delto-trapezial fascia was intact in all patients. This was opened longitudinally with a vertical extension in the line of the deltoid fibres towards the coracoid tip. The posterior superior capsular-ligamentous tissues were found to be either attenuated or absent in all patients. When present these were split and reefed around the reconstruction at the end of the procedure. The senior author prefers the use of a synthetic ligament as it avoids donor site morbidity and provides immediate stability over biologic grafts due to its relative stiffness and reduced likelihood of elongation. In 12 patients, reconstruction was performed using a polyethylene terephthalate synthetic ligament (Ligament Augmentation & Reconstruction System, LARS France), and were anatomic coracoclavicular ligament reconstructions, as per the manufacturer technique with a modification to improve anterior posterior stability of the ACJ.[7]

The LARS ligament graft was passed under the coracoid from medial to lateral. The lateral limb was passed through a 3.5mm drill hole through the clavicle from anterior-inferior to posterior-superior. The medial limb was passed through a 3.5 mm drill hole in the posterior-inferior to anterior-superior direction. The ligament is held with 4.7 mm interference screws in the tunnels. The senior author's modification was performed in 11 patients. This involved taking the medial and lateral limb and passing one under the coracoid again then suturing it to the other in a figure-of-eight configuration, effectively doubling the repair and adding an anterior translation force to the construct. One patient had an additional drill hole made in the acromion to pass the graft across the ACJ. In one case a modified Weaver Dunn procedure was employed due to a 4 cm of distal clavicle defect. The coracoacromial ligament (CAL) was released from the acromion with a sliver of bone, and whipstitched with a braided non-absorbable suture. Two drill holes were made in the superior clavicle, and the CAL was shuttled into the canal of the clavicle by passing the whipstitches through the drill holes. The sutures were then tied over the bone bridge. This was reinforced with two suture anchors in the clavicle and multiple non-absorbable sutures looped around the coracoid and tied to each other to provide early mechanical stability while the CAL graft incorporated.

### 2.2. Post-operative rehabilitation

During the first three weeks a shoulder immobilizer is worn with isometric rotator cuff exercises, passive external rotation as pain allows and flexion to 90° with the elbow supported. Closed chain exercises are performed below 90° of abduction and flexion. After three weeks the patient is weaned off the sling. Abnormal movement patterns are corrected, isometric cuff exercises are progressed to open chain active and resistance exercises. From week six dynamic exercises, active exercises through a full range of motion, cuff and deltoid strengthening and open chain exercises are progressed. Load bearing progresses as tolerated under therapist supervision.

### 2.3. Data analysis

Outcome data was collected prospectively using the disabilities of arm, shoulder and hand (Quick DASH) score and the Constant Murley (CM) score. All patients had post-operative outcome data collected. Eight patients had pre-operative outcome scores available for comparison. Categorical demographic data are presented using frequencies and percentages. Continuous variables are presented using means and standard deviations (SD). Comparison between groups was performed using the independent students t test for parametric and Mann Whitney U test for non-parametric data. Paired tests were used when appropriate. Paired tests performed for all tests were two-sided with the level of significance set at 0.01.

**Table 1**
Summary of results.

| Age | Sex | Prior ops | F/U months | CM | | Quick DASH | | Quick DASH Pre-op | | | Quick DASH Post-op | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Pre | Post | Pre | Post | Work | Sports | Pain | Work | Sports | Pain |
| 27 | M | 1 | 13 | 52 | 89 | 24.2 | 2.3 | Mod | U | Severe | N | N | None |
| 50 | M | 2 | 12 | 18 | 77 | 38.6 | 27.3 | Mod | U | Severe | Mild | Mod | Moderate |
| 49 | F | 3 | 24 | 15 | 71 | 47.7 | 18.2 | Mod | No sport | Moderate | Mild | Mild | Mild |
| 59 | M | 1 | 53 | 24 | 82 | 34.1 | 0 | No work | Mod | Moderate | No work | N | None |
| 64 | F | 1 | 59 | 36 | 46 | 25.0 | 56.8 | U | U | Extreme | S | S | Moderate |
| 24 | F | 2 | 62 | 34 | 66 | 66.7 | 27.3 | S | S | Severe | N | Mild | Moderate |
| 38 | M | 2 | 12 | 46 | 58 | 38.6 | 45.5 | Mild | Mild | Moderate | S | Mod | Severe |
| 48 | M | 1 | 19 | 42 | 74 | 43.2 | 27.3 | U | U | Moderate | Mild | Mod | Mild |
| 49 | M | 1 | 12 | | 69 | | 47.7 | | | | U | U | Severe |
| 39 | F | 1 | 16 | | 60 | | 31.8 | | | | Mild | Mild | Moderate |
| 18 | F | 1 | 15 | | 93 | | 11.4 | | | | Mild | Mild | Mild |
| 44 | M | 3 | 38 | | 66 | | 47.7 | | | | S | S | Severe |
| 30 | M | 1 | 29 | | 100 | | 0 | | | | N | N | None |

CM, Constant Murley score; DASH, disabilities of arm, shoulder and hand score; Work, Work module 'Did you have difficulty doing your work because of arm, shoulder or hand pain?'; Sport, Sport / performing arts module 'Did you have difficulty playing your instrument/sport because of pain?'; Function, use of arm for painless activities; U, unable; S, severe difficulty; Mod, moderate difficulty; Mild, mild difficulty; N, no difficulty.