Stabilisation for the disrupted acromioclavicular joint using a braided polyester prosthetic ligament

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ABSTRACT

Purpose. To report outcomes of 21 men who underwent stabilisation for the disrupted acromioclavicular joint (ACJ) using a braided polyester prosthetic ligament.

Methods. 21 men aged 23 to 76 (mean, 43) years underwent stabilisation for the disrupted ACJ of Rockwood type 3 (n=12), type 4 (n=1), and type 5 (n=8) using a braided polyester prosthetic ligament.

Results. The mean time from injury to surgery was 6.8 (range, 0–19) months. The mean follow-up duration was 30 (range, 7–67) months. The mean Constant Score was 86.8 (range, 62–100), and the mean individualised Constant Score was 88.5 (range, 68–100). The mean Oxford Shoulder Score was 43.1 (range, 28–48). The mean abduction power of the operated side was 82% (range, 31%–97%) that of the normal side. 20 patients were satisfied with the procedure. One patient was dissatisfied who developed scapulothoracic bursitis. One patient sustained a redislocation following a fall at 6 weeks and declined further surgery.

Conclusion. The braided polyester prosthetic ligament achieved good outcome for patients undergoing stabilisation for the disrupted ACJ.

Key words: acromioclavicular joint; shoulder dislocation

INTRODUCTION

Acromioclavicular joint (ACJ) injuries occur more frequently in men aged <35 years and account for 12% of shoulder girdle injuries. The mechanism of injury involves a direct blow to the shoulder tip in the adducted arm (particularly during contact sports such as rugby, wrestling, and hockey). Forces applied to the lateral aspect of the shoulder lead to inferior and medial displacement of the scapula and clavicle. As the clavicle and the distance of inferior displacement are limited by the first rib, the force is redirected to the acromioclavicular (AC) and coracoclavicular (CC) ligaments. Greater forces can lead to complete disruption of the AC ligament and then the CC ligament.
ligament, and even the muscular attachments of the deltoid and trapezius. This can lead to inferior subluxation of the acromion to the distal clavicle, as the supporting structures are disrupted.

According to the Rockwood classification,⁴,⁵ there are 6 types of ACJ injury. Type 1 is a simple sprain. Type 2 involves a disrupted AC ligament but an intact CC ligament. Type 3 involves disruption of both AC and CC ligaments. Type 4 involves disruption of both ligamentous complexes, with posterior displacement of the clavicle through the trapezius fascia. Type 5 involves a greater level of disruption of both AC and CC ligaments; the deltotrapezial fascia is torn from the lateral attachments to the clavicle. Type 6 is caused by extreme hyperabduction, in which the clavicle is inferiorly displaced to a subcoracoid or subacromial position, with high risk of neurovascular compromise.

In terms of radiographic appearance, type 1 shows normal appearance; type 2 shows some widening of the ACJ but with a normal CC distance; type 3 shows further disruption of the ACJ with 20% to 100% increase in the CC distance; type 4 can be missed on anteroposterior view but can be seen on axillary view; and type 5 shows >100% increase in the CC distance (Fig. 1).⁵,⁶ Weightbearing views (5 kg weight applied to both normal and injured sides) can maximise displacement to differentiate types.

In terms of treatment, types 1 and 2 can be treated conservatively with immobilisation in a broad arm sling until symptoms subside.⁵ Type 3 can be treated conservatively or operatively; both achieve similar patient satisfaction.⁷ Types 4 to 6 with or without failure in conservative treatment can be treated operatively.² Operative treatments include fixation across the ACJ with Kirschner wires (Phemister technique⁸) or a hook plate,⁹ fixation of the clavicle to the coracoid process with extra-articular techniques (Bosworth screw fixation¹⁰), transfer of the coracoacromial ligament to reconstruct the CC ligament (Weaver-Dunn procedure¹¹), and use of prosthetic materials (non-absorbable sutures around the coracoid,¹²,¹³ suture anchors,¹⁴ and CC screw¹⁵) to augment the ligament transfer or to reconstruct the CC ligament (the TightRope¹⁶ [Arthrex, USA], and the Lockdown¹⁷ [Lockdown Medical, Reddich, UK]). The Lockdown prosthetic ligament is a double braided polyester mesh with loops at either end (Fig. 2). It has been used for revision of the failed Weaver-Dunn procedure, augmentation of the Weaver-Dunn procedure, and stabilisation of the disrupted ACJ.¹⁷-²⁰ This study reports outcomes of 21 men who underwent stabilisation for the disrupted ACJ using the Lockdown polyester ligament.

**MATERIALS AND METHODS**

Between 2005 and 2011, 21 consecutive male patients aged 23 to 76 (mean, 43) years underwent stabilisation for the disrupted ACJ of Rockwood type 3 (n=12), type 4 (n=1), and type 5 (n=8) using the Lockdown prosthetic ligament. Patients with type 3 ACJ injury had first undergone 3 months of conservative treatment and physiotherapy; one of these patients opted for surgery after one month. Two patients with type 5 injury had delayed surgery; one had delayed referral and another opted to avoid surgery initially.

Patients were placed in the beach-chair position, and a vertical (shoulder strap) incision was made over the clavicle. The periosteum was split and the lateral 1 cm of the clavicle excised. Twenty-one The clavicle was reduced, and the measuring guide was passed around
the coracoid process from medial to lateral, using the blunt-ended curved trochar. The appropriate-size prosthetic ligament was passed around the coracoid process. The soft loop was tightened around the base, and the hard loop was looped over the clavicle from posterior to anterior and fixed with a 3.5-mm bicortical screw with a washer (Fig. 3). Appropriate tension was applied through the loop to reduce the clavicle, with a slight over-correction (2–3 mm) of the clavicle position relative to the acromion. The wound was then closed in layers.

The postoperative protocol was standardised and involved 4 weeks of immobilisation in a Polysling, followed by physiotherapist-guided mobilisation, with an aim to restart light activities at 8 weeks and return to sports at 12 weeks.

Functional outcomes were assessed using the Constant Score and the Oxford Shoulder Score. The isometric abduction power was assessed using an electronic spring balance, with the arm held in 90° of abduction in the scapular plane. Scores were compared to that of the contralateral side. An individualised relative Constant Score was calculated after adjusting for the contralateral side score. Patient satisfaction was assessed by asking patients whether they would undergo the procedure again. Radiographs were assessed for evidence of fracture, loosening, or redislocation. Redislocation was defined as a vertical displacement of >50% at the ACJ.

RESULTS

The mean time from injury to surgery was 6.8 (range, 0–19) months. The mean follow-up duration was 30 (range, 7–67) months. The mean Constant Score was 86.8 (range, 62–100), and the mean individualised Constant Score was 88.5 (range, 68–100). The mean Oxford Shoulder Score was 43.1 (range, 28–48). The mean abduction power of the operated side was 82% (range, 31%–97%) that of the normal side (Table 1).

20 patients were satisfied with the procedure. One patient was dissatisfied who developed scapulothoracic bursitis. One patient required arthroscopic subacromial decompression for impingement. One patient sustained a redislocation following a fall at 6 weeks and declined further surgery. No patient had wound infection or clavicular/coracoid process fracture, or required implant removal for irritation.

DISCUSSION

Most ACJ dislocations can be treated conservatively with good outcomes. Surgery is indicated for more severe disruptions (Rockwood types 4 to 6) and failed conservative management. Patients with high physical demand jobs or jobs that require overhead work, or athletes or soldiers are suitable for early reconstruction for type 3 injuries. There are various methods of surgical stabilisation for ACJ disruption (Table 2). Fixation across the ACJ with a hook plate may result in impingement or require implant removal. The Weaver-Dunn procedure (transfer of the coracoacromial ligament to reconstruct the CC ligament) may not provide sufficient stability, as the coracoacromial ligament only provides 30% of the strength of the intact CC ligament. A CC screw improves strength and stiffness of the construct but is associated with coracoid fracture, screw cutout, and screw removal. Other methods include coronoid cerclage sutures and suture anchors. Sacrifice of the coracoacromial ligament for transfer is associated with increased instability of the glenohumeral joint. The coracoacromial ligament acts as a buffer between the acromion and the rotator

Figure 3 (a) Rupture of the coracoclavicular ligaments, and (b) reduction of the acromioclavicular joint and fixation with the Lockdown prosthetic ligament.
Table 1
Patient characteristics and outcomes

<table>
<thead>
<tr>
<th>Sex/age (years)</th>
<th>Injured side</th>
<th>Rockwood type</th>
<th>Initial management</th>
<th>Time from injury to surgery (months)</th>
<th>Follow-up (months)</th>
<th>Postop Oxford Shoulder Score</th>
<th>Postop Constant Score</th>
<th>Postop abduction strength (kg)</th>
<th>Postop strength (% of normal)</th>
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Table 2
Comparison of various acromioclavicular joint reconstruction techniques

<table>
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<tr>
<th>Technique</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<td>Weaver-Dunn procedure</td>
<td>Widely used</td>
<td>Sacrifice of the coracoacromial ligament; lower strength and stiffness than native ligament; may require augmentation</td>
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<tr>
<td>Clavicle hook plate</td>
<td>Strong construct</td>
<td>Plate impingement may necessitate plate removal</td>
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<tr>
<td>Bosworth screw</td>
<td>Low cost, readily available</td>
<td>Bicortical fixation; risk of coracoid fracture or screw loosening or breakage; may require screw removal</td>
</tr>
<tr>
<td>TightRope</td>
<td>No sacrifice of the coracoacromial ligament</td>
<td>Risk of coracoid fracture or soft tissue irritation</td>
</tr>
<tr>
<td>Lockdown prosthetic ligament</td>
<td>No sacrifice of the coracoacromial ligament; enables soft-tissue ingrowth; good tensile strength</td>
<td>Soft tissue irritation may necessitate screw removal</td>
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</table>

cuff; the risk of cuff pathology may theoretically increase following its removal.30 Use of a prosthetic ligament avoids disruption of the coracoacromial arch and is useful when the coracoacromial ligament is deficient or unavailable (in revision surgery). Stabilisation with CC cerclage sutures or suture anchors with polyethylene or polydioxanone has achieved comparable strength to that of the native CC ligament in cadaveric testing.12,14,26 Transfer of the coracoacromial ligament without augmentation results in the weakest strength and stiffness, compared to other surgical options. The stiffness of the Bosworth screw construct is similar to native ligaments when fixation is bicortical.26 The strength of TightRope is comparable to that of the CC cerclage sutures or suture anchors. The tensile strength of the Lockdown prosthetic ligament is greater than both the native CC ligament and the TightRope.31

The success rates for ACJ reconstruction have been around 90%,2,11,13,27 For late reconstruction, the rate is about 78%.13,27 The Lockdown prosthetic ligament has been used in conjunction with the
Weaver-Dunn procedure. The Lockdown prosthetic ligament encourages soft tissue ingrowth and thus is thought to prevent late failure. There is no loss of reduction after screw removal at a minimum of 9 months, owing to soft tissue ingrowth.

The Constant Score may be biased when used in a heterogeneous group, in particular given the high weighting for the strength component. To correct this bias, the relative Constant Score to account for age is used. In our study, the strength and Constant Score of the affected side were compared to those of the non-affected side. This gave a measure of proportional strength and an individualised Constant Score, which is a more reliable measure of shoulder function in heterogeneous groups.

One limitation of this study was the potential for observer bias, as the observer involved in clinical assessment also involved in the operative procedure. In addition, preoperative function was not assessed using the same assessment scales, and thus improvement in functional scores was not known. Further randomised controlled studies are needed to demonstrate superiority of one surgery modality over another.

**CONCLUSION**

The Lockdown prosthetic ligament achieved good outcome for patients undergoing stabilisation for the disrupted ACJ.

**DISCLOSURE**

No conflicts of interest were declared by the authors.

**REFERENCES**