



## Acromioclavicular joint reconstruction using anchor sutures : Surgical technique and preliminary results

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A number of surgical procedures have been described for reconstruction of the disrupted acromioclavicular (AC) joint. Among these is the use of anchor sutures tied over a small button plate. The present study aims to evaluate the preliminary results with this technique in 15 patients with a mean age of 31 years (range : 19-48 years). The shoulder was evaluated clinically using the Constant-Murley Shoulder Score, and radiologically. Indication for surgery was Rockwood type IV-V AC joint dislocation.

All patients returned to work within a mean time of 11.2 weeks (range 8-18) postoperatively. The mean Constant-Murley Shoulder Score at last follow-up was 92.8. Postoperative radiographs confirmed anatomic reduction in all patients. Residual subluxation occurred in one patient and dislocation occurred in another. All patients except one were satisfied with the results in terms of functional performance and cosmetic appearance. In conclusion, considering its low morbidity, unnecessary hardware removal and minimal complications from breakage or migration of metal implants, this technique appears to offer a good alternative in AC joint stabilization.

**Keywords :** acromioclavicular joint ; anchor sutures ; dislocation.

### INTRODUCTION

Acromioclavicular (AC) joint injury accounts for 20% of all injuries of the shoulder (9). The indication for non-operative treatment is well established for Rockwood types I, II, III (10). In contrast, in the

more severe types of injuries (Rockwood types IV,V), surgical stabilization of the AC joint has been recommended to prevent disabling pain, weakness, and deformity (2). These treatments are based on one of three types of fixation : acromioclavicular, coracoclavicular, and dynamic muscle transfer. These procedures can all be combined with ligament augmentation and/or resection of the distal clavicle. Although some studies have used tendon allograft or autograft, most coracoclavicular reconstructions are based on transfer of the coracoacromial ligament (6).

Acromioclavicular fixation with smooth pins, fully threaded pins and screws is reportedly associated with complications such as degenerative AC joint disease, breakage and migration of the pins (14). Complications were also reported following dynamic muscle transfers (4).

Many devices have been used for coracoclavicular fixation including screws and wires. They carry

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Table I. — Details of patients with acromioclavicular injury

No.	Age at surgery (years)	Grading of injury (Rockwood)	Return to work (weeks)	Subjective result	Constant-Murley Shoulder Score	Radiological results
1	23	V	10	Excellent	100	Anatomical
2	29	IV	9	Excellent	98	Anatomical
3	25	V	8	Good	95	Anatomical
4	19	IV	11	Excellent	94	Anatomical
5	35	IV	10	Excellent	95	Anatomical
6	39	IV	11	Good	84	Subluxation
7	25	V	18	Excellent	100	Anatomical
8	43	V	12	Excellent	99	Anatomical
9	32	IV	8	Good	90	Anatomical
10	40	V	8	Poor	58	Dislocation
11	41	IV	10	Excellent	94	Anatomical
12	23	V	16	Good	98	Anatomical
13	48	V	9	Excellent	85	Anatomical
14	22	IV	13	Excellent	98	Anatomical
15	20	IV	12	Excellent	98	Anatomical

the risk of breakage and migration into the lung, heart and even large vessels (11,13). In addition, with time, cerclage material such as stainless steel wire or Dacron tape can wear through the bone, amputating the clavicle or the coracoid process and possibly resulting in loss of reduction (12).

However, use of suture anchors could potentially reduce the risk of neurovascular injury compared with the passage of sutures around the base of the coracoid. Moreover, no hardware removal is needed and minimal complications from breakage or migration of implants have been reported (1).

Our objective was to describe the use of suture anchors tied over a small button plate and to evaluate its preliminary results in 15 consecutive patients.

#### MATERIALS AND METHODS

Between 2004 and 2006, we treated 15 patients (13 males and 2 females) with Rockwood type IV-V acromioclavicular joint dislocation at Mansoura University Hospital (table I). All patients underwent AC joint reconstruction using No 5 FibreWire® suture anchors (Arthrex) and a small button plate with 4 holes. The mean age was 31 years (range 19-48 years). Three patients sustained their injuries during athletic activities, three during falls and nine during motorcar accidents. The mean time interval between the injury and the operation was 11 days (range 7-20 days).

#### Surgical Technique

Under general anaesthesia, the patient was placed in the beach chair position. The shoulder and upper extremity were prepped and draped according to the standard technique. Examination under anaesthesia was performed to document the range of motion and stability of the shoulder, and ease of reduction of the acromioclavicular joint.

A strap-like 7 cm incision was made in Langer's line, starting 2.5 cm posterior to the clavicle, crossing the clavicle 2.5 cm medial to the AC joint and extending distally to a point medial to the tip of the coracoid process. The deltoid and trapezius muscles were elevated subperiosteally from the distal clavicle and anterior acromion. The deltoid muscle was retracted anteriorly and distally to visualize the base of the coracoid. The distal inch of the clavicle was grasped with a towel clip and lifted upwards, so that the AC joint could be thoroughly debrided from the intra-articular disc, and any loose frays of the acromioclavicular ligaments were stripped off the clavicle or acromion.

The base of the coracoid was identified and prepared for introduction of the anchor. A 2 mm drill bit was used to create two tunnels through the superior cortex of the clavicle over the footprint of the two original ligaments, about 1 cm apart and 2 to 5 cm proximal to the distal end of the clavicle. A special needle was passed through these tunnels to retrieve 2 strands of the suture through each hole. The 4 free ends of the sutures were passed through the holes of the small button plate. The acromio-

clavicular joint was reduced into anatomical position, and the 4 ends were tied and tightened over the plate while the assistant held the reduction. The deltoid and trapezius muscles and the fascia were reattached to the clavicle and the skin was closed.

Postoperatively, the shoulder was protected in a sling for 4-6 weeks. Pendulum exercises were started 3 weeks after surgery. In the sixth week, the patients started progressive range of motion and strengthening exercise. Neither heavy lifting nor resistive exercises were allowed for 3 months postoperatively.

### Clinical assessment

All the patients were evaluated at least at 6 weeks, 3 months, and at last follow-up using the Constant-Murley Shoulder Score (3). Also patient data including occupation, hand dominance, date and mechanism of injury, history of shoulder injury, range of motion, neurological deficit, and return to work were recorded.

### Radiographic assessment

Standard anteroposterior radiographs of the shoulder and an anteroposterior radiograph of the AC joint with 15° cephalic tilt as described by Zanca (15) were obtained. The vertical distance between the inferior border of the acromion and the clavicle was compared with the contralateral side (less than 2 mm difference, anatomical; 2-4 mm, slight loss of reduction; 4-8 mm, partial loss of reduction; greater than 8 mm, total loss of reduction). We also recorded the postoperative degenerative changes, if any, in the AC joint.

## RESULTS

Immediate postoperative radiograph showed anatomical reduction of the AC joint dislocation in all patients (fig 1); during follow-up, one patient developed subluxation and another patient had dislocation. The mean follow-up period was 12 months (range: 9-23 months). Mean time to return to work was 11.2 weeks (range: 8-18). Free mobility of the shoulder joint was found in 13 patients; two patients had a limitation of shoulder movements. The mean Constant-Murley Shoulder Score was 92.8 (range: 59-100) (table I).

Two patients had superficial wound infection; healing was achieved by an intensive course of



*Fig. 1.* — Postoperative radiograph demonstrating anatomical reduction of the acromioclavicular joint.

antibiotics. The patient who had dislocation during the follow-up period sustained a severe trauma one month after operation, and radiographs revealed a fracture of the coracoid with avulsion of the anchor and displacement of the button plate, however he denied further surgery (fig 2). No neurovascular complications or secondary AC joint degenerative changes were detected.

## DISCUSSION

Injuries to the AC joint are among the most common injuries in the athletic patient. Many procedures have been described to reconstruct the AC joint following disruption. These treatments are based on three types of fixation: acromioclavicular, coracoclavicular and dynamic muscle transfer. A variety of methods of AC fixation have been reported in literature: use of K-wires, K-wires augmented with tension band wires, fully threaded pins, and screws. Known complications associated with pin fixation are an increased incidence of degenerative AC joint disease, breakage of the pins and migration into the lung, the heart, and even large vessels (11,13). Dynamic muscle transfers involving the short head of the biceps reportedly have a high



**Fig. 2.** — Postoperative radiograph demonstrating fracture of the coracoid process and dislocation of the acromioclavicular joint.

complication rate and have been associated with injury to the musculocutaneous nerve (4). Coracoclavicular fixation reportedly has a high rate of success and a lesser amount of complications (7). There are two basic forms of fixation : rigid and non rigid constructs. Screws and wires represent a rigid form of fixation, and sutures from either absorbable or non absorbable material characterize a non rigid form of fixation. Reported complications have included screw breakage and screw pullout (5). Fixation between the clavicle and coracoid using synthetic cerclage bands is stable enough to hold the acromioclavicular reduction, but the direction of fixation of simple cerclage techniques normally leads to anterior subluxation of the clavicle relative to the acromion, and the technique also requires a large exposure and is technically demanding (7). Jerosch *et al* (8) evaluated eight different AC reconstruction techniques in ten cadaveric shoulders and found that the bone anchor system for distal clavicle fixation in the base of the coracoid process and a medialized hole in the clavicle restore anatomy best, and they recommended this technique for anatomic AC reconstruction.

The use of suture anchors could potentially diminish the risk of neurovascular injury associated with the passage of sutures around the base of the coracoid and reduce surgical time ; placement of the fixation device in the direction of the coracoclavicular ligament using suture anchors instead of simple cerclage techniques avoids anterior displacement of the clavicle in relation to the coracoid (1). Imhoff and Chernchujit (7) compared the mechanical properties of the coracoclavicular ligament with various reconstruction techniques and found that the intact coracoclavicular ligament failed by avulsion or midsubstance tear at 589 N, with a stiffness of 38.10 N/mm and elongation to failure of 10.81 mm, while No. 5 FiberWire® (Arthrex) yielded a value of 485 N and an elongation to failure of 23.6 mm. Using two strands thus provides more than the tensile strength of the native coracoclavicular ligament. This Fiberwire anchor suture is also non absorbable and provides permanent fixation to the reduced acromioclavicular joint.

Furthermore, the sutures are tied over a small button plate, with the advantages of strengthening the repair by augmentation of the cortex of the clavicle and load distribution over its surface in addition to prevention of osteolysis of the distal clavicle. Moreover, the direction of the fiber wires was the same as the direction of the fibers of the conoid and trapezoid ligaments.

In this study, the average Constant score was 92.8 with a high level of patient satisfaction. Our results are nearly similar to those reported with an arthroscopic technique which was introduced by Chernchujit *et al* (2) with an average Constant score of 95. In the only patient who subsequently had a dislocation in our series, there was a major trauma and the anchor was strong enough to cut through the coracoid process.

Arthroscopic reconstruction for AC joint dislocation using suture anchors is more complicated and is technically demanding. Open surgical repair remains the gold standard treatment of high-grade AC joint disruption ; it provides adequate exposure and allows for good debridement of the AC joint with perfect exposure of the base of the coracoid, and relatively less surgical time. If the deltoid and trapezius muscles and the fascia are properly

reattached, the patient can start postoperative exercises in a short time and morbidity from open surgery will be minimal. We had superficial wound infection in only two patients, one of whom was diabetic, and both healed after using the proper antibiotic after culture and sensitivity test.

## REFERENCES

1. **Breslow MJ, Jazrawi LM, Bernstein AD, Kummer FJ, Rokito AS.** Treatment of acromioclavicular joint separation : suture or suture anchors ? *J Shoulder Elbow Surg* 2002 ; 11 : 225-229.
2. **Chernchujit B, Tischer T, Imhoff AB.** Arthroscopic reconstruction of the acromioclavicular joint disruption : surgical technique and preliminary results. *Arch Orthop Trauma Surg* 2006 ; 126 : 575-581.
3. **Constant C, Murley AH.** A clinical method of functional assessment of shoulder. *Clin Orthop Relat Res* 1987 ; 214 : 160-164.
4. **Ferris BD, Bhamra M, Paton DF.** Coracoid process transfer for acromioclavicular dislocations. A report of 20 cases. *Clin Orthop Relat Res* 1989 ; 242 : 184-194.
5. **Harris RI, Wallace AL, Harper GD et al.** Structural properties of the intact and the reconstructed coracoclavicular ligament complex. *Am J Sports Med* 2000 ; 28 : 103-108.
6. **Harris TG, Lynch SA.** Acromioclavicular joint separations : update, diagnosis, classification, and treatment. *Curr Opin Orthop* 2003 ; 14 : 255-261.
7. **Imhoff AB, Chernchujit B.** Arthroscopic anatomic stabilization of acromioclavicular joint dislocation. *Oper Tech Sports Med* 2004 ; 12 : 43-48.
8. **Jerosch J, Filler T, Peuker E, Greig M, Siewering U.** Which stabilization technique corrects anatomy best in patients with AC-separation ? An experimental study. *Knee Surg Sports Traumatol Arthrosc* 1999 ; 7 : 365-72.
9. **Kocher M, Duipre MM, Feagin JA.** Shoulder injuries from alpine skiing and snow boarding : aetiology, treatment and prevention. *Sports Med* 1998 ; 25 : 201-211.
10. **Larsen E, Bjerg-Nielsen A, Christensen P.** Conservative or surgical treatment of acromioclavicular dislocation. A prospective, controlled, randomized study. *J Bone Joint Surg* 1986 ; 68-A : 552-555.
11. **Mazet RJ.** Migration of a Kirschner-wire from the shoulder region into the lung : report of two cases. *J Bone Joint Surg* 1943 ; 25-A : 477-83.
12. **Moneim MS, Balduini FC.** Coracoid fracture as a complication of surgical treatment by coracoclavicular tape fixation. A case report. *Clin Orthop Relat Res* 1982 ; 168 : 133-135.
13. **Norell H, Liewellyn RC.** Migration of threaded Steinmann pin from an acromioclavicular joint into the spinal canal : a case report. *J Bone Joint Surg* 1965 ; 47-A : 1024-1026.
14. **Sethi GK, Scott SM.** Subclavian artery laceration due to migration of a Hagie pin. *Surgery* 1976 ; 80 : 644-646.
15. **Zanca P.** Shoulder pain : involvement of the acromioclavicular joint. (Analysis of 1,000 cases). *Am J Roentgenol Radium Ther Nucl Med* 1971 ; 12 : 93-506.