



## Arthroscopic fixation of type III acromioclavicular dislocations

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**Type III Acromio-Clavicular Joint dislocations can be treated successfully by surgical stabilisation *in situ*, with or without reconstruction of the coracoclavicular ligaments. The authors describe a simple and reliable mode of fixation, performed arthroscopically. The technique can be used for *in situ* fixation, or as part of an arthroscopically assisted Weaver and Dunn procedure. Using a metallic anchor loaded with a braided polyfilament suture, a strong and reliable fixation of the clavicle to the coracoid process is obtained. No hardware removal is necessary. Concomitant glenohumeral pathology can be treated simultaneously.**

**Keywords :** acromioclavicular dislocation ; arthroscopic fixation.

### INTRODUCTION

Acromioclavicular (AC) joint injuries are frequently encountered in general practice. While there is a general consensus to treat type I and II lesions conservatively, the treatment of type III AC-dislocations remains controversial. A recent survey amongst the members of the American Orthopaedic Society for Sports Medicine and the Accreditation Council for Graduate Medical Education orthopaedic program residency directors confirmed this lack of consensus regarding the mode of treatment of these injuries (12). Acute and chronic dislocations can be treated surgically with or without reconstruction of the torn coracoclavicular ligaments, and with or without resection of the distal clavicle (1,5,7,8,10,13).

More recently arthroscopic techniques have been described for both acute (4,11,14,18) and chronic (11) dislocations. We have successfully used an arthroscopic technique to treat type III AC-joint dislocations since 2005. A Nr 5 Fiberwire and a metallic anchor into the coracoid process have been used to stabilise the clavicle into the AC-joint. To the best of our knowledge this is the first clinical report to use a metallic anchor loaded with a strong non-resorbable polyfilament wire to treat AC-dislocations arthroscopically.

The technical aspect of the arthroscopic fixation from the distal aspect of the clavicle to the coracoid process is described.

### MATERIAL AND METHODS

From October 2005 till November 2006 12 patients with a type III AC-joint dislocation were treated arthroscopically at our institution. All surgeries were performed by the senior author (JS). There were 4 chronic (> 3 months from traumatic event) and 8 acute cases.

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In 10 cases a combined transfer of the coracoacromial ligament with resection of the distal end of the clavicle was performed arthroscopically (modified Weaver-Dunn procedure); in 2 acute cases a simple fixation to the coracoid was performed.

In all 12 cases the same simple fixation technique of the clavicle to the coracoid was performed arthroscopically. All cases now have between 6 and 18 months of follow-up.

### SURGICAL TECHNIQUE

The patient is installed in the lateral decubitus position with a light traction weight on the affected arm (3-4.5 kg, according to the weight and the musculature of the patient). The AC-joint is examined for instability and reducibility. The joint should be reducible manually for this all-arthroscopic technique. The position of the coracoid process is marked on the skin with a pen marker. The shoulder region is prepared and a sterile area is draped, giving free access for surgery from the midclavicular area to the upper one third of the humerus. The area around the coracoid process should be readily accessible. The surgeon should be aware of all neurovascular structures in this area, particularly medially from the base of the coracoid process. A standard posterior glenohumeral portal for arthroscopy is created, and inspection of the glenohumeral joint is performed. Intra-articular glenohumeral pathology is addressed before the stabilisation procedure of the AC-joint is started.

The arthroscope is now redirected in the subacromial bursa. Bursoscopy will reveal the coracoacromial ligament, which is a key landmark. Bursal adhesions are removed with a power shaver or an electro-coagulation device. Formal bursectomy is only necessary anteriorly. The posterior bursa is left undisturbed to minimise bleeding. A second portal is created anterolaterally 1-2 cm distal from the tip of the acromion, in line with the anterior edge of the acromion. This portal is used as a working portal, and as an accessory viewing portal.

The coracoacromial ligament is being followed anteromedially till the coracoid bone is encountered.

If a transfer of the coracoacromial ligament is being planned, this ligament is now harvested from the under-surface of the acromion with a Beaver knife. The knife is introduced through the lateral portal, and incision should start in the periosteal layer laterally to maintain adequate length of the ligament. A Nr 2 Fiberwire is placed on the ligament, and the strands are pulled posteriorly.

If no transfer of ligament is planned, then the CA-ligament is left totally undisturbed.

The plane between the deltoid muscle and the subscapularis tendon anteriorly is developed with a blunt instrument. Usually no formal adhesions are encountered in this area. The arthroscope is brought to the lateral portal. The coracoid process is now fully visible, with its insertions of the conjoined tendon inferiorly, the coracoacromial ligament anterolaterally and more medially the insertions of the coracoclavicular ligaments. Superomedially one frequently encounters adhesions and haematoma, due to the lesions to the coracoclavicular ligaments. More medially is the neurovascular bundle and one has to proceed with extreme caution in this area. For the described fixation, it is not necessary to proceed into this area.

Once the anterior surface of the coracoid process has been well defined, a spinal needle is introduced in a straight anteroposterior direction, with the tip of the needle being placed against the coracoid bone under direct arthroscopic vision. A mini-portal of 2 mm is being created at this point. A non-absorbable titanium 6.5 mm Pebax anchor (Smith&Nephew Endoscopy, Andover, UK), preloaded with Fiberwire Nr 5 (Arrex, Naples, Florida) is being used. The anchor requires pretapping. It is important to maintain the AP-direction during insertion of the anchor. The strength of the construct is being tested manually by using an anteriorly directed pull-out force.

The strands of the Nr 5 Fiberwire are then pulled out through the lateral portal.

Attention is now paid to the AC-joint. The AC-joint is opened from the underside using an electrocoagulation device. It is advisable to have an assistant holding the distal clavicle in a reduced position to facilitate this. An arthroscopic resection of the distal clavicle can be performed with a burr from an anterior portal located at the level of the AC-joint. Adhesions are removed from the underside of the clavicle and the periosteal layer is lifted from the clavicle, to have at least 1 cm of clavicle bone visible from underneath. If one is just performing a reduction without ligament transfer and distal clavicle resection, the AC-joint is not formally opened. In this case the inferolateral tip of the clavicle is located, and only the periosteal layer and adhesions are stripped from the lateral clavicle.

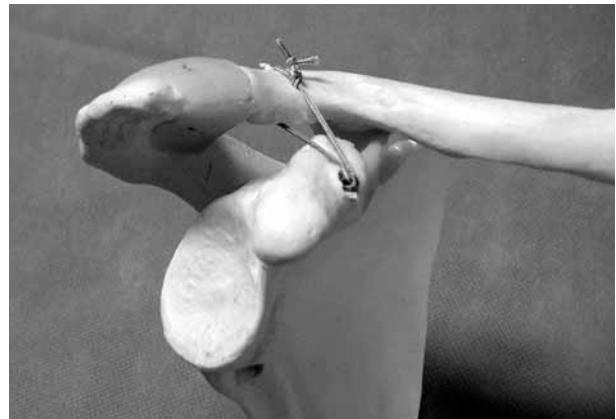
Two 21 Gauge standard intramuscular needles are used to locate the anterior and posterior aspects of the distal clavicle. These are being introduced in a superior-inferior direction and located with the arthroscope. These guiding needles remain in place and are visible

from the outside and from the underside with the arthroscope. We now have created a "target zone" on the distal clavicle. Now a 3.5 mm drill hole is made in the distal clavicle in a supero-inferior direction, approximately 1.5 cm from the distal end of the (remaining) clavicle. A small skin incision centred on the clavicle is being used for this purpose. The incision is being carried up to the periosteum of the clavicle. The exit hole of the drill bit is checked arthroscopically. One end of the Nr 5 Fiberwire suture is transferred through this hole inside-out. The other end is being transferred inside-out adjacent to the anterior margin of the clavicle, through the same skin portal. The clavicle is now held in a reduced position and the Fiberwire Nr 5 tied on the clavicle, thereby further reducing the clavicle into its position. Considerable force can be applied, and before final knot tying, reduction of the AC-joint is manually checked. The reduction can also be appreciated from within the joint with the arthroscope. This can be done both in simple reductions, and in the case of a modified Weaver-Dunn procedure. In the latter case, 2 more drill holes have to be created to transfer the CA-ligament into the distal end of the clavicle. The ligament is tied onto its receptor bed after reduction and fixation of the clavicle to the coracoid as described above. A sawbone model of the construct is shown in figure 1.

## RESULTS

After a follow-up period of 6-18 months, we observed no cases with loss of fixation. All patients were satisfied with the result of their surgery. In 3 cases (2 chronic, 1 acute) a minor superior displacement (< 3 mm) of the distal clavicle was noted on radiographs at final follow-up. None of these were symptomatic. All other cases showed a reduced and stable AC-joint.

All metallic anchors remained *in situ*; none showed evidence of migration. There was one case with a postoperative superficial wound infection in the area of the superior distal clavicle (portal of knot tying), which resolved uneventfully with local wound care and a short course of antibiotics orally (5 days cefazolin). There were no deep infections. No other complications were observed. Up to date all fixation devices have remained *in situ* and none is planned to be removed in the near future. No adverse effects to the devices have been noted so far.



**Fig. 1.** — Saw bone model depicting the position of the 6.5 mm Pebax anchor and the Nr 5 Fiberwire, stabilising the clavicle to the coracoid process.

In the study group we noted the simultaneous occurrence of 1 SLAP lesion, 1 posttraumatic full thickness cartilage fissure on the glenoid, 2 undersurface tears of the supraspinatus tendon and 1 full thickness tear of the supraspinatus tendon. All of these lesions were treated arthroscopically during the same intervention.

## DISCUSSION

The treatment of type III AC-dislocations remains controversial. Acute lesions can be treated with reduction and some form of stabilisation, either to the acromion (5,15) or to the coracoid process (7,9,11,14,18). Various hardware devices have been used for this purpose. Some advocate complementing these acute lesions with a resection of the distal clavicle (9,17,18). Others have advocated repair or augmentation of the torn coracoclavicular ligaments (1,6,7,9,13).

Chronic lesions have traditionally been treated with the Weaver-Dunn procedure or one of its modifications. In all chronic instances it has been advocated to stabilise the clavicle in some way towards the coracoid process, either by temporary (screws) or permanent (anchors + wires, loops, grafts) hardware (8,11,13,18). Biomechanical testing showed less AC-joint instability with supplementary fixation to the coracoid compared to the traditional Weaver-Dunn technique (6).

The senior author has used a modified Weaver-Dunn technique for chronic type III lesions for many years by means of open surgery. As described by Dimakopoulos *et al* (7), we have used a Nr 5 Ethibond or more recently a Nr 5 Fiberwire successfully for many years. The wire was transfixed to the coracoid process distally, and proximally tunnelled through a drill hole in the distal clavicle. This type of fixation proved to be reliable and obviated the need for hardware removal.

Biomechanical testing in cadaver specimens showed no difference if a Nr 5 braided suture wire is looped around the coracoid or if a metallic anchor is being used (2).

With the advent of increasing arthroscopic possibilities, an arthroscopic technique was developed to mimic the traditional Weaver-Dunn procedure. Some authors have recently described their experiences with an all-arthroscopic technique to treat AC-dislocations. Fixation to the coracoid was with a metallic screw from the clavicle to the coracoid process (11,14,18), with metallic anchors and a titanium plate (4), or with SecureStrand cable (18). We preferred to use a Fiberwire Nr 5, as we have done for many years with the open technique. For this purpose we used a strong bone anchor (Peba 6.5 mm) that allowed the introduction of a Fiberwire Nr 5 through its eyelet. It was thought to increase the pull-out strength of the anchor by following the principles of the deadman theory as described by Burkhart (3). The pull of the wire reduces the clavicle inferiorly and slightly anteriorly, which opposes the forces of dislocation. Wolf has described an all arthroscopic technique with SecureStrand, a polyfilament band that is also used in spinal surgery (18). This type of fixation does not require an anchor, but direct drilling from the clavicle into the coracoid is required.

Since we have used our technique, we have noticed that some patients have intra-articular lesions and that the incidence (5:12) appears higher than expected. Others have described the combination of AC-joint dislocation with rotator cuff tears, but the true incidence of this finding remains unclear up to date (16). Further studies to highlight the prevalence of concomitant lesions in patients with AC-dislocations seem warranted.

The technique we have described can be used as part of a modified Weaver-Dunn technique, or as a sole means of fixation to treat acute AC-dislocations. To the best of our knowledge this is the first clinical report to use a metallic anchor loaded with a strong non-resorbable polyfilament suture to treat AC-dislocations arthroscopically.

The rate of complications is low and no hardware failure has been noted up to date.

The fixation of the clavicle with a Fiberwire Nr 5 and a metallic anchor in the coracoid process to reduce the AC-joint appears to be effective and reliable in the clinical setting, and this confirms previous biomechanical studies.

The clinical results of the (modified) Weaver and Dunn procedure for acute and chronic Type III AC-dislocations have been well documented in the literature. Our report highlights an alternative technical aspect of this procedure, performed arthroscopically. The arthroscopic procedure might further add to the diagnostic work-up, especially concerning the concomitant intra-articular lesions. Another advantage of our technique is that no hardware removal is necessary after initial stabilisation.

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