ARTHROSCOPIC ANATOMIC STABILIZATION OF ACROMIOCLAVICULAR JOINT DISLOCATION

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A review of the literature shows that there are over 100 different surgical procedures to reconstruct the acromioclavicular joint. Despite these numerous options for reconstruction, the arthroscopic stabilization of this joint has rarely been reported. We describe a new arthroscopic technique to stabilize the acromioclavicular joint using 5-mm corkscrew anchors, No. 5 Fiberwire, and a small titanium platelet. With this technique one obtains the following advantages: anatomic reconstruction, stable stabilization, excellent cosmesis, less morbidity, no need to remove an implant, and avoidance of complications from breakage or migration of metal implants.

KEY WORDS: acromioclavicular, arthroscopic, stabilization, reconstruction

Injuries to the acromioclavicular joint are among the most commonly occurring problems in athletic patients. In a review of dislocations of the shoulder complex, acromioclavicular dislocation is the second most common injury. It accounts for 20% of all injuries of the shoulder.[1] Most commonly, a sprain to the joint occurs with varying degrees of ligamentous damage and displacement. Nonoperative treatment is well established for Rockwood types I, II, and III. The outcome is usually excellent, with full return of function following conservative treatment of these injuries.[2-6] In contrast, in the more severe types of injuries (Rockwood types IV through VI), surgical stabilization of the acromioclavicular joint has been recommended to prevent disabling pain, weakness, and deformity. The surgical techniques available for reconstructing the injured joint are varied and evolving. There are over 100 different surgical procedures to reconstruct the acromioclavicular joint, implying that there is no ideal method of reconstruction. Despite these numerous options for reconstruction, arthroscopic reconstruction of the acromioclavicular joint has rarely been reported. The aim of this report is to demonstrate a new technique for arthroscopic stabilization of acromioclavicular joint dislocations of Rockwood types IV and V (Fig 1) using 5-mm corkscrew anchors with No. 5 Fiberwire (Arthrex, Naples, FL) and a small titanium platelet.

OPERATIVE TECHNIQUE

Under a regional scalene block and combined general anesthesia, the patient is placed in the beach chair position with the injured shoulder in approximately 30° of abduction. The shoulder and upper extremity are prepped and draped in the usual sterile fashion. Examination under anesthesia is performed to document the patient's range of motion, stability of shoulder, and ease of reduction of the acromioclavicular joint. The posterior portal is created in the standard manner approximately 2 cm inferior and medial from the posterolateral corner of the acromion. After diagnostic arthroscopy of the glenohumeral joint, the camera is introduced into the subacromial space from the posterior portal. An anterolateral portal is made approximately 1.5 cm lateral and in line with the anterior border of the acromion. A 3.5-mm 90° right angle radiofrequency ablation device (OPES™; Arthrex) is introduced from the anterolateral portal and used to remove some of the bursal tissue for better visualization of the subacromial space and the base of the coracoid medially. The damaged disc is removed and the undersurface of the acromioclavicular joint is denervated using the radiofrequency ablation device to prevent persistent pain in the acromioclavicular joint in the future.

The coracoid process is identified percutaneously using a spinal needle. Then a 1-cm incision is made over the spinal needle, approximately 2 cm medial to the acromioclavicular joint over the superior aspect of the distal clavicle. A new arthroscopic guide system (Arthrex) is inserted through this incision and placed onto the superior surface of the base of the coracoid which can be seen directly from the subacromion portal to ensure accurate placement of the fixation (Fig 2) and followed by the 5-mm corkscrew (Fig 3). The strand of each suture is passed out arthroscopically through the lateral portal.

Subcutaneous dissection is performed followed by subperiosteal elevation of soft tissue to the superior surface of the distal part of clavicle without dissection into the injured acromioclavicular joint. A 2.0-mm drill bit is used to create two tunnels through the anterior half of the clavicle. A flexible needle from Nitinol (Arthrex) is passed through this tunnel to retrieve the fiberwires through the tunnel in

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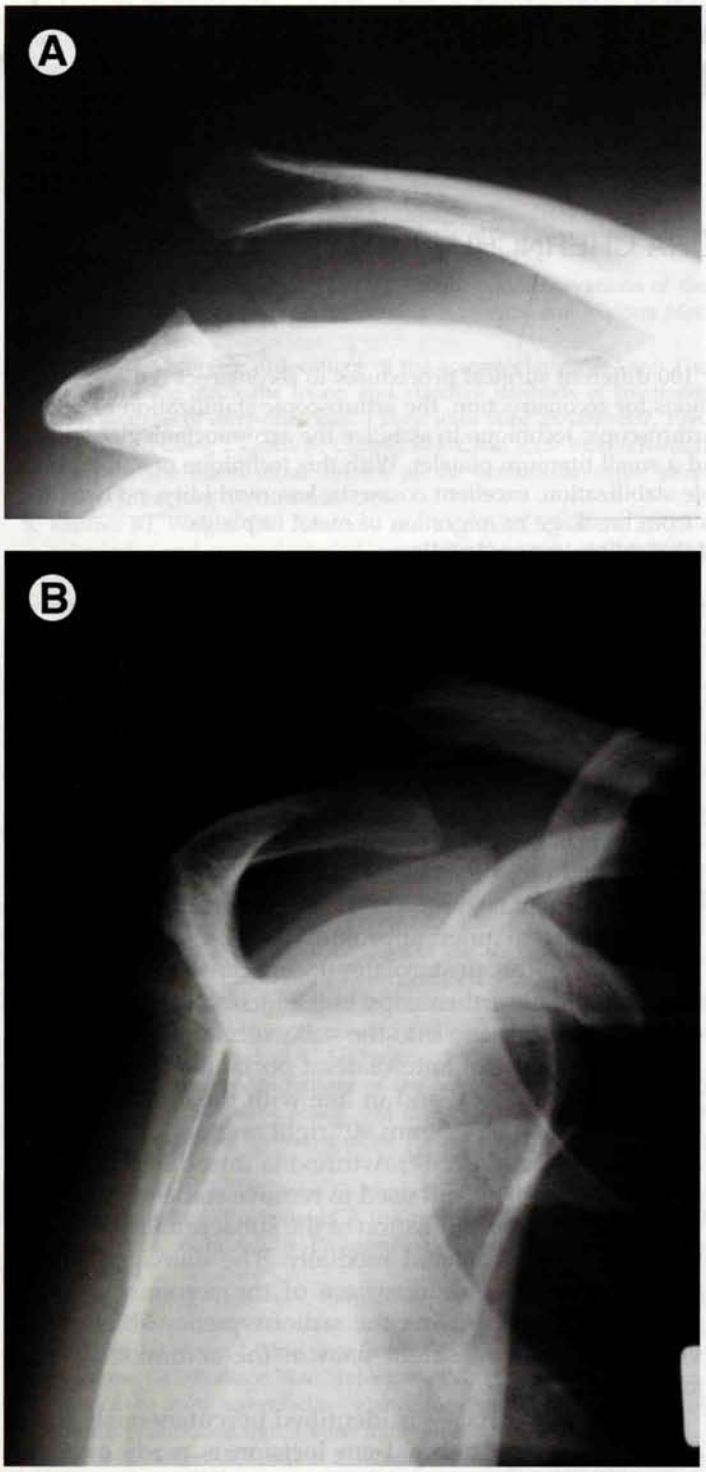

Fig 1. Preoperative anteroposterior (A) and transscapular (B) radiographs of a patient with acromioclavicular joint dislocation.

the distal clavicle (Fig 4). The same procedures are then repeated in the second tunnel.

The four free ends of the sutures are passed through the holes of the titanium plate. The shoulder traction is released and the acromioclavicular joint is reduced into anatomical position. The slipknot is made and tightened over the titanium platelet while the assistant holds the reduction (Fig 5). Perfect reduction is directly controlled using the inferior aspect of the acromioclavicular joint as a guide. Radiography is performed intraoperatively again to reassure perfect reduction (Fig 6). Postoperatively, the arm is kept in a sling for 4 to 6 weeks. Pendulum exercises are started after surgery. In the sixth week, the patient begin to start a progressive range of motion and strengthening regimen. Neither heavy lifting nor resistive exercises are allowed for 3 months postoperatively.

DISCUSSION

Review of the literature reveals five main surgical techniques: Fixation across the acromioclavicular joint, dynamic muscle transfer, fixation between the clavicle and the coracoid, reconstruction of ligaments, and excision of the distal clavicle. Because of its high rate of clinical success, lesser amount of soft tissue dissection, and relatively low incidence of complications, coracoclavicular reconstruction has become a more common surgical procedure for the treatment of severe acromioclavicular joint injuries. There are two basic forms of fixation between clavicle and coracoid, rigid and nonrigid constructs. Screws and wires represent a rigid form of fixation, and sutures (either absorbable or nonabsorbable) or grafts characterize nonrigid forms of fixation. The fixation technique structures can be looped around the base of the coracoid, passed through a transosseous tunnel in the clavicle, and fixed to the base of the coracoid with a screw or an anchor.

Fixations between the clavicle and coracoid using synthetic cerclage bands have previously been reported as the primary techniques of acromioclavicular reconstruction or as augmentation of other acromioclavicular reconstruction techniques.[7-12] Although the simple cerclage technique is stable enough to hold the acromioclavicular reduction, the direction of fixation between the clavicle and coracoid is also very important. The direction of fixation of simple cerclage techniques normally leads to anterior subluxation of the clavicle relative to the acromion (Fig 7)[13] and can

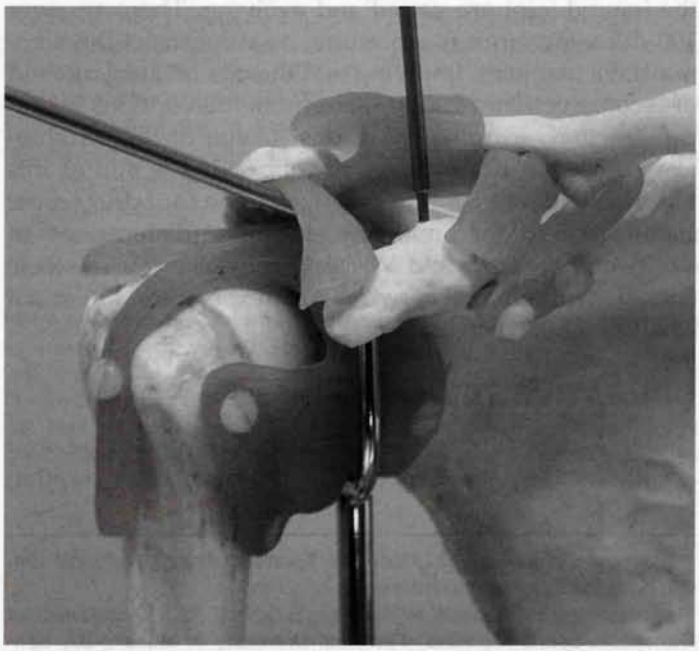

Fig 2. The base of coracoid can be seen directly from the subacromion portal to ensure accurate placement of the drill guide at the base of the coracoid.

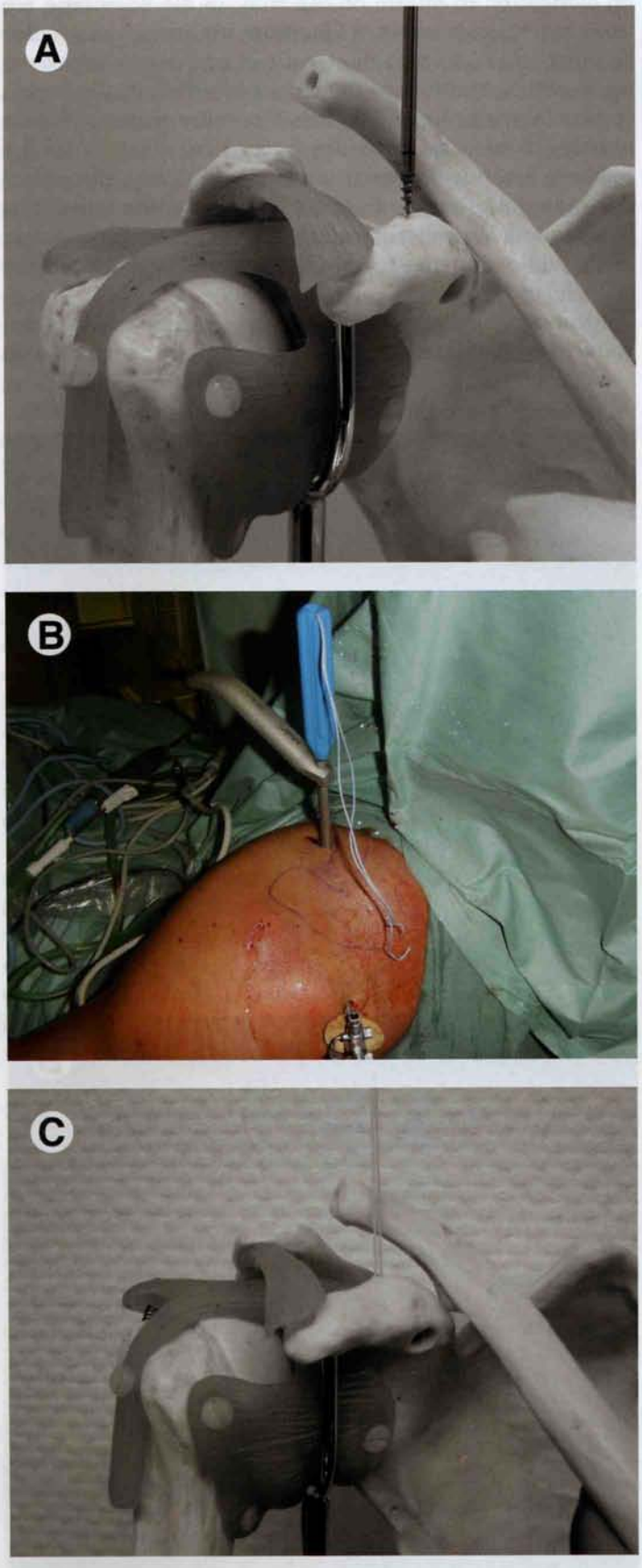

Fig 3. (A) The 2.8-mm Fastak anchor or the 5-mm corkscrew (Arthrex) is placed into the superior surface of the base of the corocoid. (B) Positioning of the special guide delivery system for the 5-mm corkscrew with No. 5 Fiberwire. (C) The strand of each suture is passed out just anterior to the distal clavicle.

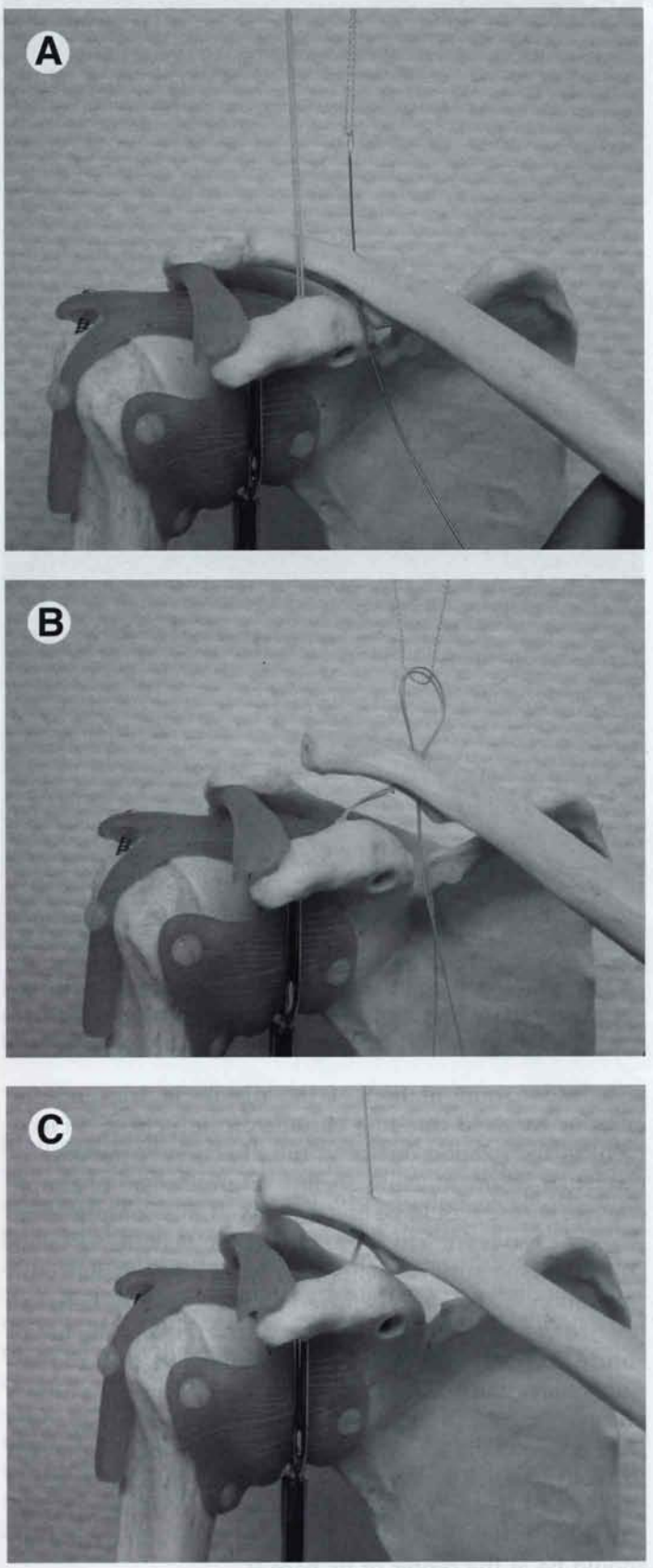

Fig 4. (A) A meniscus needle with a 2/0 thread is passed through the tunnel from superior. (B,C) The free ends of the Fiberwire are retrieved through the tunnel in the distal clavicle.

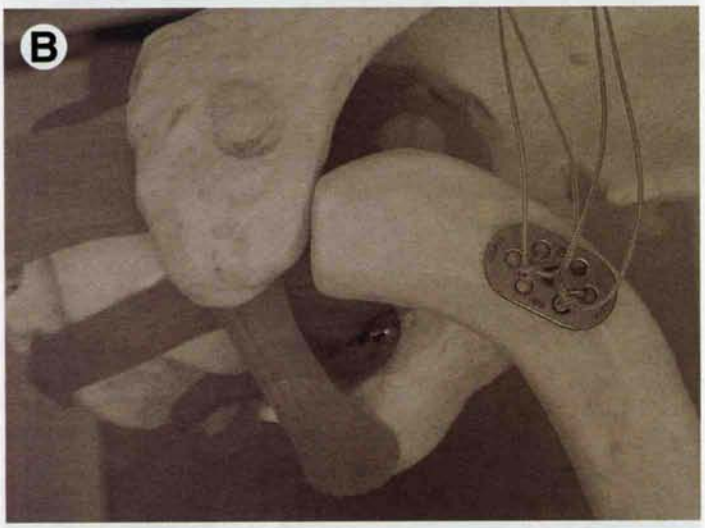

Fig 5. (A) The four free ends of the No. 5 Fiberwire are passed through the holes of the titanium plate and (B) the slipknot is made and tightened over the titanium plate.

also lead to amputation of the distal clavicle and the anterior coracoid due to a chronic erosion effect.[14] Placement of the fixation device in the direction of the coracoclavicular ligament using anchor suture instead of simple circlage suture would be better to avoid this complication. A recent cadaveric study examined the benefits of using suture versus suture anchors for acromioclavicular joint separation.[15] The study showed similar stability between the two methods of coracoclavicular fixation but 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. Drill holes on the clavicle and coracoid are also important to avoid anterior subluxation of the loop. The drill holes at the clavicle should be made at the junction of the anterior and middle of the clavicle and the drill hole at the coracoid should be at the center of its base.[13]

We compared coracoclavicular ligament properties 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. In our study we used Fiberwire (Nos. 2 and 5) (Arthrex), which is a strong suture-like material. Reported tensile strength testing yielded a value of 345 N for No. 2 and 485 N for No. 5 and an elongation to failure of 23.6 mm. In the beginning we used two strands of No. 2 Fiberwire for acromioclavicular reconstruction, so that the tensile strength was increased up to 690 N, more than the tensile strength of the native corococlavicular ligament. This Fiberwire material is also nonabsorbable and provides permanent fixation to the reduced acromioclavicular joint. Theoretically, the use of this material provides an effective stabilization which has biomechanical properties adequate to protect physiologic loads while allowing for physiologic motion between the clavicle and coracoid.

Although open acromioclavicular surgery remains the conventional treatment of high-grade joint dislocation, it

Fig 6. Postoperative anteroposterior (A) and transscapular (B) radiographic views demonstrating anatomical reduction of the acromioclavicular joint.

often requires a larger incision, with partial detachment of the deltotrapezial fascia. Recent advances in operative arthroscopic procedures allow us to better inspect the interior of the shoulder complex relative to the conventional open procedure (Imhoff and coworkers[17]). The advantage of an arthroscopic acromioclavicular reconstruction is that it can be performed as an outpatient procedure, with less compromise of musculotendinous structures, less morbidity, shorter rehabilitation, and quicker return to activity. In addition, the cosmesis of this procedure is also excellent. Wolf and coworkers proposed a new arthroscopic reconstruction technique for acromioclavicular joint dislocation using SecureStrand cable passed through a transosseous tunnel in the coracoid and clavicle with the aid of an ACL drill guide and marking hook.[18]

We propose a new arthroscopic reconstruction technique for acromioclavicular joint dislocation using No. 5 Fiberwire passed through a transosseous tunnel in the clavicle and placed suture anchors onto the base of the coracoid. In addition, the sutures are tied over a small titanium plate which is used as a cortical augmentation and to distribute load on the clavicular surface to strengthen the repair and prevent the osteolysis of the distal clavicle. By using an arthroscopic approach, the base of the coracoid is directly visualized during subacromial bursoscopy and this visualization is clearly superior to any obtained by any open approach. Although the arthroscopic reduction and fixation is more complicated, the morbidity of arthroscopic surgery is less than that of the open approach.

We have performed this technique in 15 patients, including 9 patients with type IV and 6 patients with type V acromioclavicular joint dislocation. In the first 10 patients we used No. 2 Fiberwire and 2.8-mm Fastak, while in the second series we changed to No. 5 Fiberwire and 5-mm corkscrew anchors. The preliminary results in all patients are good, with no complications and excellent patient satisfaction.

In summary, we hope that this new technique for arthroscopic stabilization of the acromioclavicular joint in high-grade dislocation using 5-mm corkscrew anchors with No. 5 Fiberwire and small titanium platelets provides adequate and permanent stability with less morbidity, and patients do not require removal of the implant. Using the arthroscopic approach enables us to accurately place the suture anchors in the base of the coracoid without difficulty and diminishes the risk of neurovascular injury associated with the passage of sutures around the base of the coracoid. In addition, the passage of theFiberwire is in the same direction as that of the native coracoclavicular ligament (Fig 8A,B), providing anatomic reduction and physiologic motion of the acromioclavicular joint, approximating the ruptured ends of the ligament, and facilitating healing of the coracoclavicular ligament.

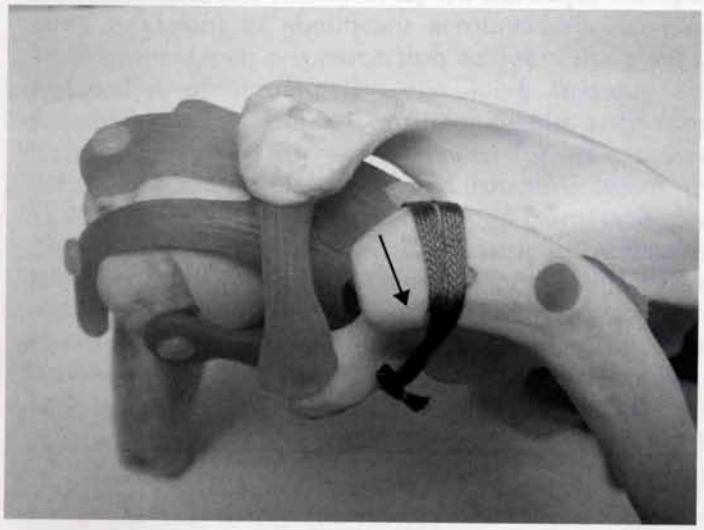

Fig 7. The direction of fixation of the simple cerclage technique leads to anterior subluxation of the clavicle relative to the acromion. The arrow shows the vector of force leading to anterior subluxation of the clavicle).

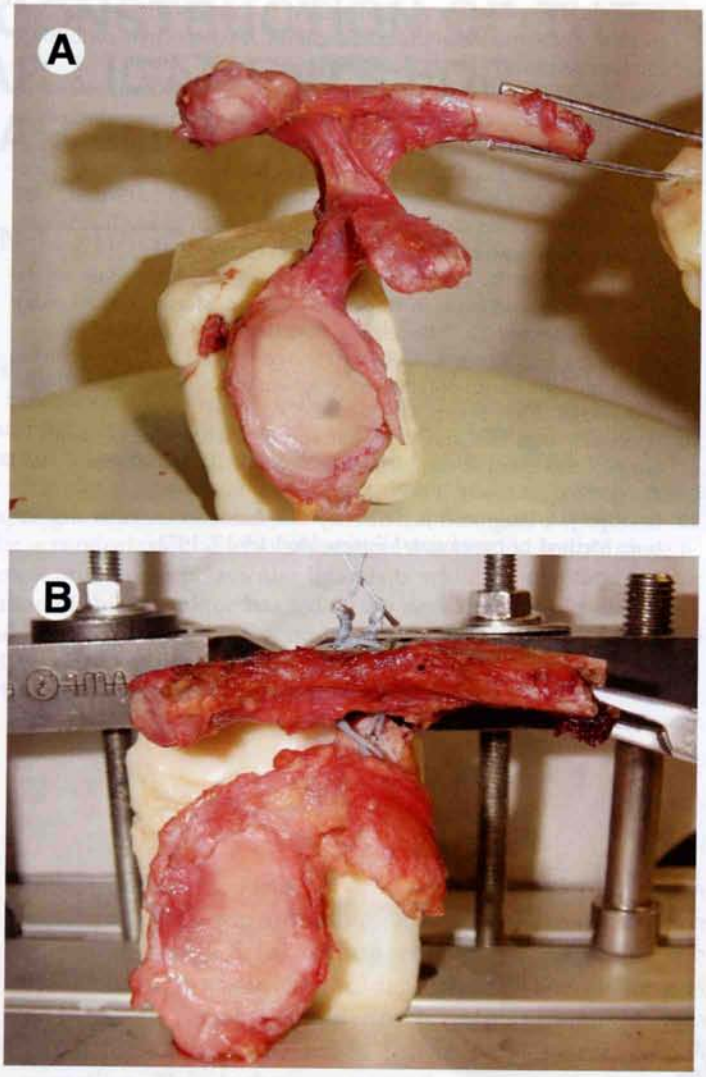

Fig 8. (A) Anatomic situation of the two coracoid ligaments. (B) Anatomic reconstruction with two corkscrews and two fiberwires in the direction of the two ligaments.

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