Anatomic Acromioclavicular Joint Reconstruction With Semitendinosus Allograft: Surgical Technique

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Abstract: Acromioclavicular joint separations are common shoulder injuries in the active patient population. Nonoperative management is recommended for Rockwood type I and II injuries, whereas surgical reconstruction is recommended for type IV and VI separations. The management for type III and V injuries is more controversial and is determined on a case-by-case basis. A multitude of surgical reconstruction techniques exist, and there is little evidence to support one technique over another. The anatomic technique aims at reconstructing the coracoclavicular ligaments and bringing the clavicle back into its anatomic position. When the anatomic technique is augmented with a graft, biomechanical studies have shown superior reconstruction strength and stability compared with standard nonanatomic techniques. Additionally, anatomic reconstruction allows for better cosmesis and functional outcome measures at midterm follow-up compared with nonanatomic techniques. In this Technical Note, we describe our preferred technique for anatomic repair of acromioclavicular joint separation using a semitendinosus allograft.

Acromioclavicular (AC) joint injury is one of the most common shoulder injuries in the athletic population,[1] and is often a result of a blunt force to the acromion with the arm in an adducted position.[2] It is estimated that in the young athletic population, the incidence of AC joint injuries is 9.2 per 1,000 person-years, with males being affected twice as often as females.[1] AC joint injuries can result in general shoulder pain, scapular instability, muscle fatigue of the trapezius and deltoid, and neurologic symptoms due to injury or traction of the brachial plexus.[3] There are a variety of nonsurgical and surgical treatment options for the management of AC joint injuries, and treatment is often determined based on the severity of injury as determined by the Rockwood classification. There is a general consensus among most orthopaedic specialists that Rockwood type I and II lesions are most appropriately managed nonoperatively, whereas types IV and VI are almost always treated surgically. The optimal management of type III and type IV injuries are more controversial, and are often decided on a case-by-case basis.[2,4] There are dozens of surgical techniques available, with little evidence to indicate that any one

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Table 1. Key Steps for Anatomic Acromioclavicular Joint Reconstruction

Identify anatomic landmarks.
Conduct diagnostic arthroscopy to evaluate for glenohumeral pathology.
Make a superior incision over the clavicle down to the deltotrapezial fascia.
Expose clavicular edges and acromioclavicular (AC) joint, tag the deltoid muscle.
Debride AC joint of any scar tissue, preventing reduction of clavicle
Bluntly dissect around the coracoid and place FiberTape around coracoid.
Pass the graft under the coracoid using a 90° hemostat and passing sutures.
Place a drill hole above the coracoid at the approximately 30-mm mark and pass FiberTape looped under the coracoid through the hole.
Pass the graft under the clavicle.
Reduce clavicle, confirm fluoroscopic reduction, tie in Dog Bone implant.
Tie graft around clavicle and oversew with multiple sutures.
Close deltotrapezial interval with multiple interrupted sutures.

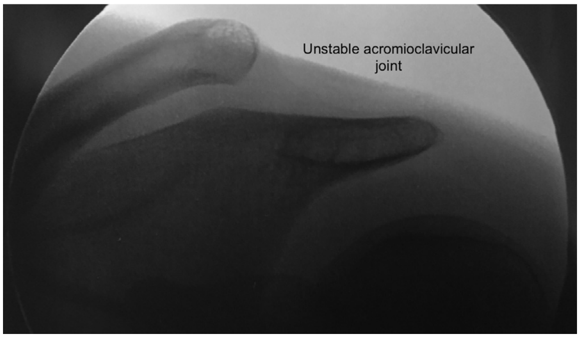

Fig 1. Intraoperative fluoroscopic anterior-posterior image showing a type III right acromioclavicular joint separation.

technique is better than another.[4] The most common surgical options include coracoclavicular screw fixation, coracoacromial ligament transfer, and numerous methods of anatomic coracoclavicular (CC) ligament reconstruction. Anatomic CC ligament reconstruction is performed in an effort to bring the CC ligaments as close as possible to their native anatomic locations, and can be accomplished either using an open procedure or arthroscopically, with and without graft augmentation.

In this Technical Note, we describe our preferred technique for open anatomic repair of acromioclavicular joint separation using a semitendinosus allograft. A summary of key steps is provided in Table 1, and a summary of the technique is provided in Video 1.

Technique

Patient Positioning and Anesthesia

Following the induction of regional and general anesthesia, the patient was placed in the modified beach chair position, taking care to pad all bony prominences and appropriately position the neck and contralateral extremity. The right shoulder was examined under anesthesia and showed no evidence of glenohumeral joint instability with well-preserved passive range of motion in all planes, but with obvious asymmetry and deformity at the AC joint. At this point, the right shoulder was prepped and draped sterilely. A time-out was called to confirm the correct patient, procedure, operative site and side, and administration of antibiotics. Intraoperative fluoroscopy was used to confirm the type III AC joint separation (Fig 1).

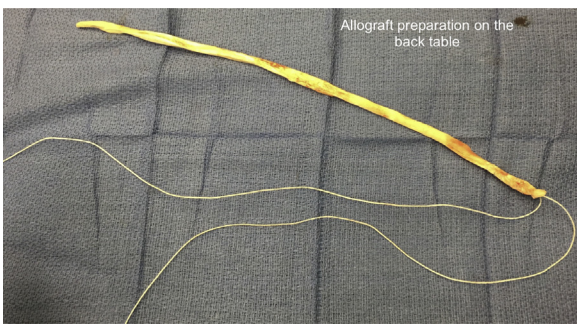

Fig 2. Intraoperative photograph of the semitendinosus allograft prepared with a simple whipstitch to allow for ease of graft passing.

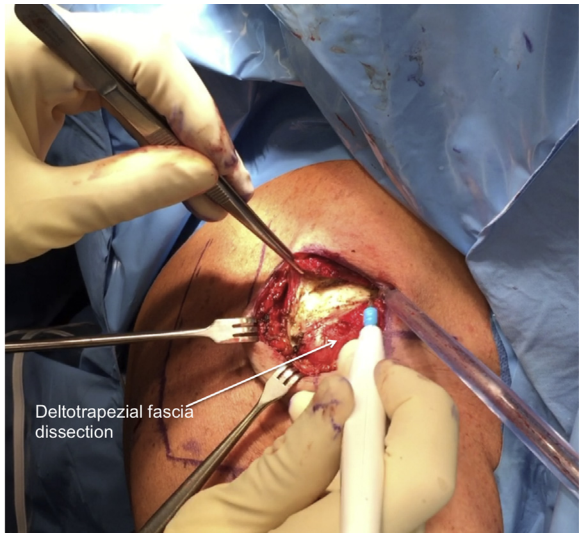

Fig 3. Intraoperative photograph of the right shoulder showing identification and dissection of the underlying deltotrapezial fascia and exposure of the clavicular edges.

Diagnostic Arthroscopy

The arthroscope was inserted into a standard posterior portal 2 cm inferior and 1 cm medial to the posterolateral corner of the acromion, and a standard midglenoid anterior portal was established using an outside-in technique through the rotator interval just lateral to the coracoid process. Diagnostic arthroscopy

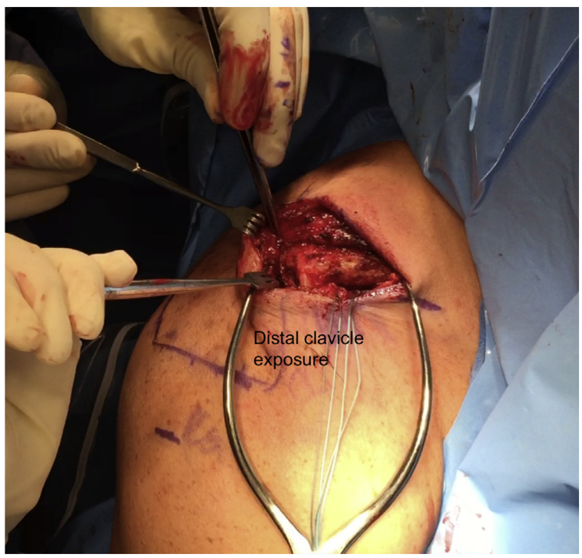

Fig 4. Intraoperative photograph of the right shoulder showing the exposure of the distal end of the clavicle after debridement of any scar tissue preventing the reduction of the joint.

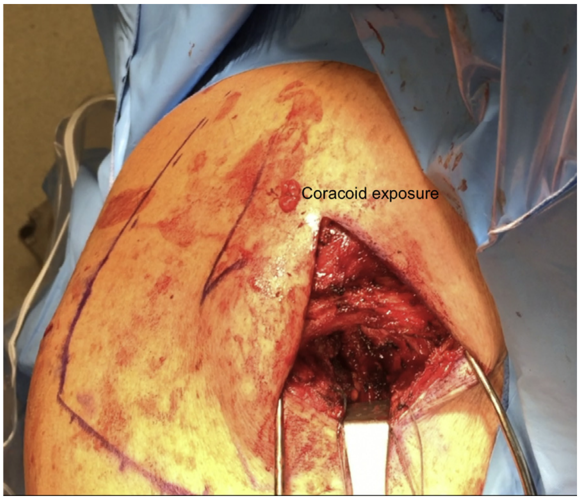

Fig 5. Intraoperative photograph of the right shoulder showing visualization of the coracoid after meticulous dissection.

revealed significant type 1 labral fraying that required debridement. The anterior labrum was intact. There was mild posterior inferior labral delamination with a small tear appreciated; no repair was performed. The remaining intra-articular structures, including the biceps tendon and rotator cuff, were intact.

At this point, the arthroscopic instrumentation was withdrawn, and attention was turned to the AC joint reconstruction. On the back table, a semitendinosus allograft was thawed and prepared at both ends with a simple whipstitch to allow for ease of graft passing (Fig 2). A superior incision was made and carried sharply down to the underlying deltotrapezial fascia, which was opened in line with the clavicle (Fig 3). The lateral-most edge of the clavicle was exposed. The AC joint was exposed and scar tissue was removed to allow for reduction (Fig 4). Attention was then turned to the coracoid, which was carefully exposed via meticulous

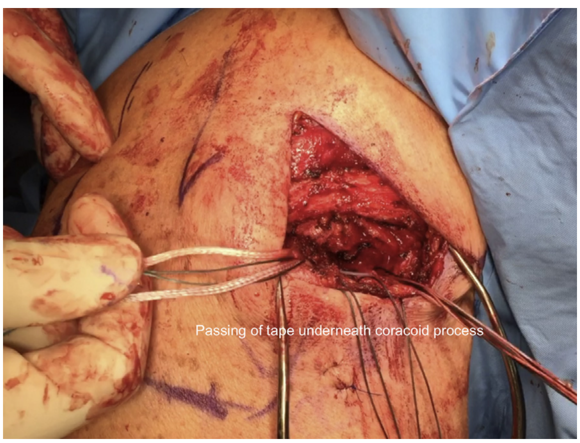

Fig 6. Intraoperative photograph of the right shoulder after passing FiberTape underneath the coracoid process that will be used to pass the semitendinosus graft.

Fig 7. Intraoperative photograph of the right shoulder showing the semitendinosus graft passed under the coracoid and clavicle.

dissection (Fig 5). A passing suture was placed around the coracoid using a 90° hemostat (Fig 6). The passing suture was used to pass 2 FiberTape sutures (Arthrex, Naples, FL) around the base of the coracoid along with a semitendinosus allograft (Fig 7). Once passed, the FiberTape ends and sutures at each end of the allograft

Fig 8. Intraoperative photograph of the right shoulder showing the drill hole was placed in the clavicle, at the approximately 30-mm point, in a posterior-to-anterior and superior-to-inferior direction.

Fig 9. Intraoperative photograph of the right shoulder showing the Arthrex Dog Bone implant placement on top of the clavicle and attached to FiberTapes that are passed through the hole previously drilled in the clavicle.

were maintained around the base of the coracoid. Attention was turned back to the clavicle, where at the approximately 30-mm point from the lateral aspect, a single drill hole was placed in the clavicle in a posterior-to-anterior and superior-to-inferior direction (Fig 8).

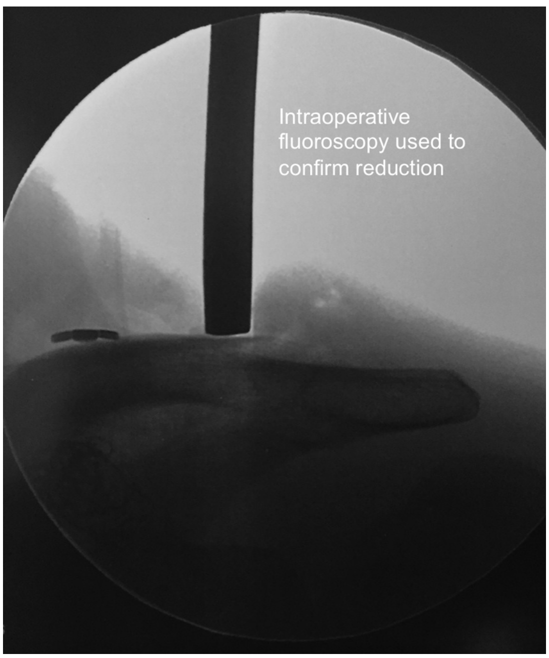

Fig 10. Intraoperative FluoroScan of the right shoulder showing provisionally reduced clavicle with the Dog Bone implant in place before tying of the FiberTapes.

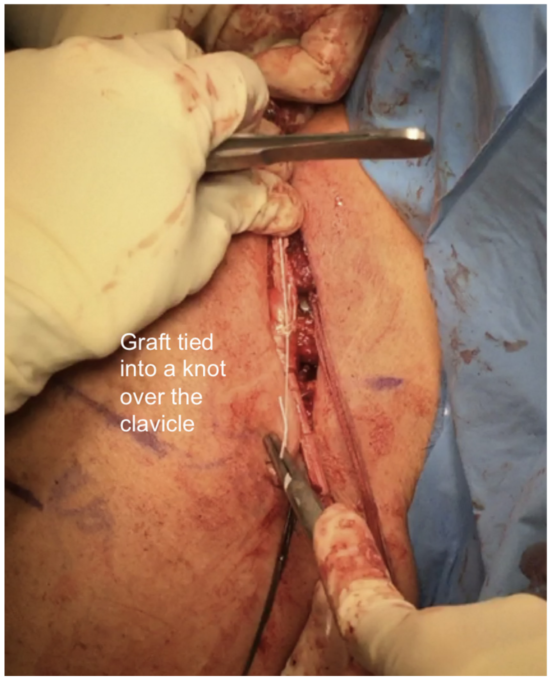

Fig 11. Intraoperative photograph of the right shoulder showing the graft being tied in a knot before over-sewing it with multiple no. 2 high-strength nonabsorbable sutures.

The 2 FiberTapes were then passed through this drill hole. A Dog Bone button (Arthrex) was placed along the top of the clavicle and the free ends of the Fiber-Tapes were passed through it (Fig 9). Tentative

Fig 12. Intraoperative photograph of the right shoulder showing over-sewing the semitendinosus graft with multiple no. 2 high-strength nonabsorbable sutures.

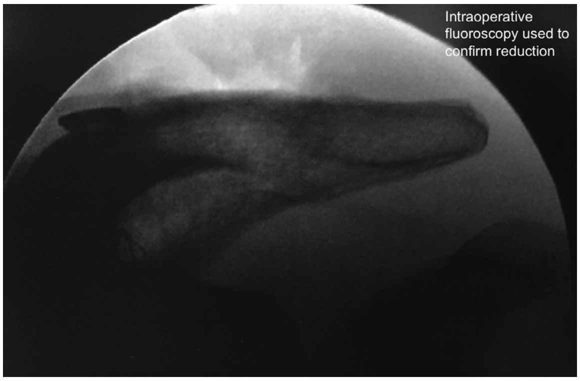

Fig 13. Intraoperative FluoroScan of the right shoulder showing successful reduction of the acromioclavicular joint after open reconstruction using a semitendinosus allograft.

reduction was confirmed via intraoperative fluoroscopy with the mini C-arm (Fig 10). The clavicle was provisionally reduced and the FiberTapes were tied, maintaining the reduction. Next, the semitendinosus allograft, already looped under the coracoid, was looped around the clavicle and tied over the front (Fig 11). This was done by tying a knot in the graft itself, followed by oversewing it with multiple no. 2 high-strength nonabsorbable sutures (Fig 12). The reduction was confirmed with fluoroscopic guidance (Fig 13).

The wound was then copiously irrigated. The deltotrapezial interval was closed with multiple interrupted no. 2 Ethibond sutures (Fig 14) taking care to maintain a watertight repair. The wound was then closed in layers in standard fashion, and the arthroscopy portal sites were closed with interrupted 3-0 Prolene sutures.

Discussion

In this Technical Note, we describe the open anatomic reconstruction of AC joint reconstruction using a semitendinosus allograft. Currently, there is no consensus in the literature as to the optimal surgical technique for AC joint reconstruction. Traditionally, nonanatomic methods such as the Weaver-Dunn procedure have been used, which incorporates the transfer of the acromial attachment of the coracoacromial ligament to the distal end of the clavicle with the goal of improving stability of the AC joint. More recently, anatomic techniques have been developed to either repair the coracoclavicular (CC) ligaments or reconstruct them with graft material.

There are several drawbacks of the nonanatomic reconstruction of the AC joint when compared with anatomic techniques. When the coracoacromial ligament is transferred from the acromion to the distal end of the clavicle, this often displaces the clavicle anteriorly and can cause permanent deformity.[5] Instead, by reconstructing or repairing the CC ligaments, the clavicle is restored to its anatomic position for better cosmesis. It has also been proposed that by reconstructing the CC ligaments, a greater degree of stability in the coronal and axial planes can be achieved

Fig 14. Intraoperative photograph of the right shoulder after the deltotrapezial interval was closed with multiple, interrupted no. 2 Ethibond sutures.

Table 2. Pearls and Pitfalls of the Surgical Technique

Pearls	Pitfalls
• Intraoperative fluoroscopy can help confirm reduction. • Diagnostic arthroscopy performed at the beginning of the procedure can help to determine the presence or absence of concomitant pathology. • Allograft preparation can be performed at any time on the back table with a simple whipstitch using high-strength, nonabsorbable suture.	• Take care not to over-reduce the AC joint; use fluoroscopy to help guide the reduction maneuver. • Clear soft tissue around the coracoid and clavicle to ensure ease of graft and device passage. • Only a single drill hole is needed through the clavicle for this technique—take care to place this drill hole in the appropriate position to avoid creating stress-risers in the clavicle.

Table 3. Advantages and Disadvantages of the Surgical Technique

Advantages	Disadvantages
• Diagnostic arthroscopy performed at the beginning of the procedure can help to determine the presence or absence of concomitant pathology. • Allograft fixation provides additional structural support to the button-tape construct. • No drill holes in the coracoid, and single small drill hole in the clavicle avoids the creation of stress risers, which may lead to fracture.	• The use of allograft introduces risks associated with allograft tissue, including infection and disease transmission. • Although the drill hole is small, placing a drill hole in the clavicle does create the potential for a stress riser, which can lead to fracture.

compared with other nonanatomic techniques.[5] The coracoacromial ligament used in nonanatomic reconstruction is also an insufficient replacement for the CC ligament in terms of strength and stiffness. Furthermore, by limiting the anterior and posterior instability inherent with nonanatomic techniques, postoperative pain may be diminished, leading to faster rehabilitation.[5]

Because of the large volume of AC joint reconstruction techniques and limited consensus of one superior technique, few direct clinical comparisons have been made between anatomic and nonanatomic reconstructions. Tauber et al.[5] conducted a prospective comparison study, with 24 patients observing clinical outcomes between the modified Weaver-Dunn and anatomic CC reconstruction techniques using a semitendinosus tendon autograft. Although both groups experienced improvements in ASES and Constant Scores at 37 months, the patients receiving an anatomic reconstruction experienced superior outcomes relative to the modified Weaver-Dunn group. In addition, the anatomic group had a decreased CC distance under stress loading ($P = .027$), indicating greater postoperative stability.

Overall, many AC joint reconstruction techniques have been described, with the majority resulting in good to excellent clinical outcomes. Anatomic reconstruction with allograft augmentation has several potential advantages over nonanataomic techniques, including better replication of the native CC ligament strength and stiffness, increased joint stability, decreased subluxation, and superior clinical outcomes scores in some studies. Advantages and disadvantages of this technique can be found in Table 2, whereas pearls and pitfalls of the technique can be found in Table 3.

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