Technical Note

Acromioclavicular Joint Reconstruction with Recessed Clavicular Implant Technique Guide

Patrick J. Buckley, B.S., Toufic R. Jildeh, M.D., Muhammad J. Abbas, B.S., and Kelechi R. Okoroha, M.D.

Abstract: Acromioclavicular (AC) joint injuries are common and often require operative intervention. Although there are many described surgical techniques, there remains a lack of consensus on the optimal technique. The purpose of this Technical Note is to provide our preferred method of AC reconstruction with a recessed clavicular implant and semitendinosus allograft, which mitigates hardware pain associated with arthroscopic techniques.

Acromioclavicular (AC) joint injury is common among young, healthy individuals. AC injuries have been reported to account for up to 40% of shoulder injuries in contact sports.[1,2] The AC joint is the principal connection between the axial skeleton and the upper extremity. The dynamic and static stabilizers of the joint allow its movement to occur in all planes while the intricate ligamentous restraints are vital for the function of the shoulder.[3-5] Injuries to the AC joint can result in pain, cosmetic concerns, scapular instability, early fatigue of the trapezius and deltoid, and neurologic symptoms caused by brachial plexus disruption.[6] With improvements in repair techniques and implants, clinical outcomes after AC joint reconstruction are excellent with low failure rates and high return-to-sport rates.[3,4]

Although there have been many described techniques for AC joint reconstruction, there is no consensus on the optimal procedure.[5] The literature has shown that anatomic reconstruction techniques are biomechanically superior to nonanatomic reconstructions[7]; however, each fixation technique possesses its own set of benefits and drawbacks. Studies have demonstrated that fixation with suture or suture tape for AC ligament repair have demonstrated similar biomechanical strength to the native AC and coracoclavicular (CC) ligaments.[8] Arthroscopic techniques are less invasive compared to open procedures.[4,9] Pan and colleagues[10] conducted a meta-analysis comparing the arthroscopic tape reconstruction to the hook and plate technique for Rockwood types III-V AC dislocations and found similar outcomes between the techniques for postoperative reduction (coracoclavicular distance weighted mean difference [WMD] 0.24, 95% confidence interval [CI] −0.67, 1.15; $P = .602$ and function of the AC joint (constant score WMD 6.12; 95% CI −3.84, 16.08; $P = .229$); however, tape fixation resulted in less postoperative pain and improved cosmesis compared to the hook and plate technique (VAS WMD −0.69; 95% CI −1.10, −0.27; $P = .001$).[10] The presently described technique attempts to address pitfalls of open reconstruction and other arthroscopic techniques.

The purpose of this Technical Note and video (Video 1) is to provide our performed method of AC joint reconstruction following an acute AC injury incorporating a recessed clavicular component. The benefit of this technique is minimally invasive surgery, improved ability to arthroscopically diagnose concomitant pathology, and improved integrity of fixation with less prominent hardware because of the design of the clavicular implant (Table 1).

Surgical Technique

Patient Setup

The patient is laid supine on a beach chair operating table, and induction with general endotracheal

From the Henry Ford Hospital, Department of Orthopaedic Surgery (P.J.B., T.R.J., M.J.A.), Detroit, Michigan, and the Mayo Clinic Department of Orthopedic Surgery (K.R.O.), Minneapolis, Minnesota, U.S.A.

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Address correspondence to Patrick J. Buckley, B.S., Henry Ford Hospital, Department of Orthopaedic Surgery, 2799 W. Grand Blvd, Detroit, MI 48202, U.S.A. E-mail: pbuckle3@hfhs.org

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Table 1. Advantages and Disadvantages of Arthroscopic AC Joint Reconstruction

Advantages
Minimally invasive with recessed clavicular implant
Improved ability to diagnose concomitant pathology
Allograft fixation improves integrity of hardware reduction construct
Disadvantages
Greater potential for clavicular fracture as a result of drilling
Visualization can be difficult compared to open surgery
Increased risk of coracoid fracture
Use of allograft introduces increased risk of infection or disease transmission

AC, acromioclavicular.

anesthesia is performed. The patient is positioned in the beach chair setup using a Trimano arm positioner (Arthrex, Naples, FL), and an examination of the extremity is performed with the patient under anesthesia.

Surgical Approach

A standard posterior arthroscopic portal is established, and the diagnostic examination is performed per surgeon preference. An anterosuperior lateral portal is established for instrumentation, and the arthroscopy is switched from the traditional 30° to a 70° scope for improved medial visualization. The coracoid is identified, and an arthroscopic burr is then used to clear and decorticate the inferior surface of the coracoid (Fig 1).

The arthroscope is then moved to the subacromial space using the posterior portal. A mid-lateral portal is then established under direct visualization. The acromion is then skeletonized, and scar tissue is debrided from under the acromion and between the acromion and clavicle joint to facilitate a more anatomic reduction.

A 3-cm incision is then made over the superior clavicle in line with the coracoid using a 10-blade scalpel; the incision is carried down to the level of the clavicle. An AC reconstruction guide (Arthrex) is placed under arthroscopic visualization at the inferior aspect of the clavicle. A guide wire is passed from the superior clavicle through the clavicle and coracoid under arthroscopic visualization (Fig 2). The guide pin is then over-reamed proximally, and a nitinol wire is used to pass the suture construct from superior to inferior and out of the mid-lateral portal. The suture construct is affixed to the knotless dog bone button (10 mm × 8 mm; Arthrex) of the low-profile AC repair system (Arthrex) and reinserted through the mid-lateral portal until visualized underneath the coracoid (Fig 3). The proximal sutures are then passed through the low-profile titanium acromioclavicular implant. After the dog bone button is firmly against the base of the coracoid, the clavicle is then manually reduced. The proximal sutures are then alternatively tightened while pressure is applied superiorly to facilitate the recessed seating of the low-profile AC implant. Reduction of the AC joint, as well as proper seating of the dog bone and the low-profile AC implant, is confirmed via intraoperative fluoroscopic images (Fig 4). Three alternating half-hitch knots are tied with both sets of sutures; the remaining suture is then cut.

Attention is turned to the semitendinosus allograft, which is prepared using two FiberLoop stitches (Arthrex) whipstitched to each end of the graft. Two soft tissue tunnels are created from the incision over the clavicle using a switching stick and progressively larger dilators. The first tunnel is positioned posterior to the clavicle and medial to the coracoid; the second tunnel is anterior to the clavicle and lateral to the coracoid. After dilation, a FiberStick (Arthrex) and suture are passed through each tunnel (Fig 5). The passing stitch of the graft is then looped around the first passing suture, and the graft is passed posterior to the clavicle and medial to the coracoid and out the anterosuperior lateral portal. The same end of the graft is then looped through the second passing stitch, and the graft is passed anterior to

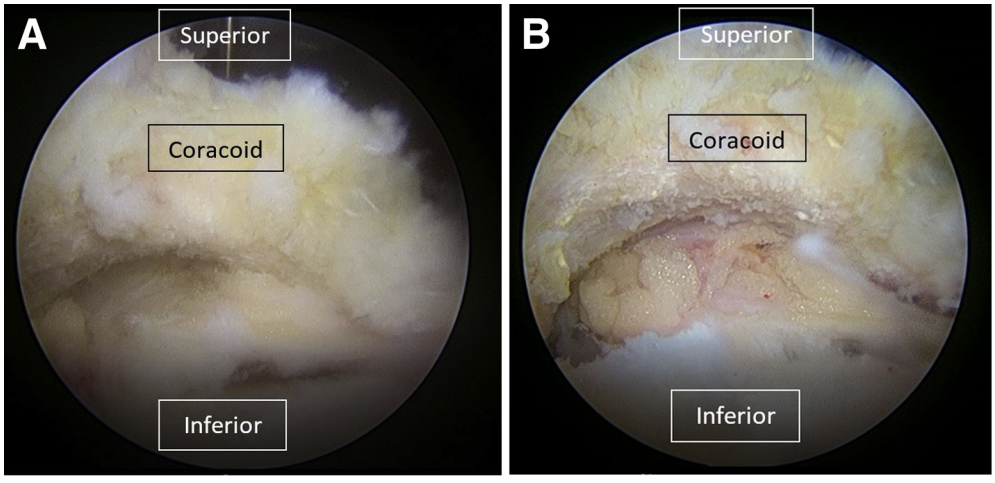

Fig 1. (A) Arthroscopic view from a standard posterior shoulder portal showing the coracoid process before debridement in a patient with an acute acromioclavicular (AC) joint injury. (B) Arthroscopic view from a standard posterior shoulder portal depicting the coracoid process after extensive debridement and decortication with a burr in a patient with an acute AC joint injury.

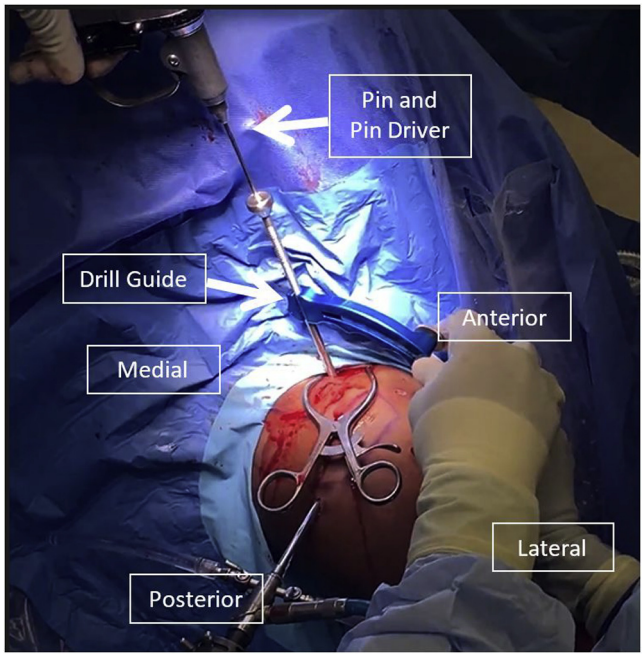

Fig 2. A patient positioned in the beach chair position undergoing arthroscopic surgery on the right shoulder for an acute acromioclavicular (AC) joint injury. The AC joint reconstruction drill guide (Arthrex, Naples, FL) is being used to pass a guide pin from superior to inferior through the clavicle and coracoid process.

the clavicle traversing around the underside of the coracoid. The graft is tied over itself on the superior aspect of the clavicle while a superior to inferior pressure is applied. The allograft is further secured using Vicryl to stitch the graft end-to-end. Excess graft is then trimmed. Fluoroscopy is again used to confirm sustained reduction of the AC joint.

Postoperative Care

The patient is placed in a sling for 6 weeks after operation. Active range of motion is permissible at the wrist and elbow. Postoperative imaging is taken at the 6-week follow-up appointment to confirm sustained reduction (Fig 6).

Discussion

This Technical Note is a detailed surgical technique for an arthroscopic AC joint reconstruction with semitendinosus allograft using a low-profile knotless coracoclavicular fixation. This technique allows for a minimally invasive approach combining the benefits of a single bone tunnel, minimal bone removal, and a low-profile clavicle insert component allowing for knotless fixation, improved cosmesis, and reduced patient discomfort when compared to alternative fixation devices.

Although AC joint reconstruction is a common procedure, it is not without risk of adverse events. In a systematic review of complications following arthroscopic AC joint reconstruction, Woodmass et al.[11] demonstrated that 26.7% of patients reported residual shoulder pain, hardware irritation, or AC pain after surgery. They found that although current TightRope/Endobutton techniques provide excellent reductions, more than one third of patients experience irritation at the superior clavicular fixation site. In a cohort study Glanzmann et al.[12] evaluated the postoperative outcomes of 19 patients who underwent AC joint reconstruction using Endobuotton techniques with 2-year follow-up. They found that 7 (36.8%) patients reported hardware-related pain at the site of upper bottom and knots. The benefit of the present technique is the use of a

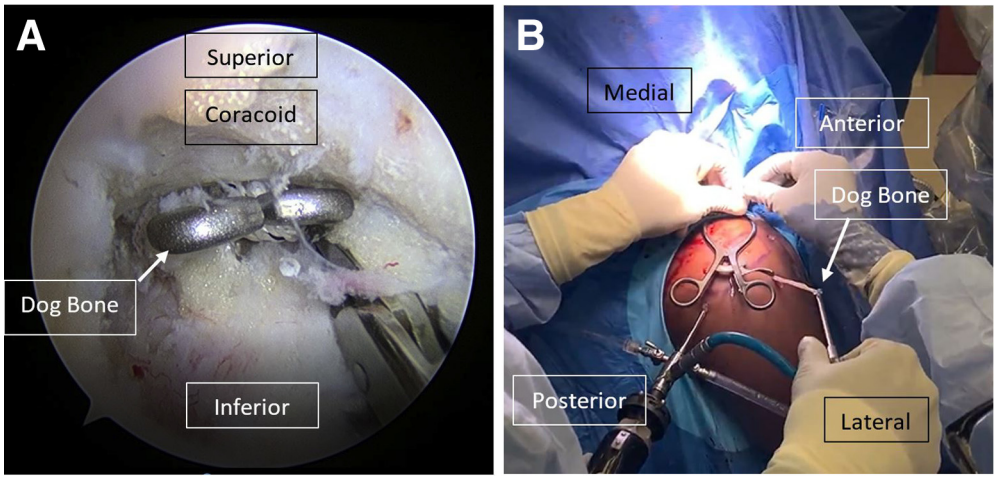

Fig 3. (A) Arthroscopic view from a standard posterior shoulder portal demonstrating a dog bone button (Arthrex, Naples, FL) being guided into position by a grasper during an acromioclavicular (AC) joint reconstruction. The surgeon's perspective. (B) A patient positioned in the beach chair position undergoing arthroscopic AC joint reconstruction on the right shoulder after an acute AC joint injury. The dog bone button (Arthrex) is being guided into position as seen from the surgeon's perspective.

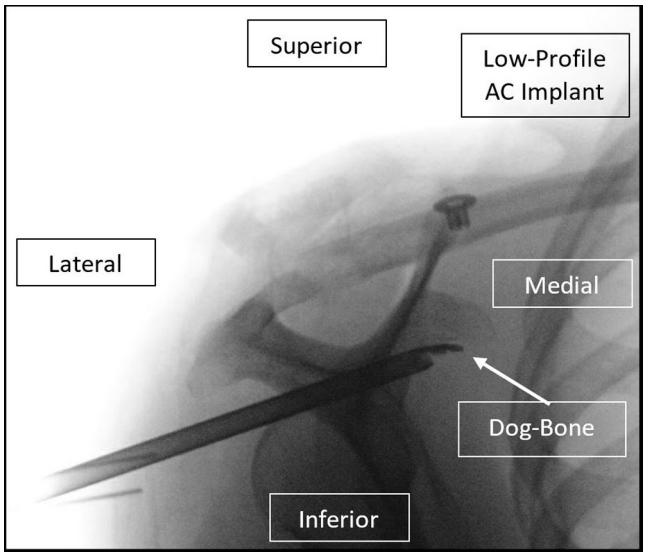

Fig 4. Intraoperative fluoroscopic confirmation during an arthroscopic acromioclavicular (AC) joint reconstruction in the beach chair position confirming proper seating of the low-profile AC implant (Arthrex, Naples, FL) and dog bone (Arthrex).

low-profile clavicle insert, which allows for knotless tightrope tensioning while minimizing the risk for post-operative hardware-related discomfort.

Several studies have sought to evaluate differences between single- and double-tunnel techniques. Hou et al.[13] performed cohort study on 21 patients who underwent surgical management for AC joint separation using either a single tunnel or two tunnel technique. Their study found that significantly more patients in the two-bundle group experienced good to excellent outcomes based on modified UCLA rating score than their single bundle group (70% vs 18%, $P > .99$). However, Pill et al.[14] performed a systematic review of treatments for AC joint disruption comparing the number of tunnels and found that patients in the double tunnel group experienced significantly more adverse events, which included clavicle and coracoid fractures. This is likely due to the increased number of drill holes and stress risers leading to an increased failure rate of the clavicle and coracoid fixation.[15-17] The present Technical Note illustrates the usage of a strong clavicle insert, which can allow for the knotless tensioning of suture tape though a single drill hole. The recessed implant confers adequate strength without the increased fracture risk attributed to the double-tunnel technique.

Open coracoclavicular ligament reconstruction has demonstrated success with reasonable outcomes[4]; however, complication rates around 50% have been reported.[18] Complications include pin and implant migration, loss of reduction over time, and early onset of arthritis at the AC joint.[4,5] As a result, several recently developed arthroscopic techniques focus on the use of augmentation to AC fixation, specifically semitendinosus allografts.[19-21] One of the benefits of using biologic augmentation includes improved biomechanical integrity because of the scaffolding properties of the graft, including secondary vascularization, which encourage healing and longevity of the repair.[22,23] Aliberti et al.[19] described a technique using a semitendinosus allograft to augment the horizontal stability of the AC joint using an interference screw for fixation. The present technique avoids the use of an interference screw, which could lead to graft damage during screw insertion. Furthermore, use of a dog bone button allows for further concomitant stabilization of AC joint where the

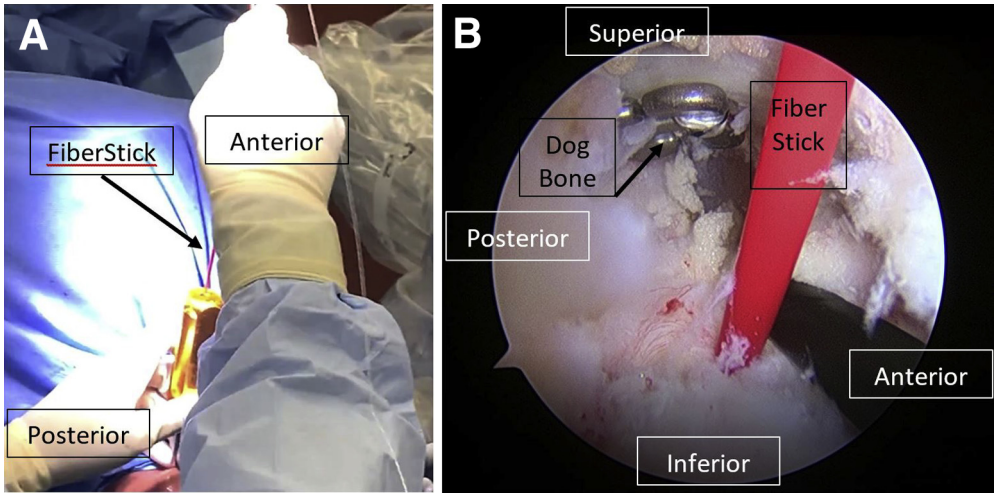

Fig 5. (A) A patient positioned in the beach chair position undergoing arthroscopic AC joint reconstruction on the right shoulder following an acute AC joint injury. The posterior position of the dilator facilitates passage of the FiberStick (Arthrex, Naples, FL) posterior to the clavicle. (B) Arthroscopic view from a standard posterior shoulder portal depicting a FiberStick being passed through the clavicular incision from posterior to the clavicle to anterior to the coracoid.

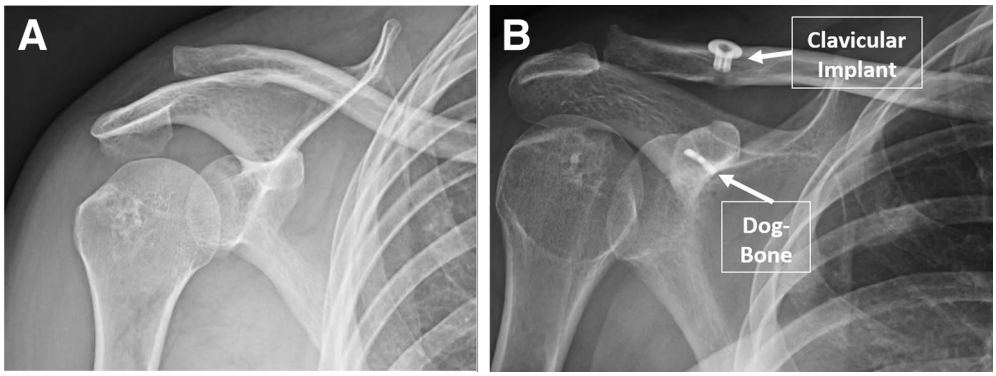

Fig 6. (A) Preoperative anteroposterior (AP) radiograph of the shoulder demonstrating separation of the acromioclavicular joint in the right shoulder. (B) Postoperative AP radiograph of the right shoulder taken at 6 weeks after arthroscopic repair of the right acromioclavicular (AC) joint demonstrating continued reduction and maintenance of surgical placement of the low-profile AC implant (Arthrex, Naples, FL) and dog bone (Arthrex).

semitendinosus allograft and the suture are working synergistically to promote joint stability while tensioning.

This technique is not without its limitations. Because of clavicular drilling, there is an increased risk of fracture after surgery. Additionally, use of the tape or rope for fixation can lead to early failure as a result of suture failure; however, the recessed clavicular implant helps to mitigate this risk.[24] Finally, whenever cadaveric tissue is used for reinforcement, there is an increased risk of infection or potential for adverse reaction to the tissue.[25]

Conclusion

This Technical Note presents a technique for an arthroscopic acromioclavicular joint reconstruction utilizing a low-profile knotless coracoclavicular fixation. This technique allows for a minimally invasive procedure with improved diagnosis of concomitant pathology and integrity of fixation. Additionally, knotless fixation and the clavicular implant design lead to less prominent hardware and reduced implant-related pain.

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