

Open Acromioclavicular Joint Reconstruction With Semitendinosus Allograft Utilizing the Cerclage Technique



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Abstract: Acromioclavicular (AC) joint injuries most commonly occur in young males after a direct injury at the acromion. General consensus stresses nonoperative treatment for type I and II injuries and surgical treatment for types IV through VI, whereas management of type III injuries is more controversial. If surgery is indicated, there are multiple techniques including hook plate, screw fixation, coracoclavicular fixation, and anatomic and nonanatomic reconstruction. The overall complication rate is high (14%), regardless of technique. In this Technical Note, we outline a technique for open repair of a chronic AC joint separation using a semitendinosus allograft using the cerclage for enhanced fixation.

The incidence of acromioclavicular (AC) joint injuries has recently been reported as 9.2 per 1,000 person-years.^{1,2} Most commonly, AC joint injuries occur in young males with a direct or indirect force at the acromion.¹⁻⁴ General consensus stresses nonoperative treatment for type I and II injuries and surgical treatment for types IV through VI. Management of type III injuries remains controversial.⁵⁻⁷ There is some evidence to advocate for surgery of type III injuries in the appropriate population.³ Generally, the literature is lacking good-quality randomized controlled trials comparing common surgical interventions and nonoperative treatment.⁸

If surgery is indicated, many described techniques exist.²⁻⁴ There is an overall 14% complication rate,

which includes loss of fixation, graft failure, clavicle and/or coracoid fracture, infection, postoperative adhesive capsulitis, and hardware failure.^{2-4,9}

Recently, there has been a trend to perform coracoclavicular (CC) fixation using suture button constructs. However, a complication rate of 44% has been reported,¹⁰ and it has generally been recommended in the acute setting (<3 weeks^{3,11}) because of the biologic healing properties. Biologic augmentation plus a suture button construct has been advocated for injuries >3 weeks old.^{3,11}

In this Technical Note, we outline a technique for open repair of a chronic AC joint separation using a semitendinosus allograft and the FiberTape Cerclage System (Arthrex, Naples, FL) for enhanced fixation.

Surgical Technique

A detailed description of the procedure is provided in [Video 1](#). The patient is brought into the operating room and administered standard preoperative antibiotics. Our preference is to perform the surgery in a beach chair position. After administration of anesthesia, the AC separation is confirmed with fluoroscopy, and the operative side is then prepped and draped ([Figure 1](#)). A surgical pause is performed according to hospital protocol.

A semitendinosus allograft is first thawed and prepared on the back table. Two #2 FiberLoop sutures (Arthrex) are used to repair the ends of the graft. It is then placed on a graft tensioner to remove any creep

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Fig 1. Preoperative anteroposterior left clavicle radiograph shows grade V acromioclavicular joint separation.

out of the tendon. At this time, the graft is also sized with a graft sizer.

A superior 4- to 5-cm longitudinal incision is made approximately 3.5 cm medial to the AC joint. Dissection is carried down to the delto-trapezial fascia overlying the clavicle. Full-thickness flaps are made along the midline of the clavicle from the coracoclavicular origin and extending laterally until the AC joint is exposed. Any remaining fibrous scar tissue is removed. For chronic separations, we routinely perform a distal clavicle resection, and ~8 to 10 mm of bone is resected with an oscillating saw (**Figure 2A,B**).

We then identify the coracoid process with careful dissection. Fluoroscopy is obtained to confirm the location of the coracoid process. Using a coracoid passer, we bluntly dissect under the coracoid to prepare a tunnel for suture and graft passage (**Figure 3**).

A 2.3 drill bit is placed bicortically 27.5 mm medial to the distal clavicle (**Figure 4A**). The pin should be placed at the midpoint of the clavicle. The free limb of the FiberTape Cerclage is then passed through this drill hole with the aid of a nitinol suture passer and captured on the undersurface of the clavicle with a hemostat (**Figure 4B,C**).

A Coracoid graft passer is then passed around the base of the coracoid. The free limb of the FiberTape Cerclage

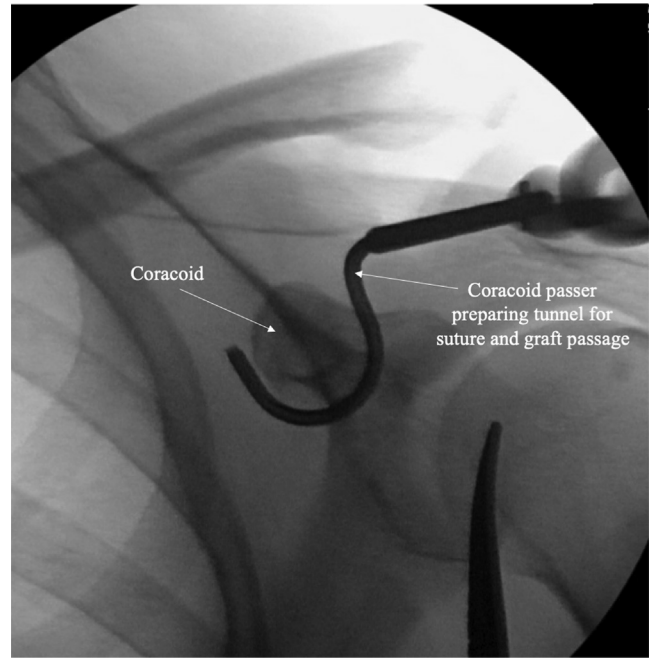


Fig 3. Intraoperative radiograph of left coracoid process with patient in beach chair position. Fluoroscopy is obtained to confirm the location of the coracoid process. Using a coracoid passer, we then bluntly dissect under the coracoid to prepare a tunnel for suture and graft passage.

and 1 free limb of the semitendinosus graft is then passed under the coracoid. With the aid of a nitinol suture passer, the free limb of the FiberTape cerclage is passed back up the drill hole and retrieved along the superior surface (**Figure 5**).

Bone tunnel preparation for the allograft is then performed with a 2.7-mm Arthrex Drill Tip Pin (**Figure 6A**). The first tunnel (posteromedial) is located 35 mm medial to the osteotomy site (45 mm if no resection performed) along the posterior half of the clavicle. The drill tip guide pin is placed, and an appropriate cannulated reamer is used. Care is taken to ensure the reamer does not violate the posterior cortex.

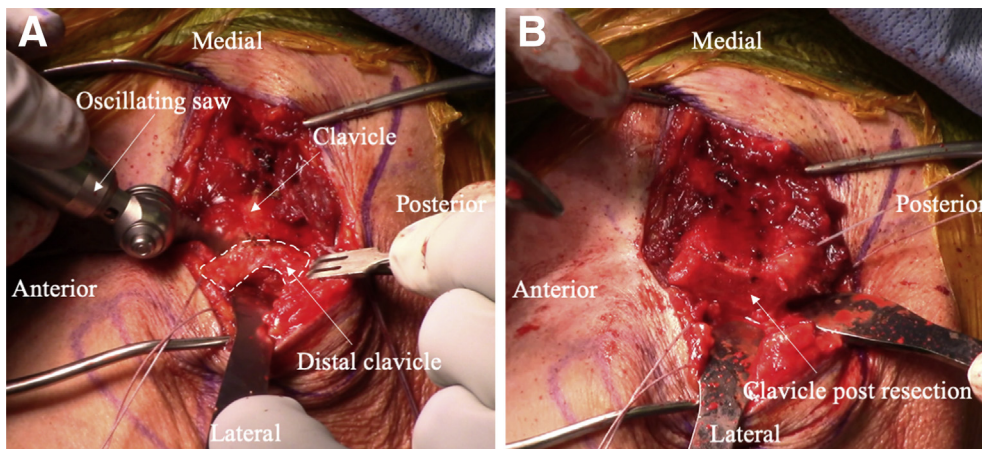
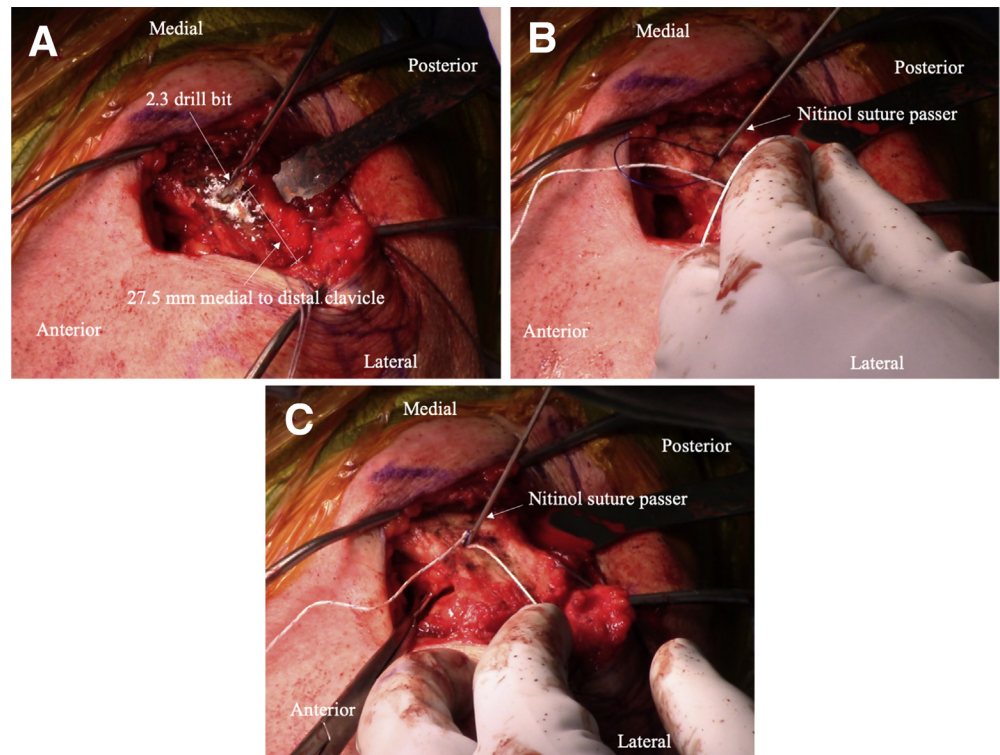


Fig 2. Superolateral view of left acromioclavicular (AC) joint with patient in beach chair position. (A) 8 to 10 mm of bone is resected from the distal clavicle with an oscillating saw. (B) Distal clavicle after bone resection.

Fig 4. Superolateral view of left acromioclavicular (AC) joint with patient in beach chair position. (A) Drilling into clavicle for placement of a 2.4-mm pin. (B) Passing nitinol suture passer through the midpoint of the clavicle. (C) Passing suture through clavicle.



The reamer size is proportionate to the outer diameter of the graft limb and the bone quality. We most commonly use a 5 or 5.5 reamer with a 5.5 × 8-mm PEEK tenodesis screw. The same procedure is repeated for the anterolateral bone tunnel. This tunnel is placed ~15 mm away from the center of the posteromedial bone tunnel (Figure 6B).

At this point, the more lateral limb of the biologic graft is taken and placed through the posteromedial bone tunnel. Next, the medial limb is fed through the anterior/lateral bone tunnel (Figure 6C). Passing the limbs in this manner creates a crossing pattern of the biologic graft. Passage of the graft through the tunnels can be facilitated with a Nitinol suture passer.

At this time, initial reduction is performed, and a provisional knot of the FiberTape Cerclage suture is created (Figure 7A). The suture limbs are passed through a dog-bone button, with the knot sitting on the button, and then loaded onto a suture tensioner. The suture construct is then tensioned to the desired tension (between 30 and 40 lb) (Figure 7B). Once the tension is set, fluoroscopy is used to confirm reduction, and a half hitch knot is thrown. The tensioner is again used to secure the construct (Figure 7C). Two alternating half hitches are then applied to finalize the construct (Figure 7D). Once initial fixation of the AC joint is obtained with the FiberTape Cerclage, the grafts are secured with complete upper displacement on the graft, ensuring its tautness. A PEEK tenodesis screw is placed in either the posterior or anterior bone tunnels

(Figure 8A). After the first screw is secured, the second PEEK tenodesis screw is placed in the second bone tunnel. After the PEEK tenodesis screws are placed, the remaining allograft is laid over the AC joint and secured to reinforce the superior AC joint capsule (Figure 8C,D). Fluoroscopy is used to obtain final AP and Zanca images of the AC joint (Figure 9).

Discussion

We have described our preferred technique for an open anatomic reconstruction using a semitendinosus

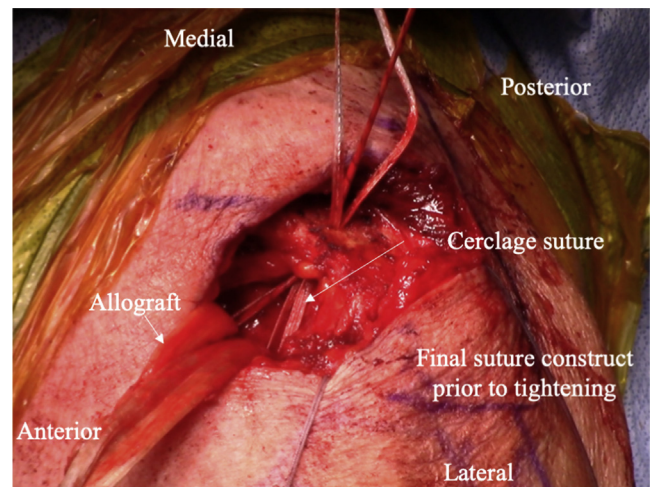


Fig 5. Superolateral view of left acromioclavicular (AC) joint with patient in beach chair position. Suture and FiberTape Cerclage passed through clavicle and looped around coracoid.

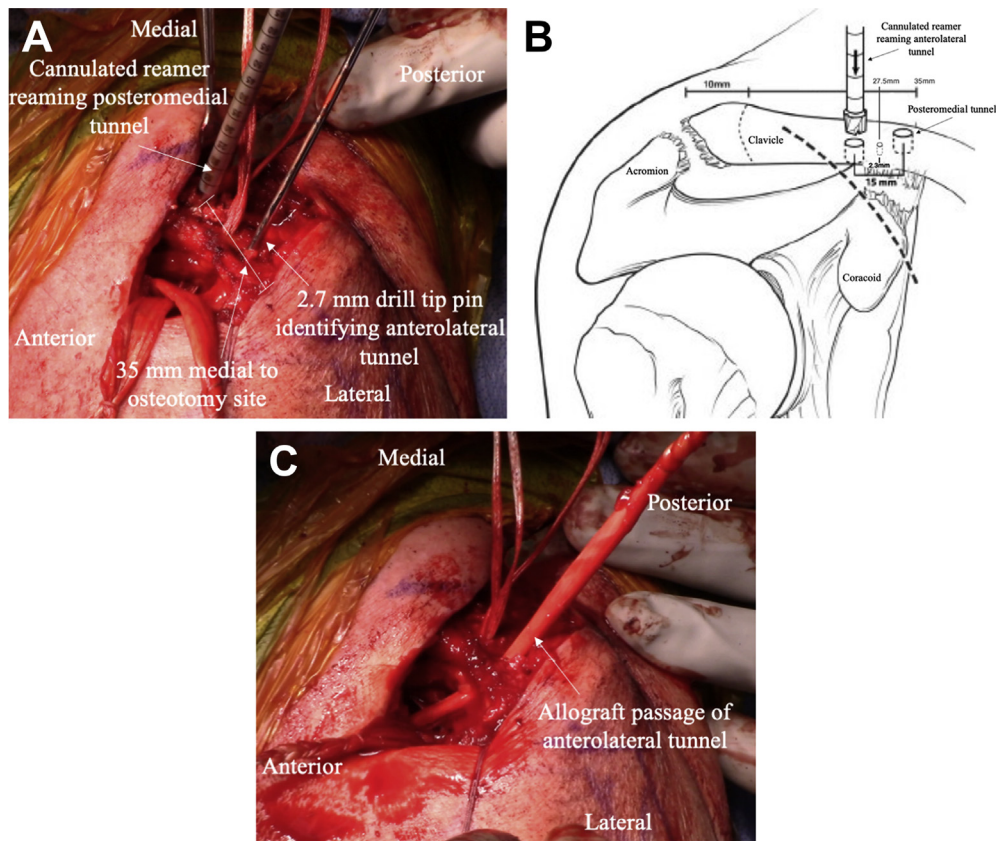


Fig 6. Superolateral view of left acromioclavicular (AC) joint with patient in beach chair position. (A) Drilling bone tunnel for allograft through the clavicle. First the drill tip guide pin is placed, and then an appropriate cannulated reamer is used to create the tunnel. The posteromedial tunnel is created 35 mm medial to the osteotomy site. (B) Animation in a right shoulder of the bone tunnels drilled in the clavicle. The first tunnel (posteromedial) is located 35 mm medial to the osteotomy site (45 mm if no resection performed) along the posterior half of the clavicle. The drill tip guide pin is placed, and an appropriate cannulated reamer is used. The reamer size is proportionate to the outer diameter of the graft limb and the bone quality. We most commonly use a 5 or 5.5 reamer with a 5.5 × 8-mm PEEK Tenodesis Screw. The same procedure is repeated for the anterolateral bone tunnel. This tunnel is placed ~15 mm away from the center of the posteromedial bone tunnel. (C) Allograft is passed through the anterolateral tunnel of the clavicle.

allograft and suture-button fixation for a chronic AC joint injury. AC joint injuries are most frequently classified using the Rockwood system.¹² While there is controversy regarding management of type III injuries, some authors advocate for surgery, and a decision should be made on a case-by-case basis.³

Currently, there are multiple described surgical techniques for AC joint separations. Historically, first-generation fixation techniques with cerclage wire, hook plate, or lag screw showed good initial outcomes.^{3,4} However, complications including hardware migration, loss of reduction, fracture, and hardware failure were a concern, and alternative methods were introduced. The nonanatomic reconstruction, Weaver Dunn procedure, was previously the most frequently used method to treat acute or chronic AC joint separations¹³; however, biomechanical studies showed inferiority in strength construct along with an unacceptable rate of recurrence.^{3,4}

Recently, newer techniques for acute fixation have been advocated to allow for healing of the native CC ligaments. These techniques most commonly include the use of a suture button through or around the coracoid and through the clavicle. Biomechanically, this construct has been shown to be equivalent to the native ligaments¹¹ but with a reported complication rate up to 44%¹⁰ including coracoid fracture. Arthroscopy has decreased the risk of coracoid fracture due to direct visualization of the coracoid. However, there is still concern of button failure as well as suture fatigue resulting in loss of reduction.

Open CC ligament reconstruction with biologic augmentation remains a viable option with good outcomes.¹⁴ Despite this, the complication rate has been reported to be up to 52%.⁹ Milewski et al.⁹ reported a 50% loss of reduction rate and a 20% coracoid fracture rate in the coracoid tunnel group. They also reported a 6% loss of reduction in the noncoracoid tunnel group.

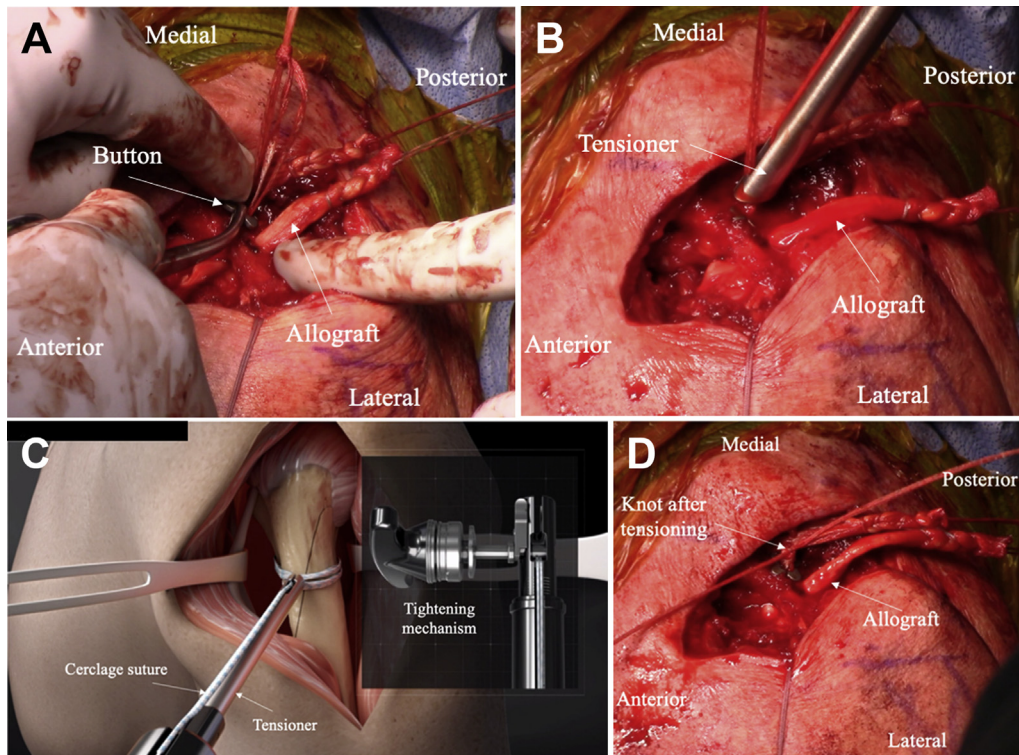
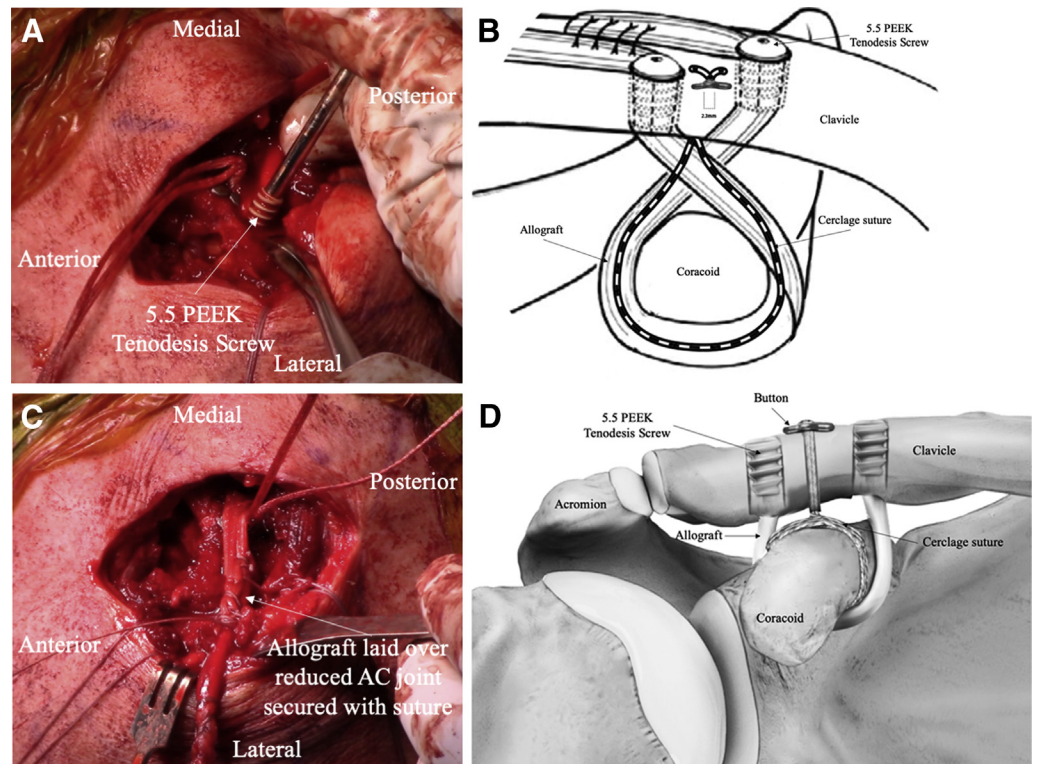


Fig 7. Superolateral view of left acromioclavicular (AC) joint with patient in beach chair position. (A) Initial reduction and provisional knot of the FiberTape Cerclage suture with dog-bone button. (B) Suture tensioner used to secure the reduction (~30 to 40 pounds of tension). (C) Animation of the tensioner and the tightening mechanism. (D) Final knot of FiberTape Cerclage suture securing the construct.

Fig 8. Superolateral view of left acromioclavicular (AC) joint with patient in beach chair position. (A) Placement of a PEEK Tenodesis Screw in the posterior and anterior bone tunnels. (B) Animation of the allograft and cerclage suture looped around the coracoid in a right shoulder. Two 5.5 PEEK tenodesis screws are used to secure the allograft in the clavicular bone tunnels. (C) Allograft is laid over the reduced AC joint and secured with suture for the final construct. (D) Animation of the final construct in a right shoulder with the dog bone button securing the cerclage suture and the tenodesis screws securing the allograft.



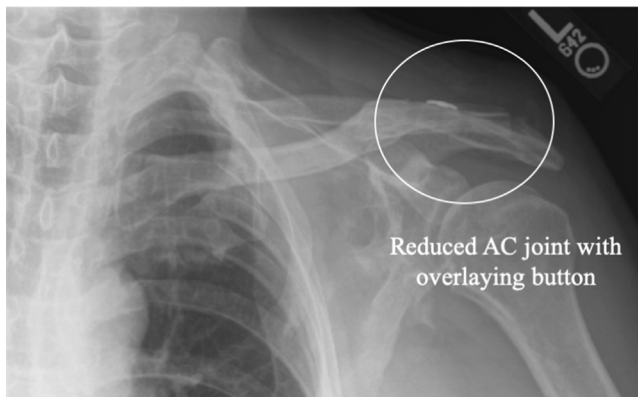


Fig 9. Postoperative anteroposterior left clavicle radiograph shows appropriate reduction of the acromioclavicular (AC) joint with overlaying button.

Those authors clearly showed the concerns of drilling the coracoid for suture button fixation.

We present a technique using a FiberTape Cerclage system with button to provide initial reduction and fixation of the AC joint. In this technique, the suture is looped under the coracoid to avoid the risk of coracoid fracture. A small drill bit and suture button reduces the risk of clavicle fracture. Another unique feature is the tensioning mechanism. The suture tensioner allows the surgeon to obtain initial fixation and reduction of the AC joint to a desired tension. The biologic augment can then be secured with the AC joint already reduced. The pearls and pitfalls of this technique are presented in Table 1. A few specific risks of the technique include clavicle fracture, neurovascular injury, recurrence of deformity, and if cadaveric tissue is used, an adverse reaction to cadaveric tissue (Table 2). This technique can be easily modified in the acute setting to allow for either an arthroscopically assisted or open technique

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none"> • Slight beach-chair position aids in exposure. • FiberTape Cerclage system allows for initial reduction and tensioning of acromioclavicular joint using measured tensiometer. Use of the tensiometer prevents the loss of tension expected with manual tying of sequential knots. • Preparation of the semitendinosus allograft can be done at the beginning of the case with #2 FiberLoop suture and tensioner to remove any creep out of the tendon. • Placing sutures around the coracoid reduces risk of coracoid fracture. 	<ul style="list-style-type: none"> • Place bone tunnels to avoid cortical perforation. • Soft tissue around the coracoid should be cleared to aid in passing of the graft and suture. • Resect 8 to 10 mm of the distal clavicle in chronic setting to aid in reduction.

Table 2. Risks

Risks
<ul style="list-style-type: none"> • Clavicle fracture • Neurovascular injury • Recurrence of deformity • Adverse reaction to cadaveric tissue (if used)

without the use of biologic augmentation. Overall, this simple technique provides an anatomic reconstruction with replication of the CC ligament, increased initial fixation with the FiberTape Cerclage suture button, and decreased risk of coracoid fracture.

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