Technical Note

Combined Coracoclavicular and Acromioclavicular Joint Reconstruction with Allograft Using a Cerclage Tensioning System

Joo Yeon Kim, B.A., Hee-Yon Park, B.A., Stewart Bryant, M.D., Brandon Gardner, M.D., Ph.D., Moyukh Chakrabarti, M.B.B.S., Patrick McGahan, M.D., and James L. Chen, M.D., M.P.H.

Abstract: Acromioclavicular joint separations are common shoulder injuries, yet standard treatment practices vary. Popular surgical techniques include reconstruction using allografts or neighboring ligaments as well as repair using screws and sutures. This Technical Note and accompanying video describe both an acromioclavicular and coracoclavicular joint reconstruction using an allograft to replace native acromioclavicular ligament along with an AC joint reduction using a Suture Cerclage System to precisely control reduction and restore anatomic alignment.

Acromioclavicular (AC) joint separations account for 9% of all shoulder injuries and make up 30% to 50% of athletic shoulder injuries.[1-3] Despite its high prevalence, therapeutic treatment for high-grade separations still awaits a gold standard.[4] The Rockwood classification is widely used to determine whether surgical intervention is recommended.[5] Type I and II injuries are usually treated conservatively whereas type IV, V, and VI injuries often are treated with surgery.[1-5] Treatment of type III injuries remain controversial, as there are limited data to support surgical intervention.[5]

Several surgical procedures have been used to treat AC joint separations with varied results.[3,6] Formerly one of the most popular procedures for treating AC joint injuries, the Weaver Dunn technique replaces the torn coracoclavicular (CC) ligament with native coracoacromial ligament.[1,7] However, the AC ligament has proven to be biomechanically the most responsible for bringing translational and rotational anteroposterior stabilization of the AC joint and the use of biologic augmentation is supported for chronic (>3 weeks) dislocations.[4,8,9] As a result, AC joint reconstruction with a graft has gained popularity and resulted in superior radiograph outcomes.[6,10-12] Despite the significant benefits in allograft reconstruction for treating AC joint separations, complication rates from clavicle fractures, hardware failure, loss of reduction, and graft failure remain cause for concern.[10,13-15]

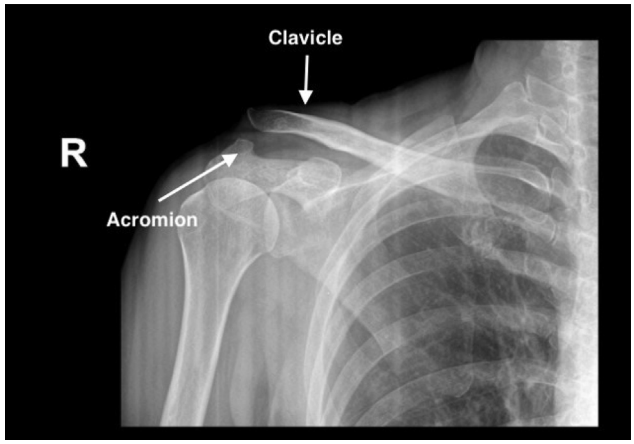

Fig 1. Preoperative radiograph (anteroposterior view) of the right shoulder, which confirms a type V acromioclavicular joint separation.

From Advanced Orthopaedics and Sports Medicine, San Francisco, California, U.S.A.

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Address correspondence to Joo Yeon Kim, Advanced Orthopaedics and Sports Medicine, 450 Sutter St., Ste 400, San Francisco, CA 94108. E-mail: jooyeon.john.kim@gmail.com

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Fig 2. Intraoperative image of Curved AC joint Graft Passing Instrument (Arthrex) is placed into the right acromioclavicular joint and used to load a nitinol wire loop and pass wire under the right coracoid.

The suture cerclage tensioning system is a precise method of controlling the amount of reduction with FiberWire instead of hardware, addressing some disadvantages of a traditional AC joint allograft reconstruction procedure.[16] The purpose of this Technical Note and Video 1 is to describe a suture cerclage tensioning system to perform reduction of a type V AC joint separation while reconstructing the AC ligaments using allograft.

Surgical Technique (With Video Illustration)

Preoperative Considerations

Preoperative assessment consists of physical examination and radiographs to confirm the AC joint separation and to evaluate the degree of separation (Fig 1). The patient is positioned in the beach chair position with a well-padded head and face cushion, and all the bony prominences are padded. The operative right shoulder is prepared and draped in the usual sterile fashion. The anatomical landmarks of the AC joint and coracoid are marked.

Surgical Approach to the AC Joint and Coracoid Process

A 5-cm curved linear incision is made extending over the AC joint, distal clavicle, and superiorly over the coracoid. The interval is dissected down from the deltopectoral fascia to the superior border of the clavicle. The trapezius attachments and periosteum from the distal clavicle and acromion are reflected until the AC joint disruption with the clavicle is visible. The distal

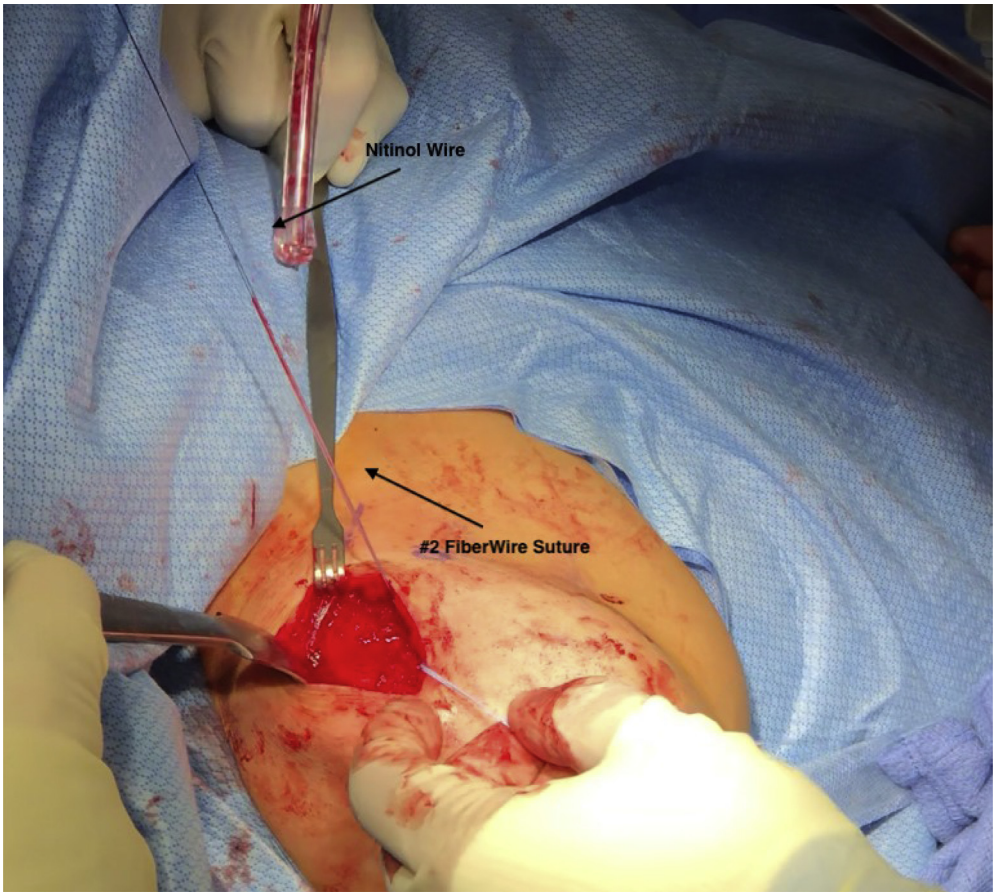

Fig 3. Intraoperative image of nitinol wire and #2 FiberWire Suture. The nitinol wire is used to shuttle a #2 FiberWire Suture under the right coracoid.

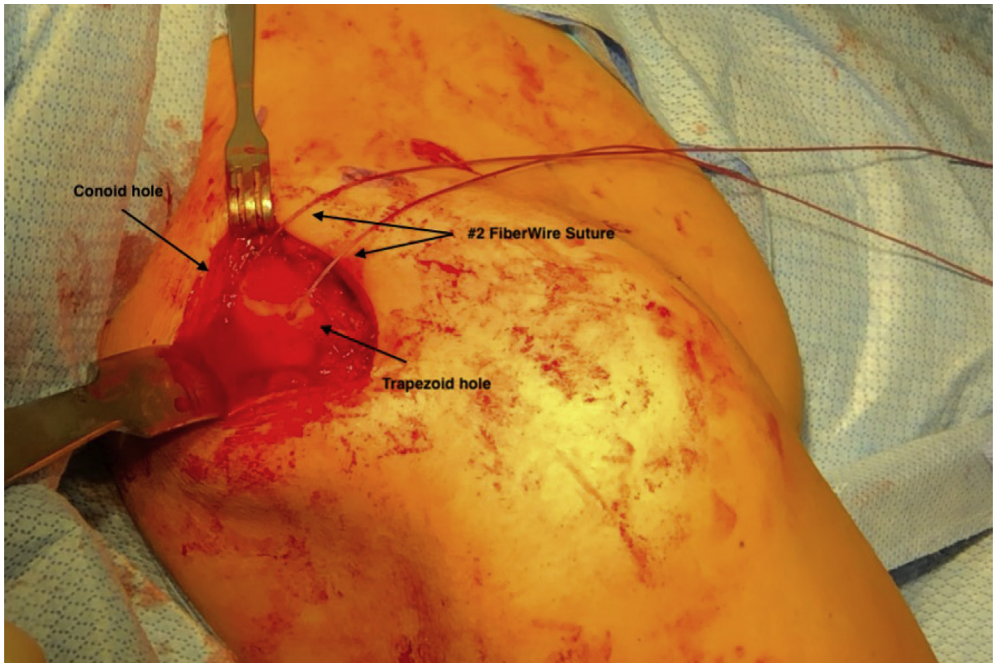

Fig 4. Intraoperative image of #2 FiberWire Suture passed through the conoid drill hole. This process is repeated for the other tail of #2 FiberWire Suture for the trapezoid drill hole. Drill holes are on the superior border of the right clavicle at the anatomical attachment sites of the conoid and trapezoid coracoclavicular ligaments.

clavicle is freely mobile and is translated inferiorly with a bone tamp to the level of the native AC joint. Dissection is continued to locate the conjoint tendon at the tip of the coracoid.

Suture Passing for Reduction

A nitinol wire loop from a Micro SutureLasso (Arthrex, Naples, FL) is loaded onto a curved AC Joint Graft Passing Instrument (Arthrex) (Fig 2). The wire is passed under the coracoid and retrieved using a clamp. No. 2 FiberWire suture (Arthrex) is then passed using the wire (Fig 3). The native attachment points of the conoid and trapezoid coracoclavicular ligaments are marked out using a ruler at 3 cm for the trapezoid ligament and 4.5 cm for the conoid ligament. The marks are then drilled to pass the cerclage. One tail of the No. 2 FiberWire suture is passed through the conoid drill hole and the other tail is passed through the trapezoid drill hole (Fig 4). The No. 2 FiberWire suture is used to pass the FiberTape suture from the FiberTape Cerclage

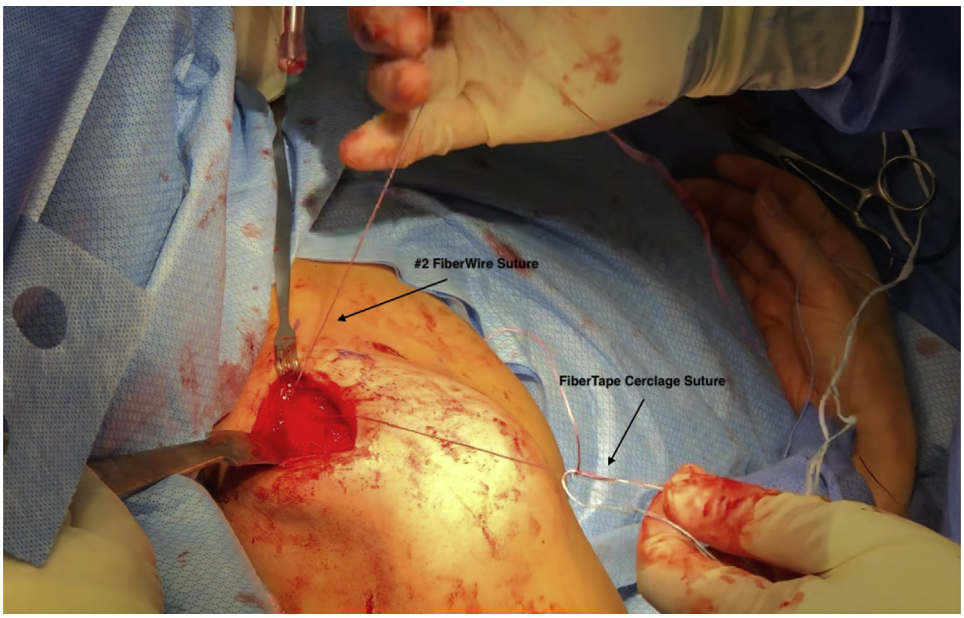

Fig 5. Intraoperative image of the FiberTape Cerclage Suture tied to #2 FiberWire Suture, which is used to shuttle the FiberTape Suture without removing from the attached card. The FiberTape Suture is passed through the conoid drill hole, under the coracoid, and out of the trapezoid drill hole of the right clavicle.

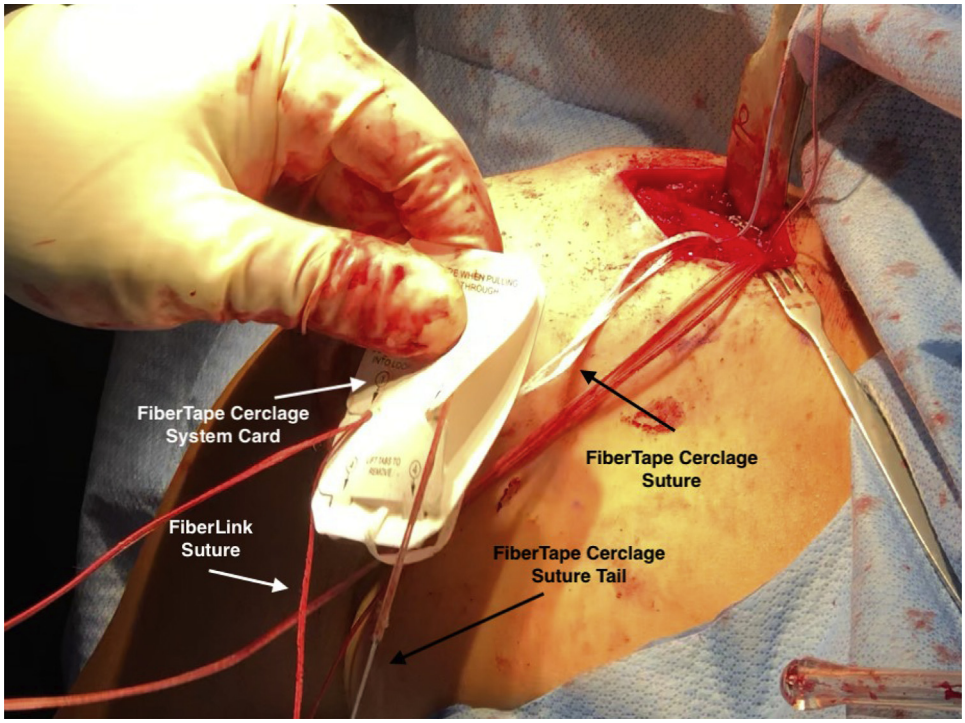

Fig 6. Intraoperative image of the tail of the FiberTape Cerclage Suture (Arthrex) loaded onto the FiberLink Suture (Arthrex) on the FiberTape Cerclage System Card (Arthrex).

System (Arthrex) and an additional No. 5 FiberWire and No. 2 FiberWire suture through the conoid drill hold, under the coracoid and out of the trapezoid drill hole without removing the FiberTape from the card (Fig 5). The suture tail of the FiberTape cerclage suture is loaded onto the FiberLink suture on the card. The FiberTape suture tail is pulled through the card using the FiberLink suture, securing a pre-tied racking hitch knot (Fig 6). The card is removed, and the racking hitch knot is tensioned to lie flush with the superior clavicular cortex.

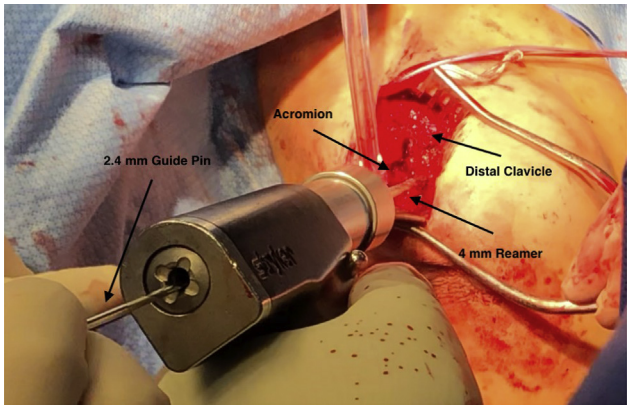

Fig 7. Intraoperative image of the surgeon using a 4-mm reamer to ream a drilled 2.4-mm guide pin into the right acromion. This process is repeated for the right distal clavicle.

Reconstruction With Allograft

A 2.4-mm guide pin is drilled into the distal clavicle and a 4-mm reamer is reamed over the guide pin. The process is repeated in the acromion (Fig 7). A 4-mm presutured tendon graft (Source) is shuttled through the acromion hole using a nitinol wire loop (Fig 8). The process is repeated by passing the other end of the graft through the distal clavicle hole. The sutures are tensioned and a surgeon's knot is tied with the graft ends lying over the superior AC joint. The graft is reinforced with No. 2 FiberWire through the graft knot (Fig 9).

AC Joint Reduction With Cerclage Tensioner

The cerclage FiberTape suture is trimmed to have 2 even ends, which are loaded on the FiberTape Cerclage Tensioner (Arthrex) (Fig 10). The ratcheting handle is winched until 80 ft-pounds of torque is reached on the display gauge of the Cerclage Tensioner. The tails of the No. 5 FiberWire sutures are tied down on top of the superior clavicle to further secure the AC joint reduction. The Cerclage Tensioner is released and 3 additional knots are tied down.

Final Examination and Postoperative Care

Fluoroscopic imaging of the AC joint is obtained to confirm proper reduction and alignment (Fig 11). The patient is fitted in a sling for 6 weeks with formal physical therapy to commence thereafter. Pearls and pitfalls of the procedure are described in Table 1.

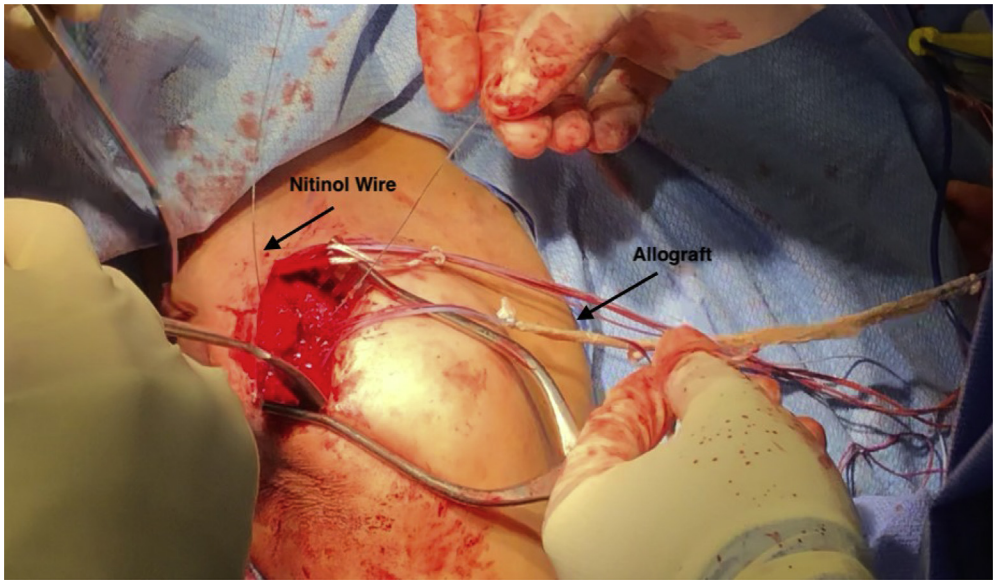

Fig 8. Intraoperative image of nitinol wire loop used to shuttle the sutures from one end of the presutured allograft through the acromion hole. This process is repeated by passing the other end of the allograft through the distal clavicle hole.

Discussion

The technique presented in this Technical Note and accompanying Video 1 illustrate a reconstruction of the AC joint using a suture—cerclage and AC ligament reconstruction with allograft. The incorporation of graft to repair the AC ligament allows for increased horizontal stability compared with traditional repairs. Other methods remain popular techniques outside of ligament repair and reconstruction.[6] However, these procedures suffer from complications such as hardware failure, loss of reduction, posterior instability, and over- or under-correction of the AC joint.[10,17,18] Several studies demonstrate that free graft AC joint reconstruction with hardware achieves greater anteroposterior and superior-inferior translational stability and is the most stable construct.[12,19]

Previous techniques have used similar procedures to our combined reconstruction. AC joint reconstruction with a graft has gained popularity for improving joint stability.[6,10] Makhni et al.[20] described another procedure using a suture cerclage tensioning system with button to achieve AC joint reduction and fixation in addition to using allograft to replicate the coracoclavicular ligament. However, there was increased risk of neurovascular injury and clavicle fracture from larger graft passage and bone tunnels.[21] Youn et al.[16] exhibited an AC joint repair using a suture cerclage tensioning system to achieve anatomical reduction

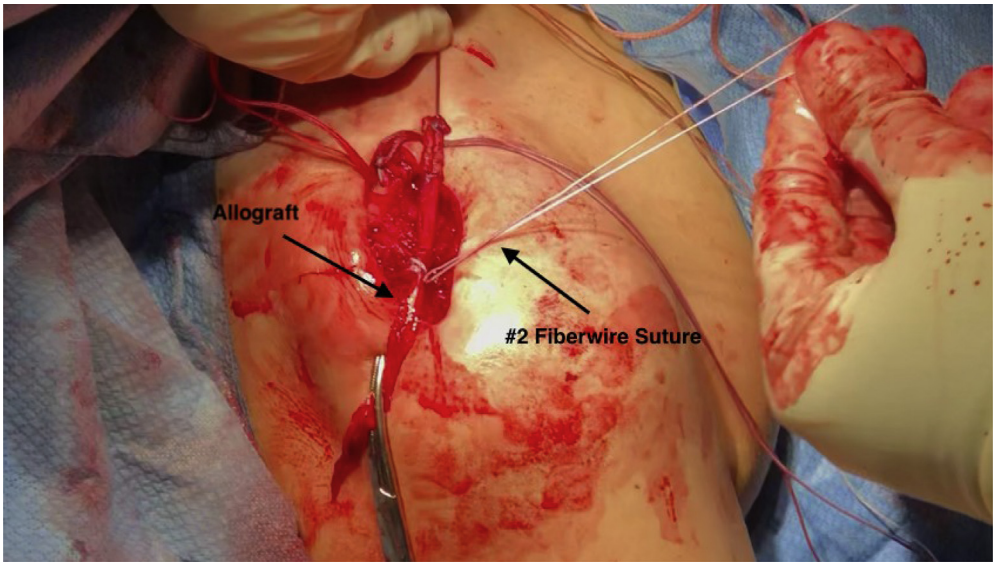

Fig 9. Intraoperative image of the allograft tied with a surgeon's knot over the superior acromioclavicular joint. The graft is reinforced with #2 FiberWire Suture passing through the graft knot.

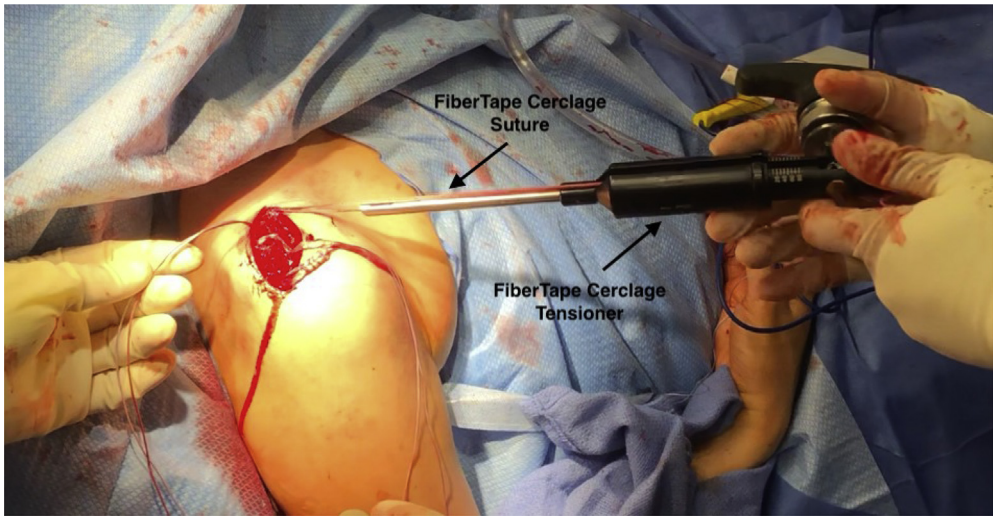

Fig 10. Intraoperative image of the FiberTape Cerclage Suture loaded into the FiberTape Cerclage Tensioner (Arthrex) for reduction of the right clavicle. Both ends of the Cerclage Suture are cut to the same length and then placed into the roller adjacent to the FiberTape Cerclage Tensioner handle.

without hardware but presented the possibility of posterior instability. Free graft AC joint reconstructions have become widespread in recent years. Using biological augmentation to replicate the CC ligament is a prevalent reconstruction method but increases likelihood of failure with anterior and posterior loading.[11,19,22] In a systematic review, Milewski et al.[21] found similar complications as well as loss of reduction for CC ligament reconstructions using allograft.

Our proposed technique of a combined AC and CC joint reconstruction with allograft using the suture cerclage tensioning system attempts to address concerns regarding posterior instability, hardware complications, and loss of reduction. The FiberTape Cerclage System is able to precisely control the amount of reduction, avoiding under- or overcorrection. In addition, the use of nonmetal implants avoids the need for hardware removal and potential hardware failure.[16] The AC joint reconstruction with allograft addresses the risk of posterior instability by replicating the AC ligament itself. This also circumvents larger graft passage through the CC joint to decrease possibilities of clavicle fractures and neurovascular injuries. As is the case for all free graft reconstructions, our technique has a potential for graft failure. Given that our technique uses larger-diameter drill holes for graft passage, another potential disadvantage includes the increased risk of intraoperative and postoperative fractures at the AC joint. Further research is necessary to analyze whether the proposed technique leads to better clinical outcomes. Advantages and disadvantages are listed in Table 2.

This Technical Note outlined the combined reconstruction of the AC and CC joint using a suture cerclage tensioning system and an AC ligament reconstruction

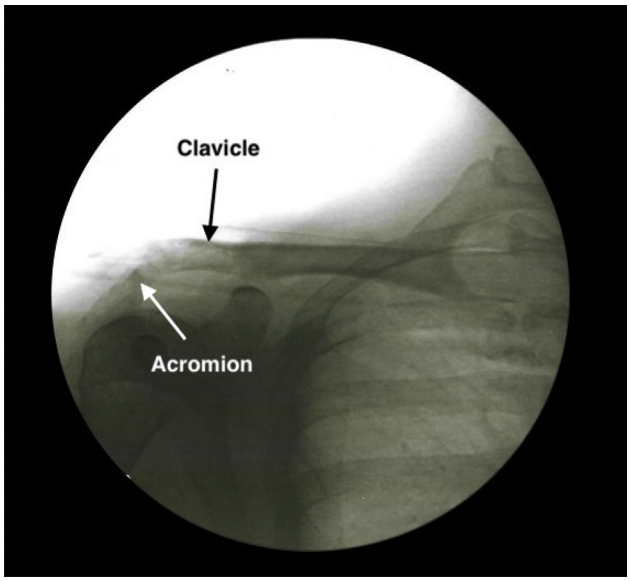

Fig 11. Final radiograph of the distal clavicle and acromion of the right shoulder confirms proper anatomical reduction using combined acromioclavicular and coracoclavicular joint reconstruction with allograft using suture cerclage tensioning system.

Table 1. Pearls and Pitfalls of a Combined CC and AC Joint Reconstruction with Allograft Using a Suture Cerclage Tensioning System

Pearls
• Achieve final AC reduction and cerclage fixation before AC allograft placement
• Apply posteroinferior clavicular pressure to manually assist in reduction
• Maintain good suture organization and proper FiberTape suture card orientation
Pitfalls
• Take care to avoid surrounding neurovascular structures
• Avoid passing allograft through underdrilled bone tunnel
• Avoid overreduction of AC joint before CC repair

AC, acromioclavicular; CC, coracoclavicular.

Table 2. Advantages and Disadvantages of a Combined CC and AC Joint Reconstruction with Allograft Using a Suture Cerclage Tensioning System

Advantages
• Surgeon can precisely control amount of reduction
• Addresses posterior instability common with AC joint repair
• Anatomic repair of CC ligaments
• No metal implants or hardware used
• Avoids graft passage around the coracoid
Disadvantages
• Technically challenging
• Possible increased risk of distal clavicle fracture
• Risk of graft failure
• Proximity of drilling to neurovascular structures

AC, acromioclavicular; CC, coracoclavicular.

with allograft. The use of allograft fixation for the AC joint provides increased horizontal stabilization and replication of the AC ligament. Finally, while technically complex, this procedure allows the surgeon to control the strength of the reduction and provide an anatomic repair.

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