## Arthroscopic-Assisted Coracoclavicular and Acromioclavicular Ligament Reconstruction for Chronic AC Joint Separation

Shaquille Charles,<sup>\*</sup> MSc , Robin Dunn,<sup>†</sup> MD, Soheil Sabzevari,<sup>\*</sup> MD, Luis Carrazana-Suarez,<sup>‡</sup> MD, Rajiv P. Reddy,<sup>\*</sup> BS, and Albert Lin,<sup>\*§</sup> MD Investigation performed at University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA

**Background:** Management of acromioclavicular joint (ACJ) separations depends on the type, chronicity of injury, and patient demographics.

**Indications:** Coracoclavicular and acromioclavicular ligament reconstruction may be indicated for patients with chronic type 3 ACJ separation who have failed conservative treatment. We describe an arthroscopic-assisted approach to facilitate graft passage around the coracoid.

**Technique:** Patients are placed in a beach chair position. A longitudinal incision at the midline of the distal clavicle is utilized for access to the ACJ, the distal clavicle, and the coracoid. The anterior, posterior, and undersurface of the distal clavicle are exposed. A standard posterior viewing and anterolateral working portals are created. A shuttling suture is passed arthroscopically and used to pass allograft and nonbiologic augmentation around the coracoid. The nonbiologic sutures are passed through a singular hole in the distal clavicle and secured with a DogBone button. The allograft is wrapped around the clavicle to recreate the coracoclavicular ligaments and secured with sutures. The ACJ capsule is reconstructed by suturing the posterior/medial limb, which is kept long, to the capsule and periosteum. Meticulous, layered closure is performed with particular attention to closing the deltotrapezial fascia.

**Results:** A postoperative x-ray at 2 weeks and 6 months are obtained to confirm proper positioning. The sling is discontinued at 6 weeks, and supervised physical therapy is initiated. At 6 months, patients are typically cleared to full unrestricted activity.

**Discussion/Conclusion:** Arthroscopic-assisted coracoclavicular and acromioclavicular ligament reconstruction in patients with chronic type 3 ACJ separation who fail conservative management can have excellent outcomes. The use of arthroscopic assistance may ease the passage of graft and nonbiologic suture around the coracoid. A 70° scope is helpful for coracoid visualization, and biologic reconstruction of the ligament with tendon graft with suture augmentation in chronic cases is vital in achieving a good outcome.

**Patient Consent Disclosure Statement:** The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form of approval from the patient(s) with this submission for publication.

Keywords: acromioclavicular joint; AC joint; reconstruction; allograft; type 3

## VIDEO TRANSCRIPT

This video demonstrates our technique for arthroscopicassisted coracoclavicular and acromioclavicular ligament reconstruction in a patient with a chronic type 3 acromioclavicular joint (ACJ) separation.

Here are our author's disclosures.

Here is an outline of the presentation topics we will discuss in this video.

ACJ separations are common traumatic shoulder injuries that comprise 3% to 12% of all shoulder surgeries, and up to 40% to 50% of shoulder injuries in contact sports, especially in men in the second to third decade of life.<sup>1,3</sup> These injuries are often caused by a direct blow to an adducted arm or falling onto an adducted arm. Complete disruption of the ACJ capsule and coracoclavicular or coracoclavicular (CC) ligaments can lead to horizontal and vertical instability.<sup>2</sup> In the acute setting, on physical

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examination, patients exhibit noticeable ACJ asymmetry, shoulder pain, diminished range of motion (ROM) and strength, tenderness over the ACJ, and difficulty with cross-adduction.

Radiographic evaluation includes a true anteroposterior view, bilateral Zanca radiographs for comparison to the contralateral, and an axillary radiograph to assess for posterior displacement of the distal clavicle.

The Rockwood classification which considers horizontal and vertical displacement is the most widely used classification.

Management of ACJ injuries are typically based on the type and chronicity of the injury, as well as patient characteristics. Conservative treatment often includes a short period of sling immobilization for comfort which may range from days to weeks. Sling removal and early range of motion is encouraged once symptoms allow. Depending on the patient's symptoms, physical therapy may or may not be necessary. Return to sports is allowed once the patient is pain free and has regained full motion and strength.

Surgical treatment is traditionally recommended for acute Type 4 to 6 injuries and chronic Type 3 separations that have failed conservative management, although this currently debated.<sup>1,2</sup> More than 60 different surgical techniques have been introduced in the literature and the optimal treatment for ACJ repair and reconstruction in the appropriately indicated remains controversial. European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA)<sup>6</sup> conducted a consensus process following Delphi technique in 2019, and the results were published in 2020. The consensus from this meeting suggested arthroscopicassisted anatomic ACJ reconstruction with suspensory device for the acute setting and adding tendon graft reconstruction in the chronic setting was a viable approach. An advantage of an arthroscopic-assisted approach is improved ability pass suture and graft around the coracoid which can be challenging in certain individuals due to body habitus and anatomic differences in the shape of the coracoid.<sup>2</sup> Furthermore, a recent study by Ranne et al<sup>5</sup> showed that arthroscopic-assisted techniques for chronic ACJ repair relative to fully open ACJ reconstruction could improve clavicle wound healing and lower the risk of early complications.

Our case is a 28-year-old man with rheumatic heart disease who presented to our clinic with right shoulder pain after a fall while skiing 5 months ago. He continued to have significant symptom and difficulties with activities of daily living, despite 5 months of nonoperative management. On examination, he had obvious deformity on right ACJ and pain with cross-body adduction. He had normal ROM and cuff strength.

Radiographs demonstrated a Rockwood type 3 ACJ separation with a 100% increase in CC interval compared with the contralateral side. Given that the patient remained severely symptomatic at 5 months despite nonoperative management surgical treatment with an arthroscopicassisted CC and AC ligament reconstruction was opted.

Here is a list of equipment needed for this technique.

An incision is made over the anterior boarder of the clavicle, centered over the ACJ. Bovie is used to achieve hemostasis, develop skin flaps, and split the platysma.

We then identified the anterior and posterior borders of the clavicle and split the deltotrapezial fascia in line with the incision.

Then using a bovie followed by key elevators, we elevate the deltotrapezial fascia and periosteum off of the distal clavicle, both anteriorly and posteriorly, and then on the undersurface.

At this point, it may be necessary to excise a small amount of distal clavicle in order to achieve anatomic reduction. It is also very important to bluntly dissect anterior to the distal clavicle in order to ensure problem-free passage of the graft later.

Next, we perform our arthroscopy using a standard posterior viewing portal and a slightly lateral anterior working portal. We skeletonize the base of the coracoid circumferentially with an arthroscopic radio frequency ablation device and a shaver.

We then insert a curved suture passer through the open incision anterior to the clavicle and medial to the coracoid around the base of the coracoid and shuttle a Nitinol wire (DYNALLOY Inc: Irvine, CA) which is retrieved out of the lateral arthroscopic portal. This wire is used to shuttle a FiberLink suture (Arthrex; Naples, FL) with a loop laterally around the coracoid for passage of the graft later. A switching stick is then inserted through the open incision, anterior to the clavicle and lateral to the coracoid. A metal dilator for an 8.2-mm cannula is then inserted over the switching stick to shuttle a Nitinol wire into the subcoracoid space. The Nitinol wire is then retrieved through the anterolateral arthroscopic portal. The Nitinol wire is then used to shuttle the lateral looped end of the FiberLink suture out of the lateral portion of the open incision. Sutures from 1 end of the whipstitched graft, 1 suture tape, and 2 FiberLinks oriented in opposite directions are then loaded into the passed FiberLinked suture. We then

<sup>&</sup>lt;sup>§</sup>Address correspondence to Albert Lin, MD, Shoulder Service, Pittsburgh Shoulder Institute, Division of Shoulder Surgery and Sports Medicine, Department of Orthopedic Surgery, UPMC Freddie Fu Sports Medicine Center, University of Pittsburgh/University of Pittsburgh Medical Center, 3200 South Water Street, Pittsburgh, PA 15203, USA (email: lina2@upmc.edu).

<sup>\*</sup>Department of Orthopedic Surgery, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA.

<sup>&</sup>lt;sup>†</sup>Department of Orthopedic Surgery, Colorado Permanente Medical Group, Denver, Colorado, USA.

<sup>&</sup>lt;sup>‡</sup>Department of Orthopedic Surgery, University of Minnesota, Minneapolis, Minnesota, USA.

Shoulder Service, Pittsburgh Shoulder Institute, Division of Shoulder Surgery and Sports Medicine, Department of Orthopedic Surgery, UPMC Freddie Fu Sports Medicine Center, University of Pittsburgh/University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA.

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pull on the nonlooped end of the FiberLink to shuttle those sutures around the coracoid.

The graft itself is then shuttled around the coracoid. We then measure 3.5 cm from the tip of the distal clavicle and make a mark with a bovie for a pilot hole. We then drill bicortically with a 3.0-mm cannulated drill bit. A Nitinol wire is then fed down through the drill bit and retrieved anterior and inferior to the clavicle. Both ends of each FiberLink suture are identified and isolated. The nonlooped end is then passed through the looped end to provide a secure luggage tag around the coracoid. With 1 FiberLink going medial and 1 going lateral to the coracoid, the Nitinol wire is then used to shuttle the SutureTape limbs and both FiberLinks sutures through the hole in the distal clavicle.

The medial limb of the graft is then passed posterior to the clavicle. The Arthrex AC Dog Bone is then loaded with both limbs of the SutureTape and both FiberLinks sutures. A gentle reduction maneuver is performed to reduce the ACJ with downward pressure using a bone tamp onto the distal clavicle and upward pressure on the arm using the arm holder.

We then obtained a Zanca view with fluoroscopy to verify the anatomic reduction of the ACJ. While maintaining the reduction, we then tie down the suture tapes followed by the FiberLinks over the Dog Bone. The posteromedial limb and the anterolateral limb of the graft are then tied over one another. These are secured in place with multiple passes of nonobsorbable suture in a figure of 8 fashion. Both limbs are then brought over the ACJ and sutured to the periosteum overlying the acromion to reconstruct the ACJ capsule. As you can see, the final construct reconstructs the CC ligaments with a Dog Bone augmentation and restores the ACJ capsule.

Finally, we close the deltotrapezial fascia, overlying our construct, and close the wound in a layered fashion.

Postoperatively, the patient is immobilized in sling for 6 weeks to prevent subsidence of the construct. At 6 weeks, the patient begins physical therapy, beginning with pendulums and passive ROM. At 10 weeks, we advance to active ROM, and at 12 weeks to strengthening. At 6 months' postoperative, the patient may return to full activity without restriction.

At 6 months' postoperative, our patient was pain free, with good function and x-ray demonstrated maintenance of the CC interval equivalent to the contralateral side. Our experience with the technique aligns with the findings reported by Ranne et al,<sup>4</sup> who reported 2-year outcomes among patients with long-term ACJ separations (grade III or V) and found that 85% of the patients had excellent results and very few complications. Furthermore, the study found that both Constant scores and Simple Shoulder Test scores improved significantly after surgery, with an average increase of >80% and 50%, respectively.

We will now conclude by discussing pearls and pitfalls:

- A limited distal clavicular excision in long-term ACJ separations may be beneficial if the ACJ is not reducible due to bone overlap
- It is very important to bluntly dissect anterior and posterior to the distal clavicle to allow problem-free passage of the graft later
- Skeletonizing the undersurface of the coracoid and visualization with a 70° arthroscope is important for passage of shuttling sutures in addition to passage of sutures and grafts around the coracoid
- Special attention is required while drilling the clavicle to avoid neurovascular injuries
- Intraoperative fluoroscopy can aid in confirming reduction of the ACJ and overreduction of the ACJ is preferred if possible, to accommodate any possibility of minor subsidence postoperatively

Here you will find our presentation references.

Thank you for viewing our video presentation of arthroscopic-assisted coracoclavicular and acromioclavicular ligament reconstruction.

## **ORCID** iD

Shaquille Charles ( https://orcid.org/0000-0003-1285-0224

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