Acromioclavicular Joint Reconstruction

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Abstract: Our technique for acromioclavicular joint reconstruction provides a variation on coracoclavicular ligament reconstruction to also include acromioclavicular ligament reconstruction. An oblique acromial tunnel is drilled, and the medial limb of the gracilis graft, after being crossed and passed beneath the coracoid and through the clavicle, is passed through this acromial tunnel and sutured to the trapezoid graft limb after appropriate tensioning. Tenodesis screws are not placed in the bone tunnels to avoid graft fraying, and initial forces on the graft are offloaded with braided absorbable sutures passed around the clavicle.

The acromioclavicular joint (ACJ) is stabilized in the coronal plane by the coracoclavicular (CC) ligaments and in the sagittal plane by the ACJ ligaments. The primary stabilizer of anterior and posterior translation is the superior ACJ ligament. The conoid and trapezoid comprise the CC ligaments and insert on the undersurface of the clavicle. The conoid inserts more posterior and the most lateral portion of its insertion is 45 mm from the distal extent of the clavicle, whereas the trapezoid is 10 mm more lateral and has a more central footprint.

ACJ instability can occur because of a direct force on the lateral acromion, as well as because of an indirect force on an outstretched arm. Surgical treatment is indicated in Rockwood type IV, V, and VI dislocations and in type III dislocations that have either failed conservative treatment, are in overhead athletes, or are in patients with manual labor occupations (Table 1). Although no gold standard currently exists for ACJ reconstruction, numerous surgical treatment options exist for achieving adequate fixation, including the Bosworth screw, Kirschner wires, or a hook plate. All of these methods have more optimal results when performed acutely, but they are associated with hardware breakage, migration, and need for removal.

Arthroscopic cortical fixation techniques are less invasive but do not anatomically reconstruct the acromioclavicular ligaments. Furthermore, these often need to be performed acutely unless a graft is used. The Weaver-Dunn technique involves transfer of the coracoacromial ligament to the distal clavicle. However, this ligament is not as strong as the native CC ligaments and does not reconstruct the acromioclavicular ligaments (Table 2).

Anatomic CC ligament reconstruction may be performed in both acute and chronic cases. However,
when performed in isolation, this may not restore horizontal stability, which may be important for overhead activity, particularly among athletes. Therefore our purpose is to describe a procedure that combines anatomic CC ligament reconstruction with acromioclavicular ligament reconstruction (Video 1). Specifically, this surgical technique has the following goals: (1) achievement of both coronal and sagittal ACJ stability; (2) avoidance of tenodesis screws or nonabsorbable sutures being passed through bone tunnels because they may be associated with graft fraying; and (3) use of braided PDS sutures (Ethicon, Somerville, NJ) around the clavicle to initially unload the forces on the graft.

**Technique**

The contralateral gracilis tendon is harvested through an oblique incision centered over the pes anserinus. The sartorial fascia is split proximal to the gracilis tendon and in line with the tendon’s course. The tendon is identified on the undersurface of the fascia with a hemostat clamp, freed of fascial bands, and harvested with a tendon stripper (Stryker, Mahwah, NJ). Care is taken to protect the saphenous nerve and medial collateral ligament during dissection and harvesting of the gracilis tendon.
Fig 5. Loop suture (arrow) is passed around the coracoid to act as a shuttle for the graft and the PDS sutures.

Fig 6. Distal clavicle excision (arrow) is performed.

Fig 7. Drilling of the conoid tunnel (white arrow) within the acromion. One should note the already formed trapezoid tunnel (yellow arrow).

Fig 8. The looped suture is passed through the conoid tunnel (white arrow) and trapezoid tunnel (yellow arrow).

Fig 9. Passage of the looped suture (arrow) around the clavicle, medial to the conoid tunnel.

Fig 10. Gracilis graft (arrows) is passed for reconstruction of the coracoclavicular ligament.
The ACJ reconstruction is performed with the patient in the supine position with the head of the bed flexed to 45°. A longitudinal incision is made from the most posterior extent of the ACJ to the coracoid (Fig 1). The deltotrapezial fascia is split longitudinally and a transverse T is made over the ACJ and clavicle using electrocautery (Bovie, Clearwater, FL) (Fig 2). The coracoid is identified, and the pectoralis minor is freed medially and the coracoacromial ligament laterally to allow for aneurysm needle (Zimmer, Warsaw, IN) passage around the coracoid (Fig 3). The aneurysm needle is passed from medial to lateral beneath the coracoid to minimize the risk of damage to the musculocutaneous nerve, which is located approximately 5 cm distal to the tip of the coracoid process (Fig 4).

A loop suture is then passed around the coracoid to shuttle the gracilis graft and 9 No. 0 braided PDS sutures (Ethicon) (Fig 5). The PDS sutures will ultimately alleviate the initial tension placed on the graft. A distal clavicle excision of 5 to 10 mm is performed with a sagittal saw (Stryker) (Fig 6). Then, anatomic conoid and trapezoid tunnels are drilled as described by Mazzocca et al.² (Fig 7). The trapezoid tunnel should be approximately 35 mm from the tip of the osteotomized clavicle (more lateral and central), whereas the conoid tunnel should be 45 mm from the tip of the osteotomized clavicle (more medial and posterior).

An oblique tunnel in the acromion is drilled with the same 4-mm drill bit (Zimmer). A Hewson suture passer (Smith & Nephew, London, England) is then used to...
place looped sutures through each tunnel (Fig 8). The aneurysm needle is used to pass a looped suture around the clavicle medial to the conoid drill tunnel (Fig 9).

The gracilis graft is passed in a crossed fashion through the clavicular tunnels, and more tendon length is passed through the conoid tunnel to pass the medial limb through the acromial tunnel. This will ultimately reconstruct the CC (Fig 10) and acromioclavicular ligaments (Fig 11).

The graft is then tensioned appropriately and is sutured to itself with No. 2 nonabsorbable sutures (Arthrex, Naples, FL) (Fig 12). A square knot is tied anteriorly with the braided PDS sutures (Fig 13). Then, either end of the knot is sutured with No. 2 nonabsorbable sutures to avoid the knot prominence associated with added alternating half-hitches of the braided PDS sutures (Fig 14). The deltotrapezial fascia is closed with nonabsorbable sutures, and absorbable subcutaneous Vicryl sutures (Ethicon) and a running Prolene suture (Ethicon) are used to close the skin. Dressing and a shoulder immobilizer (DonJoy, Vista, CA) are placed.

Rehabilitation is initiated the day after surgery with active-assisted range of motion and isometric strengthening. Resisted forward flexion and horizontal adduction/abduction are not performed in the first 2 weeks postoperatively. Full range of motion and isotonic muscle strengthening are initiated in postoperative weeks 3 to 8. Scapular stabilization and neuromuscular control are the focus of therapy exercises after postoperative week 8, and a return-to-play protocol is initiated at week 16.

**Discussion**

Although there are numerous surgical techniques available to treat unstable ACJ dislocations, we believe the technique that we have described, anatomic CC ligament reconstruction with suture augmentation, provides similar stability to the intact ligamentous state of the ACJ. The use of autograft provides a reliable
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<th>Author, Year</th>
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<th>Surgical Technique</th>
<th>Graft or Suture</th>
<th>Mean Follow-up (Range), mo</th>
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<th>Mean QuickDASH Score</th>
<th>Mean Oxford Shoulder Score</th>
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ACJ, acromioclavicular joint; LARS, Ligament Advanced Reinforcement System (Surgical Implants and Devices, Arc-sur-Tille, France); NR, not reported; QuickDASH, short version of Disabilities of the Arm, Shoulder and Hand questionnaire; UCLA, University of California, Los Angeles.
tissue structure for healing in both acute and chronic injuries. Braided PDS suture allows for initial temporary tissue structure for healing in both acute and chronic but there are only small studies available on their short-term and mid-term outcomes (Table 4). For instance, CC screw fixation is the strongest type of fixation. Despite this, there are numerous complications from its use including iatrogenic fracture, hardware migration, and the need for hardware removal with remaining stress risers. In conclusion, our surgical technique provides a modification of the anatomic CC ligament technique to enhance the anterior-to-posterior stability of the ACJ, which we believe to be imperative to performance in the overhead athlete.

References