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Research Article

Acromioclavicular Joint Dislocation Repair: A Mini Open Technique for Reconstruction of Both the Coracoclavicular (CC) and AC Joint Ligaments at a Low Cost

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Abstract

AC joint dislocations are common injuries that significantly impact shoulder function. The stability of the AC joint relies on CC ligaments for vertical stability and AC ligaments and capsular structures for horizontal stability. There are various treatment options available to repair those lesions, including open, mini-open, and arthroscopically assisted techniques. Damage to AC ligaments may be overlooked but can result in chronic horizontal instability and pain. Currently, numerous surgical procedures exist for these injuries, and there is a lack of consensus regarding the optimal technique. This article introduces a mini-open technique to address CC and AC injuries, utilizing double clavicular tunnels and ultra-high-strength suture tape material for vertical instability, and an anchor in the acromion to tackle horizontal instability.

Keywords: Acromioclavicular; Reconstruction; Coracoclavicular; AC Joint Ligaments

Introduction

Acromioclavicular (AC) joint injuries, particularly Type 2 injuries, represent a significant clinical challenge in orthopedic sports medicine [1]. Approximately 12% of all acute shoulder injuries affect the AC joint [2]. In young and active men, even higher incidences can be found, often due to participation in high-impact sports [3-5].

The AC joint is a diarthrodial joint surrounded by a capsule, with an intra-articular synovium and an articular cartilage interface. The hyaline articular cartilage becomes fibrocartilage on the acromial side of the joint by the age of 17 and on the clavicular side by the age of 24 [6]. Stability of the AC joint depends on contributions from both the coracoclavicular (CC) ligaments and AC ligament and capsular structures [7].

The AC ligament comprises four components, with the posterior and superior components being the strongest, providing horizontal stability to the AC joint. Injuries to this ligament lead to horizontal instability of the AC joint, potentially causing chronic injuries, pain, and disability (2). The AC joint provides a crucial link between the scapula and the clavicle, influencing the coordination of shoulder girdle movement [8].

Lower grade AC injuries (types I and II) are initially treated nonoperatively, with sling immobilization, ice, and rest, followed by shoulder rehabilitation focusing on scapular retraction [9]. However, surgery may be necessary in cases of persistent horizontal instability causing pain and functional impairment [2]. The horizontal instability is confirmed on physical examination by pain over the AC joint, palpable horizontal instability on mobilization, and crepitus of the AC joint with digital manipulation and during cross-adduction against resistance [10].

Classification

The Rockwood classification is the most widely used classification for AC joint dislocation but is purely radiographic [11], and it´s not easy to appreciate horizontal instability of the AC joint with traditional radiography views.

In a prospective radiographic study by Gastaud., *et al.* [12]. 15 radiographs of patients with AC joint separations, sourced from the 2014 symposium database of the French Society of Arthroscopy, were evaluated to assess inter- and intraobserver reproducibility. The study utilized Zanca, axillary lateral, and dynamic lateral views. The authors concluded that evaluating horizontal instability on radiographs, whether static or dynamic, proved challenging. The Alexander view, as proposed by Tauber., *et al*. [13], offers an alternative to the dynamic view. It requires fewer radiographs, resulting in reduced exposure to radiation.

There are many surgical techniques for AC reconstruction, and there isn't a universally accepted gold standard, especially when it comes to addressing horizontal instability. These techniques include primary repair of the coracoclavicular ligaments, augmentation with autogenous tissue (coracoacromial ligament), augmentation with absorbable and nonabsorbable suture as well as prosthetic material, additionally, stabilization with metallic screws and plates, switching between open techniques to arthroscopically assisted techniques [14,15].

Many procedures focus on reconstructing the CC ligament rather than the AC ligament [16-20].

This article describes a mini-open technique for reconstruction of both CC and AC ligaments.

Inclusion criteria

The surgical indications for this procedure, in both sexes, are those acromioclavicular type II and III lesions in which pain and scapular dyskinesia persist after 6 weeks of conservative management [11], as well as acute Type IV – VI lesions, the only surgical contraindication is that in which the surgical risks are greater than the benefits.

Surgical technique

Intravenous antibiotic prophylaxis is performed with 1g of intravenous cephalothin 1hour prior to the procedure and in those allergic to cephalosporins/penicillin we indicate vancomycin 1gr intravenous 2hours before.

The procedure is performed under general anesthesia in combination with an interscalene block, with the patient in a beach chair position (Figure 1). We use 26 mL ChloraPrepÒ for upper extremity skin asepsis and covered with sterile drapes on a regular basis. First the vertical stability is repaired and then the horizontal stability.

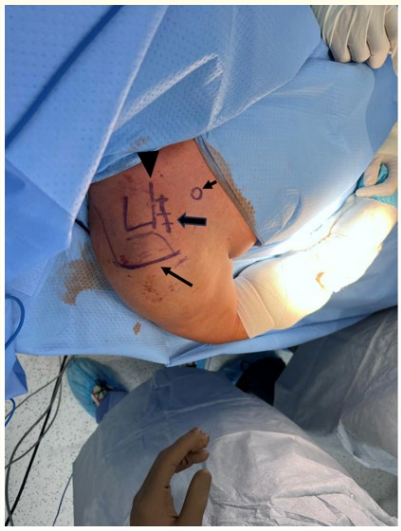

Figure 1: Patient in beach chair position, there are pointed out the anatomical structures: clavicle (arrowhead), coracoid process (short arrow), acromion (long arrow), incision (thick arrow).

Vertical stability repair

A 4 cm straight incision is made on the upper shoulder (Figure 2), starting 1 cm distal to the acromioclavicular joint and 3 cm proximal to it, on the anterior border of the acromion and clavicle.

Dissection is performed in layers to the level of the fascia. Full thickness skin flaps are raised both anterior and posterior to the clavicle and AC joint.

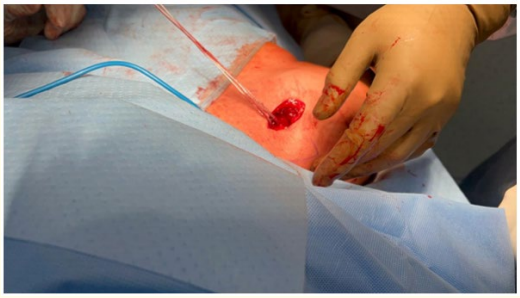

Figure 2: A 4 cm incision is made over the surgical marking. In the image we also can see heavy sutures over the clavicle.

The AC joint capsule may show a tear, as well as ligament injury, confirming a diagnosis of AC joint instability. The distal clavicle and the tissue are dissected until the base of the coracoid process is palpated. We first drill the tunnels in the clavicle, from superior to inferior, using a 3.0 mm drill bit (Figure 3). The first tunnel is made 1.5 cm medial to the AC joint, along the course of the trapezoid ligament, then we drill our second tunnel, along the course of the conoid ligament, 4.5 cm medial to the edge of the AC joint. These distances correspond to the anatomical landmarks of the CC ligament complex [21].

Figure 3: Clavicular tunnels. The distances of the tunnels are made by simulating the distance of the coracoclavicular ligaments.

Once the tunnels in the clavicle are made, we slide a pre-loaded ArthrexÒ Inc. Suture passing device (Figure 4) under the base of the coracoid process and transport a 2mm x 36-inch FiberTapeÒ suture from ArthrexÒ Inc. below the base of the coracoid.

Figure 4: ArthrexÒ suture passing device. With which we slide the suture under the coracoid process.

Subsequently, using a suture pass-through cable, we transport each end of the FiberTapeÒ over its respective tunnel (in such a way that they remain parallel to each other and not crossing), from inferior to superior across the clavicle (Figure 5). The clavicle is manually hyper-reduced by 2 mm, with contact made at the elbow, and the ends of the suture are tied with a sliding locking knot, creating a low-profile construct.

Figure 5: The clavicle is observed with the sutures transported through the bone tunnels, then the knot is made between these sutures, reducing the acromioclavicular joint.

Horizontal stability repair

With a 2.4mm drill bit, we drill the anterior wall of the acromion towards the posterior wall, up to the laser mark, 1.5 cm distal to the acromioclavicular joint. We then drill the hole, pass the two ends of the FiberTapeÒ suture for vertical fixation through a 3.9mm x 17.9mm SwivelockÒ Arthrex Inc. biocomposite suture anchor (Figure 6), we tighten the sutures at the level of the perforation and mark them with a marker. We then measure the distance to the laser mark on the SwivelockÒ and re-mark our suture.

Figure 6: Drilling over the acromion from anterior to posterior, prior to inserting the SwivelockÒ anchor with the FibertTapeÒ sutures already loaded.

We insert the anchor with the sutures under tension in such a way that they act as a stabilizer for horizontal movement, up to the previously marked point on the suture to avoid over-tensioning it (Figure 7).

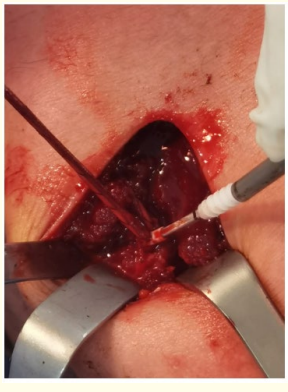

Figure 7: The SwivelockÒ anchor is placed by tensioning both ends of the FiberTapeÒ suture in such a way that once the anchor is in place, it restricts the horizontal movement of the AC joint.

We take radiographic controls (Figure 8) before closing the wound, confirming the acromioclavicular reduction.

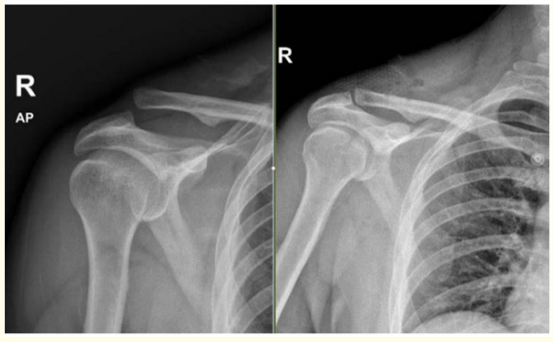

Figure 8: Preoperative (left) and postoperative (right) anteroposterior shoulder x-rays, in which the reduction of the CC and AC joints are confirmed.

We cut the excess suture, perform hemostasis, irrigate the wound with MycrodacinÒ, and close in layers, resulting in a small and aesthetically pleasing scar (Figure 9).

Figure 9: Final wound length is 4 cm.

Postoperative care

In the postoperative period, the upper extremity is kept in a sling for 6 weeks, avoiding any tensile forces along the longitudinal axis of the arm. The first week is dedicated to reducing arm inflammation. From week 1 to week 6, passive assisted range of motion is started, including flexion and abduction up to 90° and external rotation to the neutral position. The patient begins scapular retraction exercises and posture training, which helps to reduce the AC joint. Cross-body adduction is avoided during the first 6 weeks. Active range of motion exercises start at 6 weeks, with a gradual initiation assisted by a physical therapist, focusing initially on isometric muscle strengthening. By 3 months, full active shoulder movement

should be achieved, and isokinetic muscle strengthening should be started gradually. Return to sports requiring overhead arm movements is permitted after 6 to 8 months.

Results and Discussion

Currently, there is no consensus on the optimal approach to address horizontal instability of the AC joint. Many procedures for AC joint reconstruction focus on vertical instability rather than horizontal instability.

In this article, we present a mini-open technique for the reconstruction of both the AC and CC ligaments, with attention to horizontal stabilization of the AC joint, using a preloaded Swivelock Ò anchor with FiberTapeÒ suture.

The importance of the AC joint capsular ligaments in anteroposterior stability was evaluated by Limkiewicz., *et al.* [22], who found that after resection of the capsular ligaments and joint capsule, there was increased anteroposterior movement with minimal vertical movement. Tauber et al. [23], compared isolated CC ligament reconstruction versus CC + AC ligament reconstruction, finding that the CC + AC reconstruction produced better clinical and radiological outcomes in Taft scores [24] and ACJI scores [25]. Aliberti., *et al.* [10] highlighted that horizontal instability-related injuries are often overlooked, leading to diagnostic challenges and potential failure of surgical stabilization. There is consistent evidence indicating that horizontal stability significantly influences clinical outcomes [26]. Scheibel., *et al*. suggest that unresolved horizontal instability is the only factor contributing to an unfavorable clinical outcome [25].

Saier., *et al.* [27]. conducted a study to evaluate whether isolated CC ligament reconstruction using two-button devices provided horizontal stability comparable to CC reconstruction combined with supplemental AC joint cerclage using suture tape. After 5000 cycles of dynamic anteroposterior loading, only the combined AC and CC reconstruction effectively maintained horizontal stability of the AC joint, emphasizing the importance of both AC and CC reconstruction in individuals with AC joint separation.

Regarding suture placement, Mohsen., *et al.* [28]. showed greater horizontal AC stability with the double clavicular tunnel technique compared to the loop technique one year postoperatively; however, shoulder function changes reported in Constant and Taft scores were similar with both techniques.

In this study, we maintained the reduction of the AC joint using FiberTapeÒ suture. This procedure has advantages and disadvantages:

Advantages

- The biomechanical strength of FiberTapeÒ (805.5 ± 36.1 N) [29]. provides sufficient biomechanical strength to support the native CC ligament complex (589 N) [30].
- The 3 mm diameter clavicular tunnels reduce the risk of fractures compared to CC reconstruction techniques with allograft/autograft, which require drilling 6 mm diameter bone tunnels with a high risk of clavicle fracture [20].
- The use of minimal material results in lower cost and greater reproducibility.
- Primary stabilization of both joints provides better clinical outcomes in Taft and ACJI scores [24,25].
- The suture-only construct for coracoclavicular joint reduction has demonstrated good results compared to other techniques [31].
- A single small 4 cm incision for the entire procedure.

Disadvantages

- The construct resulting from tying the FiberTapeÒ sutures may cause skin discomfort immediately above.

In our study, we reduced the AC joint and secured it with a SwivelockÒ anchor inserted into the acromion with two heavy FiberTapeÒ sutures, acting as a safety belt against horizontal displacement of the joint. This method not only ensures horizontal stability but also enhances and protects vertical stability of the CC fixation.

Limitations

This study has several limitations, including its retrospective nature, small sample size, lack of a comparative cohort, and the arbitrary standard of 2 mm displacement quantification. Therefore, further research, including randomized controlled trials with larger sample sizes, is needed.

Conclusion

Currently, no surgical technique has demonstrated superior results over others. However, the authors suggest that the low-profile fixation method for the CC ligament combined with primary augmentation of the AC joint presents a reliable, reproducible, and cost-effective alternative for the surgical treatment of acute and chronic AC joint dislocations. This technique restores both vertical and horizontal stability, providing the necessary strength for ligament healing and creating a "safety belt" effect to prevent horizontal displacement of the AC joint, reducing residual pain in some patients where only CC fixation is performed.

Bibliography

1. Berthold DP., *et al*. "Current concepts in acromioclavicular joint (AC) instability - a proposed treatment algorithm for acute and chronic AC-joint surgery". *BMC Musculoskeletal Disorders* 23 (2022).

2. Aliberti GM., *et al*. "Restoring Horizontal Stability of the Acromioclavicular Joint: Open Acromioclavicular Ligament Reconstruction and Repair with Semitendinosus Allograft". *Arthroscopy Techniques* 9.10 (2020): e1619-1626.

3. Braun S., *et al*. "Primary fixation of acromioclavicular joint disruption". *Operative Techniques in Sports Medicine* 22.3 (2014): 221-226.

4. Sirin E., *et al*. "Acromioclavicular joint injuries: Diagnosis, classification and ligamentoplasty procedures". *EFORT Open Reviews* 3.7 (2018): 426-433.

5. Chillemi C., *et al*. "Epidemiology of Isolated Acromioclavicular Joint Dislocation". *Emergency Medicine International* 2013 (2013): 1-5.

6. Joints.

7. Dyrna FGE., *et al*. "The Integrity of the Acromioclavicular Capsule Ensures Physiological Centering of the Acromioclavicular Joint Under Rotational Loading". *American Journal of Sports Medicine* 46.6 (2018): 1432-1440.

8. Fraser-Moodie JA., *et al*. "Injuries to the acromioclavicular joint". *The Journal of Bone and Joint Surgery British Volume* 90.6 (2008): 90-697.

9. Ma R., *et al*. "Managing and recognizing complications after treatment of acromioclavicular joint repair or reconstruction". *Current Reviews in Musculoskeletal Medicine. Humana Press Inc* 8 (2015): 75-82.

10. Aliberti GM., *et al*. "Horizontal Instability of the Acromioclavicular Joint: A Systematic Review". *American Journal of Sports Medicine. SAGE Publications Inc* 48 (2020): 504-510.

11. Beitzel K., *et al*. "ISAKOS upper extremity committee consensus statement on the need for diversification of the rockwood classification for acromioclavicular joint injuries". *Arthroscopy - Journal of Arthroscopic and Related Surgery* 30.2 (2014): 271-278.

12. Gastaud O., *et al*. "Reliability of radiographic measurements for acromioclavicular joint separations". *Orthopaedics and Traumatology: Surgery and Research* 101.8 (2015): S291-295.

13. Minkus M., *et al*. "Quantification of dynamic posterior translation in modified bilateral Alexander views and correlation with clinical and radiological parameters in patients with acute acromioclavicular joint instability". *Archives of Orthopaedic and Trauma Surgery* 137.6 (2017): 845-852.

14. Gutman MJ., *et al*. "Outcomes Following Different Fixation Strategies of Neer Type IIB Distal Clavicle Fractures". *Archives of Bone and Joint Surgery* 10.2 (2022): 160-165.

15. Mazzocca AD., *et al*. "Evaluation and treatment of acromioclavicular joint injuries". *American Journal of Sports Medicine* 35 (2007): 316-329.

16. Jones HP., *et al*. "Salvage of Failed Acromioclavicular Joint Reconstruction Using Autogenous Semitendinosus Tendon from the Knee Surgical Technique and Case Report". *The American Journal of Sports Medicine* 29.2 (2001): 234-237.

17. Yoon JP., *et al*. "Comparison of results between hook plate fixation and ligament reconstruction for acute unstable acromioclavicular joint dislocation". *CIOS Clinics in Orthopedic Surgery* 7.1 (2015): 97-103.

18. Berthold DP., *et al*. "Minimum 10-Year Outcomes After Revision Anatomic Coracoclavicular Ligament Reconstruction for Acromioclavicular Joint Instability". *Orthopaedic Journal of Sports Medicine* 8.9 (2020).

19. Beitzel K., *et al*. "Rotational and translational stability of different methods for direct acromioclavicular ligament repair in anatomic acromioclavicular joint reconstruction". *American Journal of Sports Medicine* 42.9 (2014): 2141-2148.

20. Millett PJ., *et al*. "Two-Year Outcomes after Primary Anatomic Coracoclavicular Ligament Reconstruction". *Arthroscopy - Journal of Arthroscopic and Related Surgery* 31.10 (2015): 1962-1973.

21. Mazzocca AD., *et al*. "A biomechanical evaluation of an anatomical coracoclavicular ligament reconstruction". *American Journal of Sports Medicine* 34.2 (2006): 236-246.

22. Klimkiewicz john J., *et al*. "The acromioclavicular capsule as a restraint to posterior translation of the clavicle: A biomechanical analysis". *Journal of Shoulder and Elbow Surgery* 8.2 (2020): 119-124.

23. Tauber M., *et al*. "Arthroscopic Stabilization of Chronic Acromioclavicular Joint Dislocations: Triple- Versus Single-Bundle Reconstruction". *American Journal of Sports Medicine* 44.2 (2016):482-489.

24. Taft TN., *et al*. "Dislocation of the acromioclavicular joint. An end-result study". *The Journal of Bone and Joint Surgery. American Volume* 69.7 (1987): 1045-1051.

25. Scheibel M., *et al*. "Arthroscopically assisted stabilization of acute high-grade acromioclavicular joint separations". *American Journal of Sports Medicine* 39.7 (2011): 1507-1516.

26. Wellmann M., *et al*. "Instabilitätsmuster bei Akromioklavikulargelenkverletzungen vom Typ Rockwood III: Bedeutung der horizontalen Instailität". *Orthopade* 42.4 (2013): 271-277.

27. Saier T., *et al*. "Value of additional acromioclavicular cerclage for horizontal stability in complete acromioclavicular separation: a biomechanical study". *Knee Surgery, Sports Traumatology, Arthroscopy* 23.5 (2015): 1498-505.

28. Mardani-Kivi M., *et al*. "Horizontal instability after acromioclavicular joint reduction using the two-hole technique is preferred over the loop technique: a single-blind randomized clinical trial". *Clinics in Shoulder and Elbow* 25.3 (2022): 224-249.

29. Borbas P., *et al*. "High-Strength Suture Tapes Are Biomechanically Stronger Than High-Strength Sutures Used in Rotator Cuff Repair". *Arthroscopy, Sports Medicine, and Rehabilitation* 3.3 (2021): e873-880.

30. Walz L., *et al*. "The anatomic reconstruction of acromioclavicular joint dislocations using 2 Tight Rope devices: A biomechanical study". *American Journal of Sports Medicine* 36.12 (2008): 2398-2406.

31. Laux CJ., *et al*. "Stand-alone coracoclavicular suture repair achieves very good results in unstable distal clavicle fractures at a minimum follow-up of 1 year". *Journal of Shoulder and Elbow Surgery* 30.9 (2021): 2090-2096.