



# Arthroscopic-Assisted Acromioclavicular Joint Dislocation Repair: A Modified Technique for Horizontal Stabilization Using Suture Anchors

Jorge Teixeira Ramos, M.D., Diogo Silva Gomes, M.D., Pedro Quinaz Neto, M.D., Marco Sarmiento, M.D., Ph.D., Nuno Moura, M.D., and António Cartucho, M.D.

**Abstract:** Acromioclavicular (AC) dislocation is a common lesion often resulting from a sports injury. Nowadays, treatment is still controversial mainly in grade III lesions according to the Rockwood classification. For most surgically treated AC acute dislocations, treatment is performed with an arthroscopic procedure that anatomically reconstructs the coracoclavicular ligaments. Increasing knowledge about AC joint biomechanics has underlined the importance of its horizontal stability through the superior and inferior AC ligaments. Moreover, the pattern of lesion tends to repeat itself, with the superior AC ligament being torn most frequently from the clavicular side in a peeling fashion. Therefore, the purpose of this note is to describe the technical aspects of additional horizontal stability through superior AC ligament repair using suture anchors.

The acromioclavicular (AC) joint is stabilized both vertically and horizontally by the coracoclavicular and AC ligaments, respectively. Because the superior AC ligaments are the main stabilizer against anterior-posterior forces and their instability is associated with worse functional outcomes,<sup>1-3</sup> more attention is being directed toward their repair, with multiple techniques already described.<sup>2,4,5</sup>

Knowledge of the biomechanics and anatomy is a cornerstone to anatomic repair of these ligaments; however, only recently have some studies been published regarding the morphologic patterns of AC

ligament injury.<sup>6</sup> The surgical treatment of acute AC injuries relies on the biological healing potential of the torn ligaments.<sup>7</sup> Meanwhile, multiple arthroscopic-assisted procedures have been described using a button-suture implant to provide primary coracoclavicular stability.<sup>8</sup>

Whereas vertical stability was addressed, horizontal stability remained a concern.<sup>1</sup> To address this problem, we describe the technical features of an arthroscopically assisted procedure that aims to correct both. An additional incision will offer us better reduction and a direct approach to the AC joint. At the same time, the surgeon is able to visualize the torn ligaments and the lesion pattern to perform repair using multiple techniques. Our preferred method is to use a suture anchor, as described later.

## Surgical Technique

### Anesthesia and Patient Positioning

The patient is placed in the beach-chair position (Fig 1) under an interscalene block with general anesthesia. We do not use an arm holder, and the limb is draped in general fashion retaining enough space for the surgical approach to the clavicle. Anatomic landmarks are identified and drawn (Fig 2).

### Clavicle and AC Joint Exposure

Before the arthroscopic procedure, an incision (1.5 cm) is made on the anterior border of the clavicle,

*From the Department of Orthopedic Surgery, Hospital Vila Franca de Xira, Vila Franca de Xira, Portugal (J.T.R., D.S.G., P.Q.N.); Shoulder and Elbow Unit, Department of Orthopedic Surgery, Hospital CUF Descobertas, Lisbon, Portugal (D.S.G., M.S., N.M., A.C.); and Department of Orthopedic Surgery, Hospital Particular do Algarve, Algarve, Portugal (D.S.G.).*

*The authors report the following potential conflicts of interest or sources of funding: A.C. receives personal fees from Arthrex, outside the submitted work. Full ICMJE author disclosure forms are available for this article online, as supplementary material.*

*Received July 4, 2020; accepted October 7, 2020.*

*Address correspondence to Jorge Teixeira Ramos, M.D., Department of Orthopedic Surgery, Hospital Vila Franca de Xira, Estrada Carlos Lima Costa No. 2, 2600-009 Vila Franca de Xira, Portugal. E-mail: [jorge.a.ramos@hvfjx.pt](mailto:jorge.a.ramos@hvfjx.pt)*

*© 2020 by the Arthroscopy Association of North America. Published by Elsevier. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).*

*2212-6287/201162*

*<https://doi.org/10.1016/j.eats.2020.10.004>*

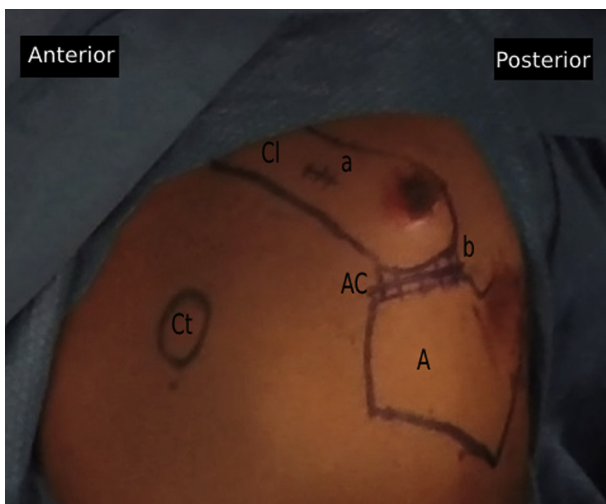


**Fig 1.** Setup for shoulder arthroscopy in left shoulder. The patient is in the beach-chair position.

3.5 cm medial to the AC joint. This incision is purposely located off the midline to avoid button and suture irritation of the skin (Table 1). The deltotrapezial fascia is incised in line with the skin, and the flaps are elevated subperiosteally. Afterward, by use of a 2.4-mm drill, the superior cortex is incompletely perforated to mark and center the definite drilling site, as well as to guide the final drilling. Then, a 3-cm anteroposterior incision is performed over the AC joint to evaluate the AC ligament injury pattern and to excise any tissues preventing adequate reduction such as the deltotrapezial fascia.

### Arthroscopic Preparation

A diagnostic arthroscopy is performed in a routine fashion to confirm or exclude any associated lesions. Then, the coracoid is debrided of any tissues that might interpose with the suture-button implant or that interfere with the view (Fig 3). In this process, the



**Fig 2.** Beach-chair position. Skin landmarks for left shoulder arthroscopy. (a, clavicle incision; A, acromion; AC, acromioclavicular joint; b, acromioclavicular incision; Cl, clavicle; Ct, coracoid process tip.)

**Table 1.** Pearls and Pitfalls of Technique

#### Pearls

- Clavicle incision on anterior clavicle border
- AC joint incision to excise any interposing tissue
- Incomplete predrilling of superior clavicle cortex to ensure future drill site
- Switching of camera to anterolateral portal for better visualization
- Use of drill guide through anterolateral portal and camera in anterior portal
- Hyper-reduction of AC joint
- Understanding superior AC ligament rupture pattern

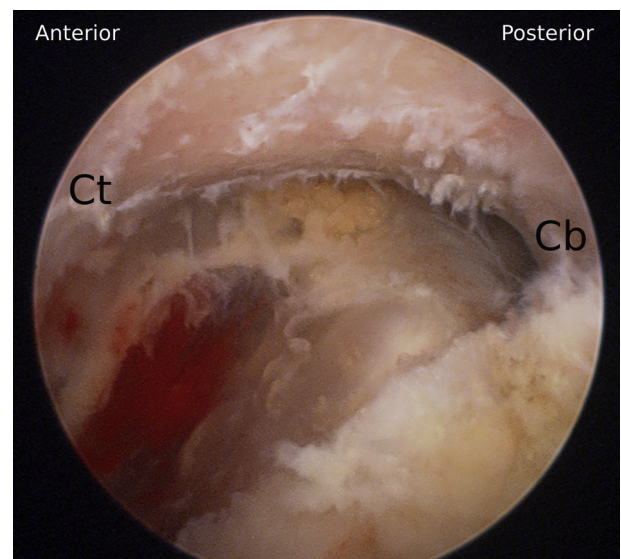
#### Pitfalls

- Inadequate excision of interposing tissues
- Clavicle incision over button location
- Inadequate AC joint reduction because of tissue interposition
- Excentric drilling of tunnel—insufficient button placement
- Non-recognition of importance of repairing superior AC ligaments

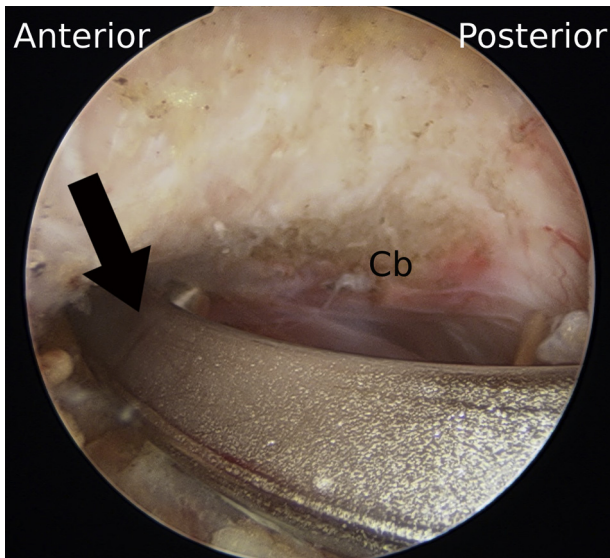
AC, acromioclavicular.

camera can be switched to the anterolateral portal, giving us a clear lateral view of the coracoid process.

At this point, the camera is switched to the anterior portal, and the drilling guide is usually inserted through the anterolateral portal and centered at the base of the coracoid process (Fig 4). The previously drilled hole at the superior aspect of the clavicle comes in handy at this point because it allows for stabilization of the drill and correct aiming of the drill guide. The drill is then passed through the clavicle and the coracoid process (4 cortices should be felt) under direct visualization (Fig 5). A shuttle nitinol wire loop is passed through the cannulated drill and retrieved with a grasper through the anterolateral portal. Then, it is replaced with a FiberWire shuttle suture (Arthrex, Naples, FL) for the single purpose of its resistance and our reassurance while pulling the implant (Fig 6).

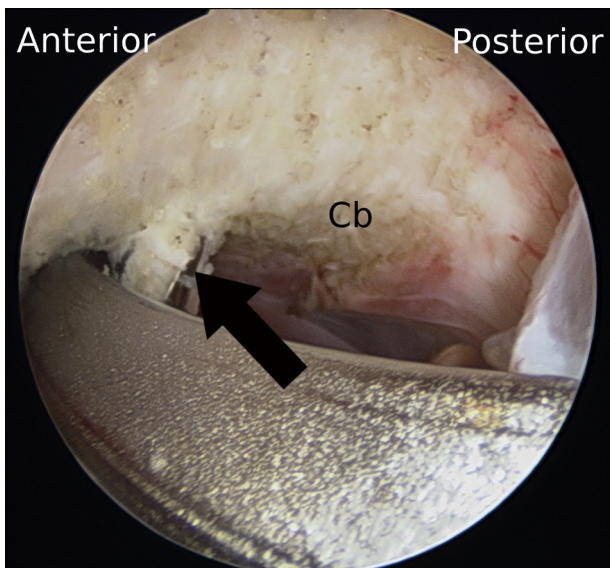


**Fig 3.** Beach-chair position. Coracoid process view of left shoulder from anterolateral portal. (Cb, coracoid process base; Ct, coracoid process tip.)

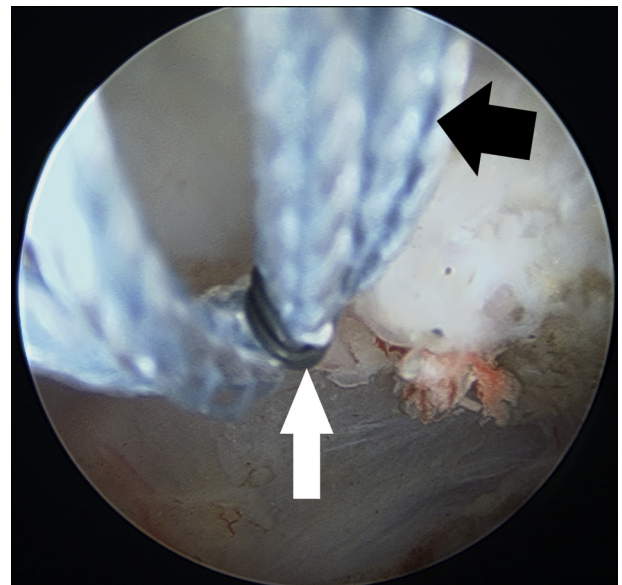


**Fig 4.** Beach-chair position. Anterior portal view of left shoulder showing drill guide (arrow) inserted through anterolateral portal centered at coracoid process base (Cb).

Two FiberTapes (Arthrex) are mounted on the button. The 4 ends of the sutures are passed through the shuttle suture while the button is held with a grasper, which will aid the placement of the button at the base of the coracoid process. A combined movement of cranial traction and grasper positioning will allow the correct setting of the button (Fig 7). The 4 free strands are then threaded through another button that will lie on top of the clavicle.



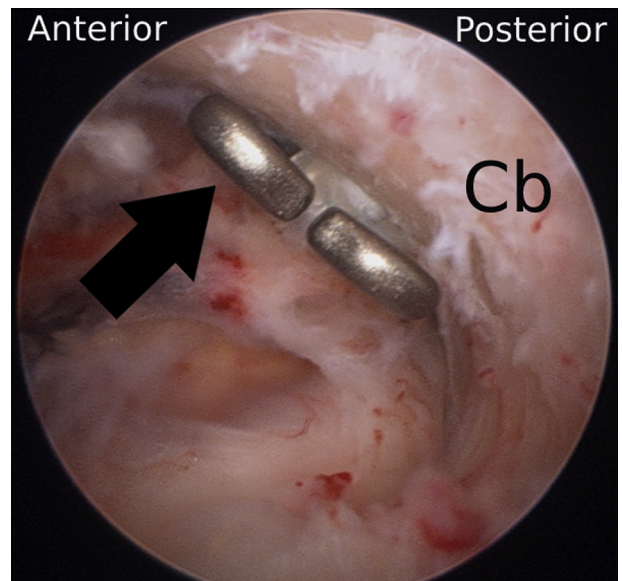
**Fig 5.** Beach-chair position. Anterior portal view of left shoulder showing drill (arrow) exiting at coracoid process base (Cb). This step must be performed under direct visualization to avoid any iatrogenic injuries. Therefore, it is important to stop after 4 cortices are felt.



**Fig 6.** Beach-chair position. Anterior portal view of left shoulder showing FiberWire (black arrow) being shuttled through drilled hole. After drilling, a nitinol wire loop (white arrow) is passed through the cannulated drill and is then replaced with a FiberWire for its resistance while pulling the implant.

#### AC Joint Reduction

The next step of our procedure consists of hyper-reduction (we believe this compensates for some loss of tape tension while tying the knots and over time) of the AC joint and the coracoclavicular distance by pressure applied downward on the clavicle and upward



**Fig 7.** Beach-chair position. Anterolateral portal view of left shoulder showing button placement at coracoid process base (Cb). When the FiberWire is in place, 2 FiberTapes are mounted on the button and are shuttled through the drilled hole with combined cranial traction and grasper positioning. The arrow indicates the button implant.

on the elbow. While the assistant performs this, the surgeon ties the first knots with 2 strands. This is the time for the first and only intraoperative radiograph to be taken to confirm adequate AC joint reduction, which is complemented by direct palpation of the superior AC joint (Fig 8; Video 1). To achieve anatomic reduction, any tissues in between (fascia, meniscus, or even ligaments) should be removed. If correct reduction is achieved, the remaining knots and strands are tied and the ends remain uncut.

### Horizontal Stabilization

A direct incision is made—or was already made—over the AC joint. This step is critical because it allows the removal of any tissue interposing between the clavicle and the acromion, usually the deltatrapezial fascia. Moreover, it gives us the exposure needed to add horizontal stability to our repair. From our experience, the longest or largest superior AC ligament remnants are usually attached to the acromial side, leaving the clavicular surface footprint naked, as stated in other studies.<sup>6</sup>

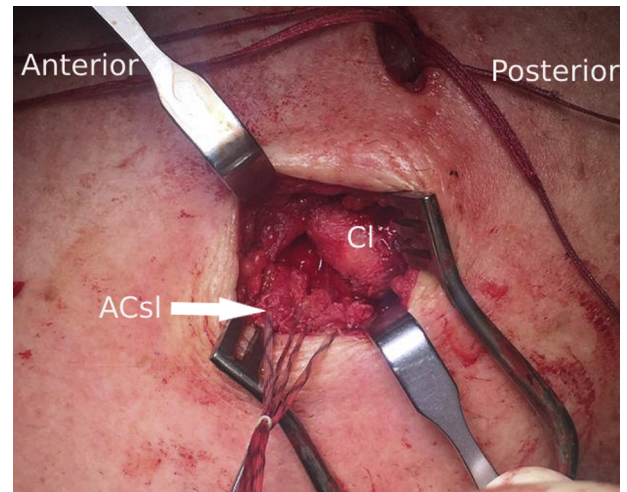
Two modified Kessler sutures are passed through the ligament (anterior and posterior) (Fig 9, Video 1) using SutureTape. Then, the 4 strands are mounted on a knotless suture anchor (3.5-mm SwiveLock; Arthrex) (Fig 10; Video 1) that is placed approximately 5 mm from the lateral clavicle border (Fig 11, Video 1).

### Closure

Before closure, the button strands that remain uncut are retrieved subcutaneously from the AC joint incision



**Fig 8.** Beach-chair position. Anterior-posterior view of left shoulder. Intraoperative fluoroscopy reveals adequate acromioclavicular joint reduction and button placement.

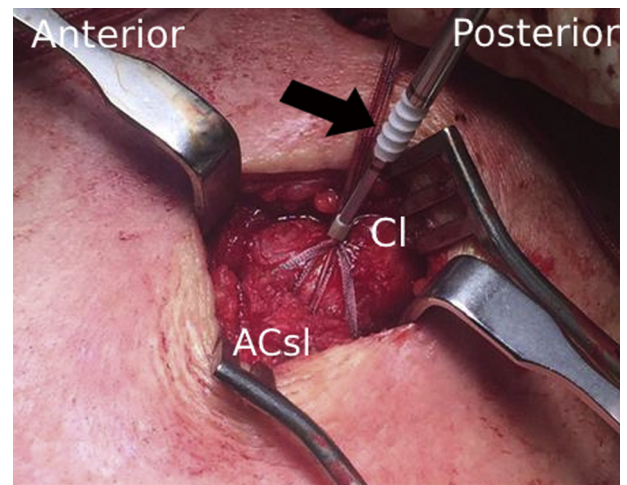


**Fig 9.** Beach-chair position. Anterolateral view of left shoulder showing 2 modified Kessler sutures passed on acromial side of superior acromioclavicular ligaments (ACsl, arrow). (Cl, clavicle.)

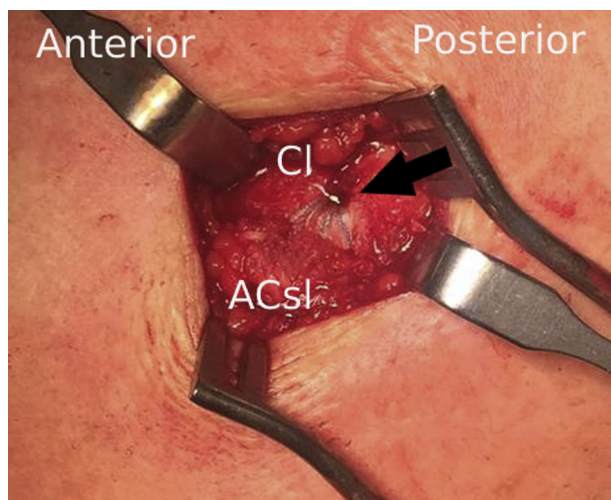
and cut midway from both incisions to avoid knot volume—related complications. The deltatrapezial fascia is closed in both places with Vicryl interrupted sutures (Ethicon, Somerville, NJ), and the skin is closed with a No. 3-0 interrupted nylon suture or surgical staples (Fig 12).

### Rehabilitation Protocol

After surgery, the patient is instructed to keep the shoulder in a sling for 5 weeks and is allowed shoulder pendular and external rotation exercises, as well as unrestricted elbow, wrist, and hand movements. Physiotherapy is initiated at 4 or 5 weeks with the initial focus on range-of-motion exercises and strengthening exercises toward scapular stabilization



**Fig 10.** Beach-chair position. Anterolateral view of left shoulder showing 4 strands of FiberTape through SwiveLock (arrow) providing delta configuration. (ACsl, superior acromioclavicular ligaments; Cl, clavicle.)



**Fig 11.** Beach-chair position. Anterolateral view of left shoulder showing anchor inserted in clavicle (Cl), pulling superior acromioclavicular ligaments (ACsl) and providing adequate horizontal stability. The SwiveLock is inserted in a previously drilled hole 5 mm from the lateral clavicle border. The arrow indicates the anchor insertion site.

afterward. Noncontact sports are acceptable from 3 months after surgery, and contact sports are only allowed after 6 months.



**Fig 12.** Beach-chair position. Anterolateral view of left shoulder showing cosmetic result at end of procedure.

## Discussion

More than 50 procedures for treating AC joint injuries have been published in the literature. Their emphasis is mainly on vertical rather than horizontal instability.<sup>1</sup> A growing number of publications regarding horizontal AC joint stabilization are being published. By itself, this reveals the rising knowledge about shoulder biomechanics and anatomic structures previously overlooked.<sup>6,9,10</sup> Incorporation of AC ligament repair or reconstruction showed improved patient outcomes.<sup>11</sup>

With a focus on that improvement, we do provide horizontal stability in all our patients undergoing AC joint instability repair. In our experience, there is a repetitive pattern of superior AC ligament injury that is more prevalent. Usually, the ligament stays attached to the acromion and detaches from the clavicle border. Hessmann et al.<sup>12</sup> also found the previous pattern to be the most frequent. According to Maier et al.,<sup>6</sup> who described, to our knowledge, the first morphologic classification of acute AC ligament tears, there are 4 distinct patterns: AC-1 is a clavicle-sided detachment and was found in approximately 70% of cases, which is similar to our data. The remaining patterns are AC-2, -3, and -4, corresponding to an oblique tear, midportion tear, and acromial detachment, respectively.

Our approach aims to repair AC-1 tears although it may also be used in a reverse way to repair AC-4 tears. This classification is also useful to understand one of the large limitations of this technique. Oblique (AC-2) or midportion (AC-3) tears are not suitable for our suture anchor repair because the length of the remaining ligament may not be enough to provide an anatomic repair. Chronic tears also should not be repaired according to this technique owing to the limited biological healing potential.

Using 2 modified Kessler sutures instead of 1 seems to improve repair strength, although biomechanical studies need to be undertaken to prove this statement. In summary, to restore optimal biomechanics to the AC ligaments, we must provide both anatomic AC joint and/or AC ligament reduction and physiological AC joint stabilization, which will ultimately determine the quality of AC ligament biological healing.<sup>4</sup>

## References

1. Aliberti GM, Kraeutler MJ, Trojan JD, Mulcahey MK. Horizontal instability of the acromioclavicular joint: A systematic review. *Am J Sports Med* 2020;48:504-510.
2. Scheibel M, Droschel S, Gerhardt C, Kraus N. Arthroscopically assisted stabilization of acute high-grade acromioclavicular joint separations. *Am J Sports Med* 2011;39:1507-1516.
3. Metzloff S, Rosslenbroich S, Forkel PH, et al. Surgical treatment of acute acromioclavicular joint dislocations: Hook plate versus minimally invasive reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2016;24:1972-1978.

4. Izadpanah K, Jaeger M, Ogon P, Sudkamp NP, Maier D. Arthroscopically assisted reconstruction of acute acromioclavicular joint dislocations: Anatomic AC ligament reconstruction with protective internal bracing—the “AC-RecoBridge” technique. *Arthrosc Tech* 2015;4:e153-e161.
5. Banffy MB, Van Eck CF, Stanton M, ElAttrache NS. A single-tunnel technique for coracoclavicular and acromioclavicular ligament reconstruction. *Arthrosc Tech* 2017;6:e769-e775.
6. Maier D, Jaeger M, Reising K, Feucht MJ, Südkamp NP, Izadpanah K. Injury patterns of the acromioclavicular ligament complex in acute acromioclavicular joint dislocations: A cross-sectional, fundamental study. *BMC Musculoskelet Disord* 2016;17:385.
7. Millett PJ, Horan MP, Warth RJ. Two-year outcomes after primary anatomic coracoclavicular ligament reconstruction. *Arthroscopy* 2015;31:1962-1973.
8. Shin SJ, Kim NK. Complications after arthroscopic coracoclavicular reconstruction using a single adjustable loop-length suspensory fixation device in acute acromioclavicular joint dislocation. *Arthroscopy* 2015;31:816-824.
9. Hislop P, Sakata K, Ackland DC, Gotmaker R, Evans MC. Acromioclavicular joint stabilization: A biomechanical study of bidirectional stability and strength. *Orthop J Sports Med* 2019;7:2325967119836751.
10. Morikawa D, Mazzocca AD, Obopilwe E, et al. Reconstruction of the acromioclavicular ligament complex using dermal allograft: A biomechanical analysis. *Arthroscopy* 2020;36:108-115.
11. North AS, Wilkinson T. Surgical reconstruction of the acromioclavicular joint: Can we identify the optimal approach? *Strategies Trauma Limb Reconstr* 2018;13:69-74.
12. Hessmann M, Gotzen L, Gehling H, Ruschenpohler D. Results of reconstruction of acromioclavicular joint rupture with PDS implants. *Unfallchirurg* 1997;100:193-197 [in German].