

## CASE REPORT

# Holding it Together: Chronic Acromioclavicular Reconstruction Combining Anatomical and Non-anatomical Reconstruction Using Allograft With Augmentation

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### ABSTRACT

The acromioclavicular joint (ACJ) represents the main connector between the axial and appendicular skeleton. Chronic ACJ instability disrupts the shoulder girdle's synchronized dynamic, leading to a significant limitation in daily activities and chronic pain secondary to osteoarthritis. In most cases, surgical intervention is recommended to restore its integrity. Thus, various procedures, including anatomical and non-anatomical reconstruction, have been proposed in the literature; however, none have shown superior to one another. Furthermore, a combination technique has not been discussed. The authors present a case of chronic ACJ injury (Rockwood type V), which was successfully treated with a combination of anatomical reconstruction of the coracoclavicular (CC) ligament using semitendinosus tendon allograft with bio screw fixation and non-anatomical stabilization of ACJ with button suture technique.

**Keywords:** Acromioclavicular joint, Rockwood type V, Anatomical reconstruction, Non-anatomical reconstruction, Allograft

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### INTRODUCTION

To date, there is no gold standard in ACJ reconstruction of chronic ACJ injury, and many methods have been described in the literature with variable outcomes (1). Healing of the ACJ is highly unpredictable despite the various repair methods, including the modified Weaver Dunn procedure, reconstruction using autograft or allograft (2). A more recent study shows that anatomical reconstruction of the coracoacromial (AC) joint alone have a high failure rate (1). Other complications of such procedures, such as lateral clavicle osteolysis and graft tunnel widening, are well described. However, none of the studies has discussed a combination technique using both the anatomic and non-anatomical approach.

### CASE REPORT

A 56-year-old gentleman was initially seen in the emergency department after a motor vehicle accident with a complaint of pain over the left shoulder. Clinical examination revealed swelling with tenderness and multiple abrasion over the region. The radiograph confirmed a Rockwood Type V ACJ disruption; see Fig. 1.

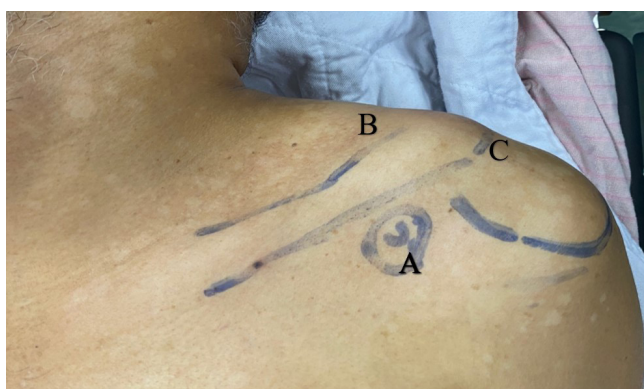
Due to severe abrasion with underlying psoriasis, surgical intervention was delayed as he was referred to the dermatology team and was put on an arm sling. The patient has come to follow up in the subsequent month after receiving treatment for his skin condition. He complained of persistent pain over his left shoulder. On examination, there is a prominence over the left lateral clavicle with tenderness on superficial palpation with limited range of motion. Also, positive cross-body abduction indicative of anterior-posterior instability and irreducible



**Fig. 1 : Preoperative radiograph shows superior displacement of the left clavicle with skin tethering.**

superior-inferior instability was noted. Radiological examination revealed an increase in coracoclavicular (CC) distance compared to the contralateral side. Thus, surgical intervention was offered. Given our previous unfavourable experience with autologous semitendinosus graft alone (anatomical reconstruction), additional AC stabilization was considered. Thus, a novel open reduction technique combining anatomical reconstruction of the CC ligament using semitendinosus tendon allograft with bio screws fixation and non-anatomical stabilization of AC joint with button suture technique has been done to strengthen the fixation further.

The patient was placed in a beach chair position. A skin incision slightly below the intended side was made to avoid wound breakdown; see Fig.2.



**Fig. 2 : Anatomical landmarks of A. Corocoid, B. Distal clavicle and C. Acromion was marked. An incision was made along the clavicle plane.**

Further dissection follows the clavicle subcutaneously. The distal clavicle was first identified after it was freed from deltoid and trapezius muscle through subperiosteal detachment. The initial reduction attempt was unsuccessful; 0.5 cm of the distal clavicle was excised using an oscillating saw, followed by nibbling of acromion end until the cancellous bone can be visualized. The reduction



**Fig. 3(a) : Distal clavicle was excised and reduced to its anatomical position and temporarily fixed using Kirshner wire (K-wire). Reconstruction of CC ligaments using allograft was done in a figure of eight manners. Augmentation using anchor suture over coracoid was done. A. Distal Clavicle B. Allograft ligament C.Anchor suture.**

**Fig. 3(b) : Immediate post- reconstruction shows Allograft was fixed with bioscrews over the clavicle followed by augmentation using two anchor sutures over the coracoid and distal clavicle. The remaining allograft was excised and suture to cover hardware over the clavicle. A. Anchor suture over the distal clavicle, B. Allograft fixed with two bioscrews and C. Anchor suture over the coracoid .**

of ACJ was confirmed under an image intensifier and initially fixed with two 1.8mm K wires; see Fig. 3(a).

Next, the corocoid process was identified though palpation and image intensifier for CC reduction and allograft placement. After confirming the initial reduction with fluoroscopy, a button suture was done to secure the CC distance. Two allograft tunnels were then created, mimicking the anatomical position of CC ligaments, approximately 20 mm from the ACJ, the other 40mm more distal and placed posteriorly. The tendon graft was then passed beneath the coracoid process in a figure of eight manners and secured with two 6 mm x 23 mm bio screws. The final tightening of the button suture supports the anchoring of the allograft; see Fig. 3(b). The excess allograft of both limbs was sutured together over the hardware to prevent prominence and irritation. The initial 1.8mm K wire was then secured with a button suture addressing the AC joint. Intraoperative



**Fig. 4 : Postoperative radiograph of the left shoulder shows an anatomical reduction of ACJ and CC with preservation of CC distance.**

fluoroscopy shows an anatomical reduction of ACJ, see Fig.4.

Post-operatively, he was put on an arm sling for six weeks. Pendulum range of motion exercise was initiated and co-managed with a sports physician and physiotherapist. Upon follow-up, there is a significant improvement in the abduction of the left shoulder up to 150 degrees, forward flexion of up to 120 degrees. The University of California (UCLA) shoulder score was more than 27, indicating excellent shoulder function.

## DISCUSSION

To date, there is no gold standard concluded for chronic ACJ disruption. Traditionally, non-anatomical reconstruction methods were introduced, the Weaver - Dunn procedure. It involves the transposition of the CC ligament to the distal end clavicle to provide stabilization. However, it yields mixed results and complication, including permanent deformity secondary to anterior displacement of the clavicle, and persistent pain was highlighted. This is because Weaver-Dunn only achieves axial stability; however, coronal stability was not addressed (3).

Hence, anatomical ACJ reconstruction by grafts was initially advocated in a chronic setting as it provides better stability in a biaxial plane by reconstructing its primary stabilizer, CC joint, either using autogenous graft or allograft. Its benefit has been well implicated, including more biological and avoiding complications including hardware migration, loosening and infection. However, more recent studies have conflicting results(4). Despite some have reported structurally favourable outcomes, this technique alone is associated with a high rate of secondary displacement of ACJ and loosening of graft tunnel (2). Thus a combined technique, an anatomical and non-anatomical reconstruction was proposed as they will function synergistically in both function and stability. With adequate stability, the loosening of the screw tunnel and loosening can be avoided.

This case report has demonstrated that the excision of the distal third of the clavicle serves two purposes. Firstly, to restore the ACJ plane, the distal end clavicle may be the source of painful ACJ. Augmentation of ACJ with anchor suture

provides superior biomechanics and provide further stability while allowing the tendon to integrate with its tunnel. Carofino and Mazzocco technique was adopted where tendons pass through a clavicular tunnel, subacromial in a figure of eight fashion and fix to clavicle tunnel using bio screws (1, 5). This technique was further improvised by including augmentation of CC with double button fixation. This will allow the allograft to integrate and distal end clavicle to heal without secondary displacement or substance tear. It is not surprising that the patient has benefited such significantly reduce pain and improves range of motion with this improved technique. However, a long-term follow-up and more sample size are needed to confirm the hypotheses.

In conclusion, combining anatomical and non-anatomical reconstruction addresses the pain and enhances stability to better graft healing. Together with adequate physiotherapy and rehabilitation protocol, a more favourable outcome can be achieved.

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