Arthroscopic fixation for acute acromioclavicular joint disruption using the TightRope device

Deepak Chaudhary, Vineet Jain, Deepak Joshi, Jitesh Kumar Jain, Ankit Goyal, Nitin Mehta
Sports Injury Centre, Safdarjang Hospital, Delhi, India

ABSTRACT

Purpose. To review outcome after arthroscopic fixation for acute acromioclavicular (AC) joint dislocation using the TightRope device.

Methods. Records of 15 men and 2 women aged 19 to 52 (mean, 35) years who underwent arthroscopic fixation using the TightRope device for acute (<3 weeks) AC joint dislocation of Rockwood type III (n=6), type IV (n=1), and type V (n=10) were reviewed. Outcome was evaluated using the Constant score. The coracoclavicular (CC) distance before and after surgery was compared.

Results. The mean follow-up period was 22.1 (range, 12–37) months. The mean time to return to work was 4 (range, 1.5–12) months, excluding one failure. The mean postoperative Constant score was 86.4 (range, 63–96). The CC distance decreased from 21.5±5.2 mm preoperatively to 9.8±3.5 mm at 6 months and to 10±3.2 mm at one year. There was no over-correction. All patients had satisfactory outcome except for one who had rupture of the TightRope suture at 6 months. Two patients had partial loss of reduction (≥2 mm) after 3 to 6 months secondary to osteolysis at the clavicular button site.

Conclusion. Arthroscopic fixation using the TightRope device for acute AC joint dislocation achieves satisfactory outcome.

Key words: acromioclavicular joint; shoulder dislocation

INTRODUCTION

Acromioclavicular (AC) joint injuries account for 3% to 5% of all shoulder injuries.1 Rockwood types I and II AC joint injuries are usually managed conservatively, whereas types IV to VI injuries are managed surgically in which the clavicle is displaced posteriorly and inferiorly, respectively, along with disruption of the AC and coracoclavicular (CC) ligaments.2–5 Treatment for type III injuries should be determined on a case-by-case basis.5,6 Surgical options include open/closed reduction and Kirschner wire fixation,7 hook plate fixation,8,9 CC joint screw fixation,10,11 Weaver-Dunn procedure,12 anatomic CC joint reconstruction
using the Surgilig or a prosthetic ligament and distal clavicular resection. For arthroscopic CC joint reconstruction, non-absorbable suture, polydioxanone suture and semitendinosus graft, and the flip button such as the TightRope device (Arthrex, Naples [FL], USA) have been used. The TightRope comprises 2 metallic buttons (10 mm in diameter) joined by a no. 5 FiberWire loop. It is used to maintain the reduced AC joint to enable healing of disrupted AC joint ligaments. This study reviewed outcome after arthroscopic fixation for acute AC joint dislocation using the TightRope device.

MATERIALS AND METHODS

Records of 15 men and 2 women aged 19 to 52 (mean, 35) years who underwent arthroscopic fixation using the TightRope device for acute (<3 weeks) AC joint dislocation of Rockwood type III (n=6), type IV (n=1), and type V (n=10) between April 2011 and June 2014 were reviewed (Fig. 1). Only one patient had a concomitant injury (a Bankart lesion).

Patients were placed in the lateral decubitus position under general anaesthesia with inter-scalene block. A posterior portal for a 30° arthroscope and an anterosuperior instrument portal through the rotator interval using an outside-in technique were made. The glenohumeral joint was evaluated. The coracoid base was exposed using a radiofrequency ablation device. It was important to maintain contact with bone to avoid injury to neurovascular structures. A 1-cm incision was made over the lateral clavicle, perpendicular to the superficially palpable coracoid. The deltotrapezius fascia was incised, and the centre of the clavicle was identified. The drill guide was inserted through the anterosuperior portal, and the guide tip was positioned under the coracoid base. A sufficient bone bridge around the 4-mm reamed tunnel was ensured. A 2.4-mm guide pin was inserted into the clavicle and coracoid. A 4-mm cannulated drill was then passed over the pin and through the coracoid. The pin was then removed, and the drill was left in situ. A Nitinol suture passing wire was passed through the drill and taken out through the anterosuperior portal using an arthroscopic grasper, leaving the suture loop superiorly. The drill was then removed, and the wire was in position. The 2 white traction sutures from the oblong button passed through the wire loop, and the button was then flipped to pass through the drill hole. The Nitinol suture passing wire was then drawn out of the anterosuperior portal. Once the oblong button was seen under the coracoid, the trailing suture was used to flip it, locking it under the bone. The clavicle was then reduced by the surgical assistant. The sutures were tied over the top of the superior button. The wounds were then closed in layers.

Postoperatively, a shoulder immobiliser was applied for 4 weeks, and elbow flexion-extension exercises were allowed. At 6 weeks, full active motion of the shoulder was allowed. At 3 months, heavy resistance work was allowed.

Outcome was evaluated using the Constant score. The CC distance before and after surgery was compared using the student’s *t* test. A *p* value of <0.05 was considered statistically significant.

RESULTS

The mean time from injury to surgery was 9 (range, 5–21) days (Table 1). The mean follow-up period was 22.1 (range, 12–37) months. The mean time to return to work was 4 (range, 1.5–12) months, excluding one patient who had rupture of the TightRope suture at 6 months. The mean postoperative Constant score was 86.4 (range, 63–96). The CC distance decreased.

![Figure 1](image-url)  
Figure 1  Pre- and post-operative radiographs showing Rockwood (a) type III and (b) type V acromioclavicular joint dislocation fixed with the TightRope device.
from 21.5±5.2 mm preoperatively to 9.8±3.5 mm at 6 months and to 10±3.2 mm at one year. There was no over-correction.

All patients had satisfactory outcome except for one who resumed weightlifting training at 4 months and broke the TightRope suture at 6 months (Fig. 2a). The patient also had a Bankart lesion repaired. His Constant score was 100 at 5 months, 53 at 6 months, and 63 at final follow-up. The patient declined revision surgery. Two patients had partial loss of reduction (≥2 mm displacement from initial reduction) after 3 to 6 months secondary to osteolysis at the clavicular button site (Fig. 2b).

**DISCUSSION**

Stability of the AC joint depends on the AC and CC ligaments. A fall onto the shoulder is the most common injury mechanism that pushes the acromion inferiorly relative to the clavicle, resulting in a sequential failure of AC ligaments, joint capsule, CC ligaments, and deltotrapezial fascia. With increasing displacement, the conoid ligament is the primary restraint to superior translation and the trapezoid ligament primarily resists compression.

Kirschner wire fixation may be at risk of Kirschner wire migration. Screw and hook plate fixation requires hardware removal, and may be at risk of infection, shoulder stiffness, and osteolysis of the acromion. Screw fixation may be at risk of screw cutout and dislocation. Percutaneous cannulated screw fixation resulted in a 32% failure rate secondary to screw pullout and subluxation after screw removal. The Surgilig fixation requires open reduction of the AC joint. Compared with open repair, arthroscopic repair using the TightRope has a lower risk of stiffness, infection, soft tissue morbidity, and hardware irritation; requires no surgery for hardware removal; and enables simultaneous detection and management of intra-articular pathology.

A superior labral tear from anterior to posterior is the most common concomitant injury. The mean distance between the superior aspect of the coracoid and the inferior aspect of the clavicle is 1.10 to 1.30 cm.

Rockwood types IV and VI AC disruptions are rare. An axillary lateral view is useful in diagnosing a posterior dislocation (type IV). Management for
type III injuries (CC interspace distance increased by 25% to 100% compared with the contralateral side) remains controversial. Conservative treatment can lead to good-to-excellent outcome \(^40\), \(^41\) or residual pain and persistent symptoms. \(^42\), \(^43\) To maximise function, surgery is recommended in young and active patients. \(^5\), \(^43\), \(^44\)

Loss of reduction is a common complication and has been reported in 4.3\% \(^34\) and 16\% \(^36\) of patients after hook plate fixation, 18\% of patients after TightRope fixation, \(^38\) 11.3\% of patients after screw fixation, \(^11\) and 16.7\% of patients after fixation using the ligament augmentation and reconstruction system. \(^45\)

For TightRope fixation, osteolysis around the clavicular button may result in subluxation during healing of the AC ligaments and may impair functional outcome. This may be related to the small size of the double flip button. \(^46\) The strength of healed ligaments may not be equal to native ligaments, even after one year. \(^47\) If healing of the ligaments does not occur, partial or complete loss of reduction may occur. The TightRope for CC ligament reconstruction only provides supraperiorinferior stability and does not prevent anteroposterior translation, which can lead to osteolysis and loss of reduction. In a cadaveric study, when CC ligament reconstruction using a fibre wire is strengthened by a semitendinosus graft, anterior and posterior translation is less, compared to the modified Weaver-Dunn procedure (coracoacromial ligament transfer and no. 2 fibre wire looped around the coracoid). \(^48\) In our study, a single TightRope device was used, as in other studies (Table 2). If 2 TightRope devices had been used, the relatively small coracoid process of our patients may have fractured. Fixation using 2 TightRope devices enables stronger reconstruction than native coracoacromial ligament, \(^26\), \(^27\) but decreases shoulder mobility. \(^49\) In a cadaveric study comparing shoulders with single versus double clavicular coracoid tunnel fixed with suture button devices versus the modified Weaver-Dunn procedure, stability of the AC joint was comparable in shoulders with single or double clavicular tunnel techniques. \(^28\) Both techniques have a high load to failure for superior translation and less translation in all 3 directions, as well as higher superior stability, compared with the modified Weaver-Dunn procedure. \(^28\) Nonetheless, there is a risk of coracoid fracture. The most common mode of failure for the TightRope device is suture breakage. \(^21\), \(^25\)

Limitations to this study included the small sample size and short follow-up. Healing of CC ligaments was not evaluated.

**CONCLUSION**

Arthroscopic fixation using the TightRope device for acute AC joint dislocation achieves satisfactory outcome.

**DISCLOSURE**

No conflicts of interest were declared by the authors.
34. Liu HH, Chou YJ, Chen CH, Chia WT, Wong CY. Surgical treatment of acute acromioclavicular joint injuries using a modified Weaver-Dunn procedure and clavicular hook plate. Orthopedics 2010;33.