



## Early failure of coracoclavicular ligament reconstruction using TightRope system

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**This prospective study reports the results of early failure of coracoclavicular (CC) ligament reconstruction using TightRope.**

Nine consecutive patients who had CC ligament reconstruction using TightRope or GraftRope were assessed for radiological and functional outcomes using DASH and Oxford Shoulder scores. With an average age of 38.4 (21-70) years, four patients had type III injuries, two type IV and two type V injuries. The mean follow-up was 22.8 (12-42) months. In 7 out of 9 patients, secondary progressive loss of reduction was observed at an average of 3.1 (1-7) months. Three patients underwent revision. The mean DASH score at latest follow-up was 27.45 (19.6-35) & Oxford shoulder score was 30.5 (20-43).

Coraco-clavicular reconstruction with TightRope or GraftRope appears to result in failure with progressive AC joint subluxation perhaps due to ‘windscreen wiper’ micromotion. Surgeons should be wary of this potential problem whilst choosing this method of reconstruction for CC ligament reconstructions.

**Keywords :** AC Joint ; CC ligament ; TightRope ; failure.

### INTRODUCTION

Acromio-clavicular joint dislocations are not uncommon, accounting for about 4% of dislocations (19). Though most of them can be treated non-operatively, some particularly type IV-VI require

operative management. Various techniques have been described in the literature each with its own advantages and limitations (2,7,11,13,15-17). The ideal reconstruction should be minimally invasive, with predictable outcomes and minimal complications. We report a prospective series of coracoclavicular (CC) ligament reconstruction using TightRope, with early high failure rate.

### PATIENTS AND METHODS

A prospective review was performed of 9 consecutive CC ligament reconstruction using TightRope or GraftRope (Arthrex, Naples, FL, USA) systems over a 2 year period. The TightRope consists of two buttons : one round clavicle button and one oblong coracoid button. The buttons are joined by number 5 Fiberwire®.

The procedure was done in beach chair position under general anaesthesia and regional block. Strap incision over the AC joint was used for all patients. Deltoid was split to gain access to coracoid. Both TightRope and

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GraftRope fixation was done with drill holes in the coracoid and clavicle using manufacturer's jig and instructions. The drill hole in the coracoid was independent of the hole in clavicle. Allograft or autograft augmentation was used in patients who had GraftRope system using tenodesis screw. Per-operative images were taken to ensure satisfactory reduction of the AC joint. Lateral clavicle resection was performed in two cases. Post-operatively sling was used for 4 weeks, followed by active range of motion. Patients were advised to avoid lifting weights for 3 months.

Patients were followed-up at 6 weeks, 3 months and 6-monthly thereafter. They were evaluated clinically and radiologically for loss of reduction, as well as functional outcome using DASH and Oxford Shoulder Scores. Patients who had loss of reduction and had clinical symptoms were offered revision procedure. Loss of reduction was measured as vertical height from superior surface of acromion to superior surface of clavicle.

## RESULTS

There were nine patients in the study group with an average age of 38.4 (21-70) years. All but one patient were males. Seven patients had injury to the left shoulder. Four patients had type III injuries, two type IV, two type V and one patient had fracture lateral end of clavicle. All were closed injuries (Table I). The mean duration between injury and surgery was 250 (9-1095) days. Three patients had TightRope and six had GraftRope system (Figs. 1 & 2). Patients who had CC ligament with GraftRope had supplemental grafts : cadaveric allografts were

used in four and palmaris longus autograft was used in two patients.

With a mean follow-up of 22.8 (12-42) months, patients were reviewed to assess functional and radiological outcomes. In 7 out of 9 patients, secondary progressive loss of reduction was observed both clinically and radiologically at an average of 3.1 (1-7) months (Fig. 3). The mean loss of reduction was 14.7 mm (0-26.6). Most of the radiographs showed widening of clavicular tunnel suggestive of 'windscreen wiper effect'. The immediate post-op width of clavicular tunnel measured on AP radiograph was 3.92 mm (3.9-4.1). This increased to a mean 8.29 mm (3.9 to 12.72) at follow up. In one patient, there was widening of the clavicular tunnel but no loss of reduction of AC joint (Fig. 4). Three patients underwent revision, which suggest that mode of failure was due to failure of the holding suture (Fig. 5). One patient awaits further revision. Subjectively 1 reported excellent, 4 good, 3 fair and 1 poor results. The mean DASH score at latest follow-up was 27.45 (19.6-35) and Oxford shoulder score was 30.5 (20-43) (Table II). There were no intra-operative complications. We no longer use TightRope/ GraftRope for CC ligament reconstruction.

## DISCUSSION

Acromio-Clavicular joint injuries pose a therapeutic challenge. Type I and II injuries are predominantly treated non-operatively. Though the

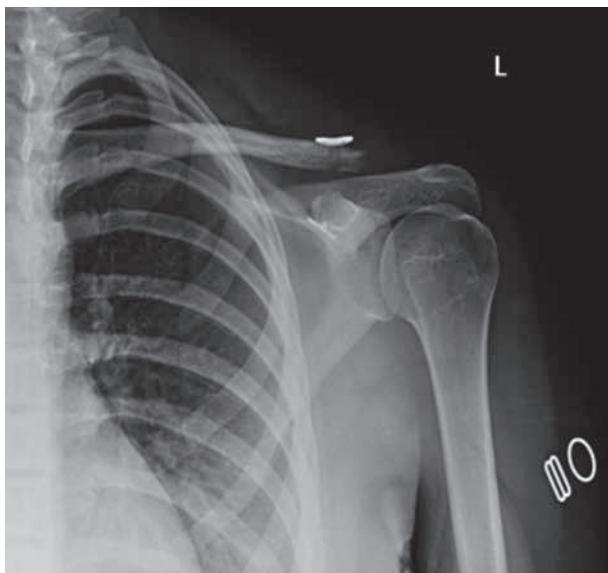
Table I. — Demographics and injury pattern of patients who underwent AC joint reconstruction with TightRope or GraftRope

S.No	Age	Sex	Side	MOI	ASA	Classification	Closed/Open	Delay (days)
1	36	M	R	Fall of heavy pallets at work	I	III	Closed	20
2	23	M	L	Football	I	Fracture lateral end of clavicle	Closed	9
3	25	M	L	Fall from bike	I	IV	Closed	118
4	21	F	L	RTC	I	V	Closed	230
5	45	M	L	Fall	I	III	Closed	115
6	37	M	R	RTC	I	III	Closed	20
7	53	M	L	Fall from bike	I	III	Closed	144
8	36	M	L	Fall	I	V	Closed	1095
9	70	M	L	Fall from Stairs	I	IV	Closed	499

[Abbn : M-Males, F-Females, R-Right, L-Left, MOI-Mode of Injury, ASA-American Society of Anesthesiologists grading].



**Fig. 1.** — Pre-operative shoulder radiograph showing Type V AC joint dislocation.



**Fig. 2.** — Post-operative shoulder radiograph demonstrating good fixation with TightRope.

treatment of type III remains controversial, a review of 2000 patients by Phillips *et al* (14), suggests no significant difference between surgical and non-surgical methods for type III injuries. Surgery remains the mainstay of treatment of Type IV-VI injuries. The techniques vary from open, to all



**Fig. 3.** — Follow-up shoulder radiographs demonstrating loss of reduction of AC joint and widening of clavicular tunnel.

arthroscopic methods with variable results (2,7,11-13,15-17).

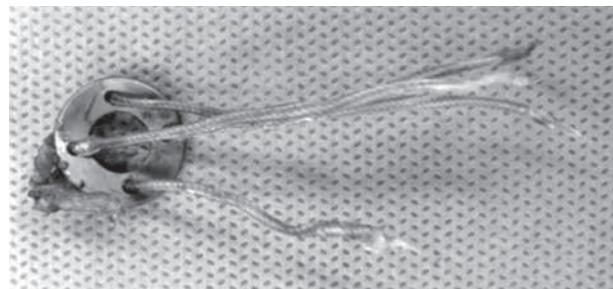
Newer techniques have emerged to overcome some of the problems with earlier techniques like prominent metal work, screw pull out, fracture of coracoid process, injury to brachial plexus and need for removal of metalwork (8,13,18). Minimally invasive or all arthroscopic techniques use grafts to reconstruct the CC ligament with reports of lower complications and avoiding the need for metalwork removal (8). Ligament reconstruction using auto, allograft and synthetic grafts appears to be gaining popularity now (7,11,15-17). However secondary loss of reduction remains a concern (3).

We have used TightRope and GraftRope in this series to reconstruct CC ligament. TightRope was used for acute injuries less than 3 weeks and GraftRope for chronic injuries. All patients in the TightRope group had loss of reduction, but two patients in the GraftRope group did not have any loss of reduction. Also, clavicular tunnel widening was not noted in one patient in the GraftRope group. We accept that because of the small numbers in each group, it is not possible to assess any significant difference between the two groups. Many series have



**Fig. 4.** — Radiographs of shoulder demonstrating widening of the clavicular tunnel in a patient with no secondary loss of reduction.

reported good outcomes with the use of these grafts (6-8,10). However, these grafts are not without problems. Ball *et al* (1) report a case of fracture clavicle with TightRope and Cook (4) *et al* report early



**Fig. 5.** — Intra-operative photograph showing failure of TightRope.

failures with the use of TightRope in a series of 10 patients. Fracture of coracoid was also reported by Gerhardt *et al* (9).

In our series of 9 patients, there was evidence of early subluxation at an average 3.1 months. Three patients underwent revision : intra-operative findings suggest that the mode of failure was due to failure of the holding suture. Most of the radiographs showed widening of clavicular tunnel suggestive of micro motion. Anatomical features and biomechanical forces acting on the AC joint during shoulder joint movement may explain this ‘windscreen wiper effect’ micromotion, but in-vivo studies may be needed to support this theory. TightRope was originally designed for tibio-fibular syndesmotic injuries

Table II. — Surgical procedure, complications and outcome of all patients who underwent TightRope/GraftRope fixation

S.No	Procedure	Graft	Problems	Additional procedure	DASH scores	Oxford scores
1	Tight Rope	None	Secondary loss of reduction	Excision of lateral end + exostosis	19.6	37
2	Tight Rope	None	Secondary loss of reduction	ORIF offered – patient refused	30.8	26
3	Graft Rope	Allograft	Secondary loss of reduction	Removal and reconstruction with other technique	23.3	26
4	Graft Rope	Allograft	Secondary loss of reduction	Awaiting surgery	19.6	20
5	Graft Rope	Allograft	No loss of reduction – widening of clavicular tunnel		34.2	30
6	Tight Rope	None	Secondary loss of reduction		30.8	30
7	Graft Rope	Palmaris Longus	Secondary loss of reduction		19.6	43
8	Graft Rope	Palmaris Longus	None		34.2	43
9	Graft Rope	Allograft	Secondary loss of reduction		20	20

of the ankle (5). Its use was extended to AC joint injuries of the shoulders and currently is being used in other joints as well. We think that the forces across the AC and CC joints are significantly higher, and it is possible that this is contributing to failure.

Also position of the coracoid button could be crucial. Inferior placement is ideal, though the curved shape of the coracoid makes it difficult with a tendency for the button to displace medially.

Caution must be exercised whilst using these synthetic grafts for AC joint reconstruction because of the potential problem of failure, with secondary and progressive AC joint subluxation and widening of clavicular tunnel.

## CONCLUSION

Coraco-clavicular reconstruction with TightRope or GraftRope appears to result in failure with progressive AC joint subluxation. Surgeons should be wary of this potential problem whilst choosing this method of reconstruction for CC ligament reconstructions.

## REFERENCES

- 1. Ball SV, Sankey A, Cobiella C.** Clavicle fracture following TightRope fixation of acromioclavicular dislocation. *Injury Extra* 2007 ; 38 : 430-432.
- 2. Carofino BC, Mazzocca AD.** The anatomic coracoclavicular ligament reconstruction : Surgical technique and indications. *J Shoulder Elbow Surg* 2010 ; 19 : 37-46.
- 3. Chernchujit B, Tischer T, Imhoff AB.** Arthroscopic reconstruction of the acromioclavicular joint disruption : surgical technique and preliminary results. *Arch Orthop Trauma Surg* 2006 ; 126 : 575-581.
- 4. Cook JB, Shaha JS, Rowles DJ, Bottoni CR, Shaha SH, Tokish JM.** Early failures with single clavicular transosseous coracoclavicular ligament reconstruction. *J Shoulder Elbow Surg* 2012 ; 21 : 1746-1752.
- 5. Cottam JM, Hyer CF, Philbin TM, Berlet GC.** Treatment of syndesmotic disruptions with the Arthrex TightRope : a report of 25 cases. *Foot Ankle Int* 2008 ; 29 : 773-80.
- 6. Dabis J, Chakravarthy J, Kalogrianitis S.** Management of Grade III acromioclavicular joint dislocation using arthroscopic tight rope fixation. *Injury Extra* 2011 ; 42 : 123.
- 7. DeBerardino TM, Pensak MJ, Ferreira J, Mazzocca AD.** Arthroscopic stabilisation of acromioclavicular joint dislocation using the AC GrafRope system. *J Shoulder Elbow Surg* 2010 ; 19 : 47-52.
- 8. El Sallakh SA.** Evaluation of Arthroscopic Stabilisation of Acute Acromioclavicular Joint Dislocation Using the TightRope System. *Orthopaedics* 2012 ; 35 :e18-e22.
- 9. Gerhardt DC, VanderWerf JD, Rylander LS, McCarty EC.** Post-operative coracoid fracture after trans-coracoid acromioclavicular joint reconstruction. *J Shoulder and Elbow Surg* 2011 ; 20 : e6-10.
- 10. Hergenreger GS, Kadletz R.** TightRope-the revolutionary anatomical fixation in acromioclavicular joint dislocation – a case report. *Tech Shoulder Elbow Surg* 2006 ; 7 : 86-8.
- 11. Lädermann A, Gueorguiev B, Stimec B, Fasel J, Rothstock S, Hoffmeyer P.** Acromioclavicular joint reconstruction : a comparative biomechanical study of three techniques. *J Shoulder Elbow Surgery* 2013 ; 22 : 171-178.
- 12. Larsen E, Bjerg-Nielsen A, Christensen P.** Conservative or surgical treatment of acromioclavicular dislocation. A prospective, controlled, randomized study. *J Bone Joint Surg Am* 1986 ; 68 :552-555.
- 13. Mares O, Luneau S, Staquet V, Beltrand E, Bousquet PJ, Maynou C.** Acute grade III and IV acromioclavicular dislocations : Outcomes and pitfalls of reconstruction procedures using a synthetic ligament. *Orthop Traumatol Surg Res* 2010 ; 96 721-726.
- 14. Phillips A, Smart C, Groom A.** Acromioclavicular dislocations : conservative or surgical therapy. *Clin Orthop Rel Res* 1998 ; 353 :10-7
- 15. Ranne JO, Sarimo JJ, Rawlins MI, Heinonen OJ, Orava SY.** All-arthroscopic double-bundle coracoclavicular ligament reconstruction using autogenous semitendinosus graft : A new technique. *Arthrosc tech* 2012 ; 1 : e11-e14.
- 16. Richards A, Tennent TD.** Arthroscopic stabilisation of acute acromioclavicular joint dislocation using the TightRope system. *Tech Shoulder Elbow Surg* 2008 ; 9 :51-54.
- 17. Robinson S, Ralte P, Sinha A, Morapudi S, Fischer J, Waseem M.** A comparative study of acute and chronic acromioclavicular joint dislocation managed with the modified weaver-Dunn procedure and Hook plate reinforcement. *Injury Extra* 2011 ; 42 114.
- 18. Rolla PR, Surace MF, Murena L.** Arthroscopic treatment of acute acromioclavicular joint dislocation. *Arthroscopy* 2004 ; 20 :662-668.
- 19. Tossy JD, Mead NC, Sigmund HM.** Acromioclavicular separations : useful and practical classification for treatment. *Clin Orthop Relat Res* 1963 ; 28 : 111-119.