Results of open surgical repair of acute types III and IV acromioclavicular joint dislocation using the tightrope

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Background
Acromioclavicular joint dislocation presents a difficult challenge in controlling the stresses on the clavicle during the recovery period and hampers early mobilization of the shoulder joint. We have chosen a new modality for fixation types III and IV and compared its results with other methods of fixation.

Patients and methods
Between 2008 and 2011, 13 cases of acute acromioclavicular joint dislocations were treated at our facilities using the Arthrex tightrope for restoring attachment of the clavicle to the coracoid process. The study group included 10 male and three female patients, with an average age of 34.2 years. The average duration between the injury and surgical fixation was 6.3 days. All patients had an MRI scan performed before surgical intervention for assessment of the coracoclavicular ligaments. Patients were evaluated at the end of 6 months after surgical reconstruction using the Constant Shoulder Scoring System.

Results
At the end of the follow-up period, there were only three failure cases and 10 of our 13 patients (76.9%) were adequately satisfied with the outcome.

Conclusion
Tightrope fixation is a very safe modality for fixation of acromioclavicular dislocations that restores anatomy and allows for early mobilization of the shoulder joint.

Keywords:
acromioclavicular, dislocation, tightrope

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Introduction

Acromioclavicular dislocation, although a rare event [1], leads to serious disturbance of the shoulder function in addition to the serious disfigurement. Several surgical techniques have been described for adequate reduction and fixation [2–4], which include excision of the lateral end of the clavicle, fixation with a screw [5] or a hook plate [6], as well as using a semitendinosis tendon graft for the reconstruction of the coracoclavicular ligaments; however, many of those are associated with a high incidence of failure and unsatisfactory results in terms of shoulder function and daily activities. We report on a series of 13 cases fixed with a new implant, the tightrope, that allows for early mobilization and minimizes failure rates.

Patients and methods

Thirteen cases of acute type III and IV acromioclavicular joint dislocations were managed at our facilities between 2008 and 2011. The average age of the patients at the time of presentation was 34.2 years (range 23–45 years). The study included 10 male and three female patients. Ten cases presented directly to the Emergency Department on the same day of the injury, whereas there were three cases who were referred from other facilities and seen later, with the oldest injury being 2-week-old. The mean time between the injury and operative procedure in our series was 6.3 days. All patients had plain radiographs performed when first seen, followed by an MRI scan to assess the integrity of the coracoclavicular ligaments. Cases with evident type IV on plain radiography had no MRI performed as the integrity of the ligaments were not in doubt. On the MRI scan, coronal T1 and T2 images were utilized to view the conoid and the trapezoid ligaments to determine the need for surgical reconstruction of the ligaments using the tightrope implant (Figs 1 and 2).

Patients were all operated within 24–48 h of the initial diagnosis. All cases were performed under general anesthesia with the patient seated in the beach chair position. The arm was draped and left free dangling to be held and maneuvered by the assistant as required, and a sandbag was placed under the scapula to make the coracoid process more prominent and easily palpable. The acromioclavicular joint was approached through a shoulder strap incision, in line with the coracoid from a point half an inch to 1 inch behind the clavicle to a point one inch below the level of the coracoid process [7]. Dissection was carried out in the

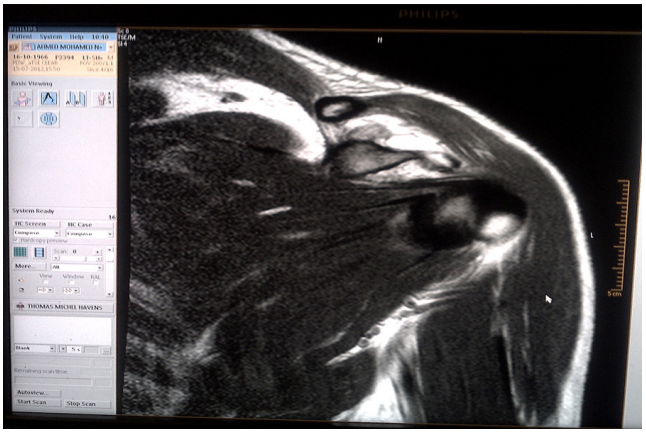
subcutaneous and the tissue below the acromioclavicular joint; thereafter, the lateral end of the clavicle and the upper surface of the acromion were sharply stripped subperiosteally. The interval between the origin of the deltoid and the insertion of the trapezius muscles was identified and the fibers of the deltoid split vertically to expose the coracoid process. After the coracoid process was identified, the clavicle was reduced in place and then the drill guide was placed with a guide stop placed underneath the coracoid as close as possible to the base of the coracoid; a guide pin was then drilled through the drill guide placed 2.5 mm from the lateral end of the clavicle. The guide was then removed and a cannulated drill was then used over the guidewire to make the desired hole in the clavicle and the coracoid process. Thereafter, the guidewire was removed and the cannulated drill was used as a sheath to pass the suture passing wire, which has a wire loop at its end for passing the tightrope implant. The implant was then passed, once through the hole of the coracoid process, and the button was flipped, providing attachment to the coracoid process, and then the acromioclavicular joint was reduced under vision; with the assistant holding the reduction, the knots were tied on the upper surface of the clavicular button to hold the reduction in place. The arm was manipulated in abduction, flexion, and rotation to check stability of fixation. The capsule of the acromioclavicular joint was repaired whenever it was possible. The wound was then closed and the arm was immobilized in an arm support [8].

Postoperative radiographs were taken to confirm adequate reduction. Patients were immobilized completely for a week, and then the arm support was removed at intervals and patients were allowed shoulder abduction and flexion up to 90° as tolerated by their pain. Physiotherapy in the form of electric stimulation for the deltoid and trapezius muscles was started after the third week. After 6–8 weeks, patients were allowed normal shoulder mobilization.

At the end of 6 months all patients were evaluated using the system adopted by the European Society for Shoulder and the Elbow Surgery, which is the Constant scoring system [9,10]. The variables in this scoring system are pain, activities of daily living (together totaling 35 points), range of motion, and strength (together totaling 65 points) (Table 1).

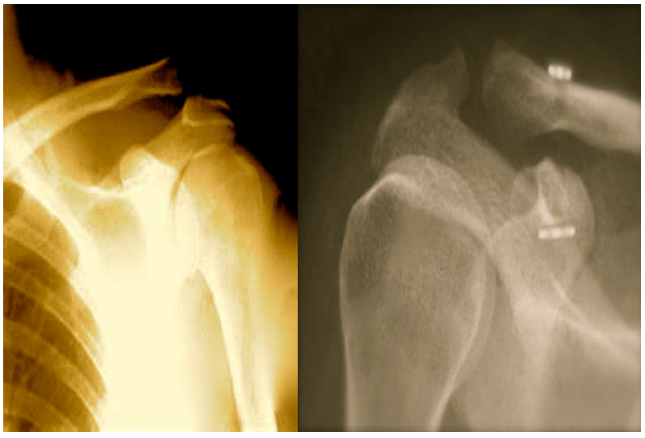
Strength was given a total of 25 points based on the ability to resist a spring balance with the shoulder abducted 90° and 30° of forward flexion, resisting for 5 s three times repeatedly. Finally, patients were given

Figure 1



Coracoclavicular ligaments on MRI scan.

Figure 2



Radiography of a case of type II dislocation, and another case after tightrope reconstruction.

Table 1 Assessment of range of motion of the shoulder [10]

Range of motion							
Forward flexion		Abduction		External rotation		Internal rotation	
0–30	0	0–30	0	Not reaching the head	0	End of thumb to lateral thigh	0
31–60	2	31–60	2	Hand behind the head with the elbow forward	2	End of thumb to buttock	2
61–90	4	61–90	4	Hand behind the head with the elbow positioned back	2	End of thumb to the lumbosacral junction	4
91–120	6	91–120	6	Hand on top of the head with the elbow forward	2	End of thumb to L3	6
121–150	8	121–150	8	Hand behind the head with the elbow positioned back	2	End of thumb to T12	8
151–180	10	151–180	10	Full elevation from on top of the head	2	End of thumb to T7 (interscapular)	10

a final score out of 100, which reflects their overall functional outcome [9].

Eleven of our cases were available at the outpatient clinic for direct evaluation and filling of SST form, whereas in two cases, patients were guided to fill out a form dispatched to them through mail as they had already changed their country of residence and were not available for examination.

Results

At 6 months' follow-up, patients were rated on the basis of the Constant scoring system. Three cases had failure of the implant at various periods postoperatively, at 7, 11, and 14 days (average 10.6 days). These patients underwent an open revision performed using the tight graft rope implant (Arthrex Inc., 1370 Creekside Boulevard Naples, Florida 34108-1945, USA) and a semitendinosis graft harvested from the ipsilateral side. Using the drill hole in the clavicle, another hole was made with a cannulated drill and the sutures were looped around the coracoid with the tendon and then drawn through the holes in the clavicle and secured with a screw. All cases of failure occurred from the coracoid side due to reflipping of the button. The results of the remaining 10 cases are shown in Table 2.

The average Constant score was 94.8 (range 90–98), all our patients had no problems at all with their activities of daily living, and excellent results were reported for the range of motion; however, after 6 months none of them showed full return to normal muscle strength.

There were no cases of infection or postoperative neurological deficits in our series, and the only reported complications were the three failure cases (23.1%) referred to earlier. The remaining 10 cases (76.9%) were satisfied with their function and returned back to their normal level of activity.

Table 2 Results of constant scores in our group of patients

Case number	Pain	Activities of daily living	Range of motion	Strength	Constant score
1	14	20	40	22	96
2	14	20	40	22	96
3	12	20	38	22	92
4	15	20	40	23	98
5	12	20	38	23	93
6	14	20	40	23	97
7	15	20	40	23	98
8	11	20	36	23	90
9	14	20	34	23	91
10	14	20	40	23	97
Average					94.8

Discussion

Acromioclavicular joint dislocation still poses a treatment problem [11]; types I and II injuries are always treated conservatively [12]. Types III, IV, VI, and VII [13] always pose the dilemma of choosing a fixation technique that offers adequate stability and has minimal complication and failure rates. Over 60 different techniques and implants have been described in the literature for reconstruction. Bannister *et al.* [14] classified them along two main lines: coracoclavicular ligament reconstruction with or without distal clavicle excision, as in the Weaver–Dunn technique, which can now be performed arthroscopically [15], and coracoclavicular stabilization with repair or reconstruction of the coracoclavicular ligaments, as in the Bosworth technique [5]. The Bosworth screw however may break if early mobilization is attempted and requires removal. In contrast, hook plates fail or cause later impingement symptoms [16]. Recently, wire loops and suture materials have been used either alone or in combination with tendon grafts to reconstruct the coracoclavicular ligament complex [17,18]. Fixation with a tightrope implant, which can be performed with either open or arthroscopic technique, provides a rigid fixation technique and allows for the healing of the coracoclavicular ligament complex without any graft supplementation; it allows for early mobilization without the need for further surgical removal of a screw or a hook plate.

To our knowledge, the tightrope implant was first used by Hernegger *et al.* [19], who published a case report on fixation of an acromioclavicular dislocation using the tightrope implant; since then, several studies have used the same implant using an all-arthroscopic, an arthroscopically assisted, or an open technique for reduction and fixation of the joint. In our series, we have used the tight graft rope using an open technique for placement of the implant. Our results correlate with the findings of Vieira *et al.* [20], who used in their series of 10 cases the UCLA evaluation system. All their patients were satisfied with the outcome and the average point rating was 32.5 points. In a study on a similar series of 10 cases, El Sallakh [17] used an all-arthroscopic technique and reported a mean Constant score of 96.3 points, and all patients returned to their normal work activities within 10–12 weeks postoperatively. The operative simplicity and the near-anatomical reconstruction make this technique for treating acromioclavicular dislocations an excellent alternative. Most of the other techniques of reconstruction involve harvesting grafts, ligament transfer, or the placement of implants that cause local irritation and may require later removal. The tightrope implant avoids all these shortcomings and it can be

applied in either open or arthroscopic technique based on surgeon skills. The procedure is associated with a low rate of complication, and failures can be avoided by proper implantation [17]. With the implantation performed through an open surgical approach, further safety is added particularly for surgeons who are not familiar with shoulder arthroscopy techniques. The lateral dissection about the coracoid is totally safe and avoids any proximity with the brachial plexus and the axillary nerve [21]. The functional outcome is quite satisfactory and allows for early mobilization of the shoulder, as well as early return to normal daily activities. There is obviously no need for later removal of any implants. All these advantages make it an ideal choice for type III or higher cases of acute acromioclavicular dislocation.

Conclusion

Tightrope fixation provides a simple and safe technique for fixation of types II, IV, and VI acromioclavicular dislocations with a low rate of failure and complication. It allows early mobilization and return to functional activity and avoids the need for later removal of any implants.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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