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Technical Note

Combined Use of Hook Plate and TightRope System for the Treatment of Acromioclavicular Joint Dislocation: A Novel Surgical Technique

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Abstract

Acromioclavicular joint dislocation is a frequent sports-related injury. Numerous surgical techniques have been described for its management but there is yet to be a gold standard. This paper presents a novel surgical technique that combines the use of a hook plate and TightRope system. The combined technique has the potential to combine the advantages of both individual techniques, improving functional outcomes for patients with acromioclavicular joint dislocations.

Keywords: Acromioclavicular joint; Shoulder separation; Hook plate; Tightrope; Surgical technique

Introduction

Acromioclavicular (AC) joint dislocation, or shoulder separation, is a common shoulder injury amongst young and healthy individuals, typically in the setting of contacts sports or fall with force directed onto the acromion under an adducted arm. It has been reported that AC injuries account for up to 10% of all shoulder injuries and 40% of shoulder injuries in contact sports [1]. The AC joint connects the axial skeleton to the upper extremity, thus injury to the AC ligament or Coracoclavicular (CC) ligament can lead to severe functional impairment. AC joint injury can present with symptoms ranging from pain, instability, and decreased range of motion to fatigue and cosmetic concerns. Despite its pervasiveness, it's likely to still be under diagnosed with lower grade injuries being under reported. Treatment depends on the severity of the injury, often classified according to the Rockwood classification system [2]. Low-grade injuries (Rockwood types I and II) typically respond well to conservative treatment. High-grade injuries (Rockwood types III to VI) typically require surgical intervention, although some surgeons may favor non operative management at first. For those in need of surgical intervention, there remains a debate between experts on the optimal approach.

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With the ongoing advancement of implants and techniques, numerous strategies have been proposed. In the acute high-grade setting, fixation with sutures, screws, and hook plates are favored whereas biologic ligament reconstruction is recommended for cases of chronic AC joint instability. Clinical and biomechanical studies have demonstrated that different fixation techniques have their own set of advantages and disadvantages. Of those techniques, the hook plate and tightrope system are popular options. The hook plate technique is often favored for its ease-of-use while allowing immediate rigid fixation and stabilization of the AC joint. However, in addition to the need for implant removal surgery, subacromial impingement, acromial osteolysis and loss of reduction has been reported, leading to complications such as acromion fracture and rotator cuff tear [3]. The TightRope system is a less invasive alternative that restores the CC interval by securing the clavicle to the coracoid, bypassing the need to stress the acromion. However, drawbacks include construct instability with loss of CC interval reduction, as well as risk of coracoid fracture [4]. This paper outlines a surgical technique combining both methods to address these drawbacks. The purpose of this technique guide is to provide our preferred method of AC joint reconstruction utilizing both the hook plate and tightrope system. This technique can be used for acute or chronic AC joint injuries. Utilizing this construct provides enhanced stability and minimizing complications associated with each individual method. The additional fixation improves construct integrity and decreases the risk of implant loosening, ultimately allowing the patient to become more active and decreasing recovery time.

Surgical Technique

Patient positioning and approach

The patient is placed in a beach chair position under general anesthesia. The operative shoulder is prepped and draped in normal sterile fashion. Bony landmarks, the Acromioclavicular (AC) joint and the incision are outlined using a surgical marking pen (Figure 1). A longitudinal incision is made, centered over the distal third of the

clavicle and extending distally to the level of the AC joint (Figure 2).

Manual reduction of the AC joint reduction and hook plate selection

Homan's retractors are placed anteriorly and posteriorly to expose the distal clavicle and AC joint. A 3.5 mm hook plate is chosen based on the patient's anatomy and centered on the distal clavicle with the hook positioned beneath the acromion (Figure 3). Care is taken to use the narrowest hook distance to limit impingement in the post-operative period. The plate is secured to the clavicle with a cortical screw to assure anatomic reduction as well as appropriate plate and blade placement on the clavicle and acromion. The placement of the hook plate provides manual reduction of the AC joint under direct visualization and confirmed with C-arm. Care is taken to center the plate on the clavicle, but also leave enough clavicle posterior to the plate to allow access for the tight rope placement, typically outside and independent of the plate construct. Once the plate is in satisfactory position and the AC joint is reduced, combinations of cortical and locking screws are placed in the clavicle (Figure 4).

Figure 1: Bony landmarks, AC joint and incision outlined.

Figure 2: Direct visualization of distal clavicle and AC joint.

Drill hole placement for tightrope insertion

A 3.7 mm drill hole is created through the clavicle and base of the coracoid process (Figure 5). Blunt digital dissection allows the surgeon to palpate the coracoid and with C-arm guidance the drilling is completed. Depending on the desired anatomic reduction, the drill hole can be placed anterior or posterior to the hook plate. This allows slight correction in the Anterior-Posterior (AP) direction as needed. If the clavicle is too narrow, the drill hole may be placed through a distal hole in the hook plate.

Figure 3: Hook plate in position.

Figure 4: Radiograph demonstrating hook plate with screw fixation.

Figure 5: Radiograph demonstrating drill hole placement for tightrope implant.

Tightrope system insertion

The TightRope device is inserted through the drill hole and through the coracoid. With the inserter in the coracoids tunnel, pulling on the TightRope implant suture allows the button to flip perpendicular to the coracoid base. C-arm is used and can confirm button deployment and position (Figure 6). Remove the inserter and sequentially tighten the free sutures on the clavicle button until the desired tension. Once tight and satisfactory position is confirmed with the C-arm, the free ends of the suture can be cut. Obtain final x-rays (Figure 7).

Closure

The wound is irrigated, and the incision is closed in a layered

fashion deep with monocryl for the skin closure. The patient is then placed in a regular sling and brought to the recovery room accompanied by anesthesia.

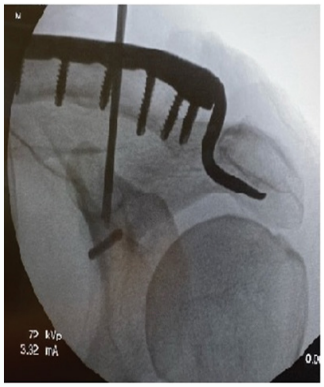

Figure 6: Radiograph demonstratingTight Rope implant with button deployment.

Figure 7: Radiograph demonstrating final implants.

Discussion

The purpose of this technical note is to outline a reliable surgical approach for combining the hook plate and TightRope techniques for AC joint dislocations. This strategy theoretically addresses the complications associated with the individual techniques. While the hook plate allows for immediate anatomic reduction and rigid stabilization of the AC joint, it transfers superior migration stress from the distal clavicle to the undersurface of the acromion. This persistent pressure often leads to subacromial osteolysis and delayed scarring of CC ligament, resulting in loss of reduction after the hook plate is removed [5]. Despite this concern, hook plates remain a reliable method for treating AC joint injuries. Huang et al. compared treatment of acute-type V AC joint dislocations with hook plate fixation to treatment with CC reconstruction using mersilene suture and found that there was no difference in patient satisfactory outcomes while improved radiographic CC distance in the hook plate group [6]. Incorporation of the tightrope facilitates the restoration of the coracoclavicular interval and serves as a secondary stabilizer, theoretically alleviating the load on the acromion and coracoid. Improving the distribution of forces across the shoulder suspensory complex theoretically reduces the risks of osteolysis and fracture while improving construct integrity and further minimizing loss of reduction. Moreover, increased stabilization may also allow for earlier plate removal, thus reducing the risks associated with extended hardware presence. This is consistent with numerous studies that have reported the use of hook plate with concomitant CC reconstruction provided statistical differences in reduction maintenance as well as reduced incidence of acromial osteolysis [2,7].

This combined hook plate and tightrope technique has been utilized for both acute and chronic AC joint Injuries and appears to offer better patient outcomes (Figure 8). Preliminary results have suggested increased patient satisfaction, enhanced shoulder function, and reduced incidence of postoperative complications. Despite promising results with our technique, this technique is not without limitations. Correct placement of the tightrope respective to the hook plate can be technically demanding, particularly in patients with a narrow clavicle. Although in such cases, the tightrope can be placed through the distal end of the hook plate. Using combined procedures also require more time. As with using the hook plate and tightrope individually, there is potential risk of clavicle or coracoid fracture. Further research is also needed to determine the long-term effects and potential complications of this combined technique, as current studies have primarily focused on short-term outcomes.

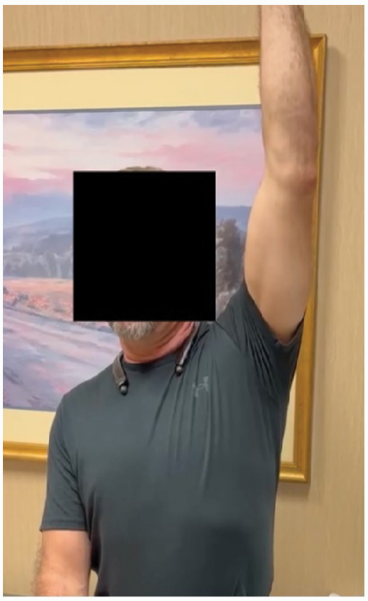

Figure 8: Range of motion at 2 week post-op visit.

Conclusion

The combined use of a hook plate and TightRope system for treating acromioclavicular joint dislocations represents a novel surgical technique combining the advantages of each individual operation, and offers the possibility of enhancements of stability, reduced complications, and improved functional outcomes. Further clinical studies are warranted to validate these findings and to evaluate the safety and efficacy of this technique in comparison to traditional methods.

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