

REVISION ANKLE SYNDESOSIS FIXATION - FUNCTIONAL OUTCOME AFTER TIGHTROPE® FIXATION

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ABSTRACT

BACKGROUND

Syndesmotic disruptions are often seen in ankle fractures. Malreduction of these fractures can result in arthritis and instability. A proportion of these patients with malreduction require revision fixation. This study presents the results of revision fixation in such patients, using the Ankle TightRope® (Arthrex) system.

METHODS

Between January 2000 to December 2009, 124 patients who underwent ankle fracture fixations with syndesmotic stabilisation were analysed. Out of 124 patients, 8 patients were diagnosed with failure of primary stabilisation (based on radiological and clinical criteria) and subjected to revision fixation using the Ankle TightRope® (Arthrex) system. Followup was done at periodic time intervals of 3, 6 and 12 months. Both clinical and radiological assessment was performed. Complications and duration of hospital stay was recorded. Functional evaluation was performed using the American Orthopaedic Foot and Ankle Society (AOFAS) scoring system.

RESULTS

Five patients had good results, one satisfactory and two had poor outcomes.

CONCLUSIONS

Ankle TightRope® fixation is an alternative method of stabilisation in patients who require revision syndesmosis fixation. Further studies are required to evaluate this method of revision stabilisation as compared to screws.

KEYWORDS

Ankle Syndesmosis, Revision Fixation, Fixation Failure, Ankle TightRope®.

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INTRODUCTION: Syndesmotic disruptions are seen in 13% of all ankle fractures (Figure 2A).⁽¹⁾ These require anatomical reduction to provide optimal functional outcome.^(2,3) Malreduction of the syndesmosis has been reported to cause secondary arthritis and instability that is correlated with poor subjective and objective outcomes.^(2,4,5) These injuries present a challenge in operative decision-making and reduction. Whilst there are studies describing the outcome of malreduced syndesmotic injuries, there are few studies which report the outcome after revision fixation of the syndesmosis.

We present the results of revision fixation of malreduced tibiofibular syndesmosis using the Ankle TightRope® (Arthrex) system. The TightRope® is a low

profile system comprised of a #5 FiberWire loop which is tensioned and secured between metallic buttons placed against the outer cortices of the tibia and fibula, providing physiologic stabilisation of the ankle mortise (Figure 1). To our knowledge, this is the first study to report the results of revision syndesmosis fixation using the Ankle TightRope®.

AIM AND OBJECTIVES: To assess the Ankle TightRope® (Arthrex) system as a method of revision fixation in patients with malreduced tibiofibular syndesmosis and present the results/outcomes.

MATERIALS AND METHODS: Between January 2000 to December 2009, 124 patients who underwent ankle fracture fixation with syndesmotic stabilisation were analysed.

Inclusion Criteria: 8 out of 124 of these patients were diagnosed with failure of primary stabilisation and required revision of the syndesmosis fixation. Failure was defined when the following criteria were met (Figure 2B):

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1. Decrease in tibiofibular overlap of <10 mm on anteroposterior (AP) view ^(6,7).
2. Increase in the tibiofibular clear space >5 mm in the AP view ^(6,7).
3. Tibiofibular overlap of <1 mm on mortise view.⁽⁷⁾
4. Associated pain in the ankle.

All measurements were made on radiographs by the radiologist, 1 cm proximal to ankle joint line.

Exclusion Criteria: The remaining 116 patients in whom the criteria for failure were not met. These patients had a successful primary stabilisation of ankle syndesmosis and did not require a revision.

In our series, the mean age of the eight patients at the time of revision surgery was 49 (range 23- 85 years). The primary ankle injury in seven ankles was Weber C type fracture and in one ankle it was a Weber B type fracture. Average time for failure after primary stabilisation was 8 weeks (range 1 day-14 weeks). Of the eight patients in our series, one had failure because of technical intraoperative error, and seven had failure of stabilisation despite initial adequate fixation.

Revision Surgical Technique: All revision syndesmosis fixations were carried out by the senior author (Heath Taylor). A longitudinal incision was made over the lateral aspect of the lower third of the fibula. Previous syndesmotic screws were removed if present (Figure 2C). A medial incision was made to expose the medial gutter and clear any

interposed soft-tissue. The anterior aspect of the tibiofibular joint was exposed and under direct vision, a pelvic reduction clamp was applied to reduce the syndesmosis. Two ankle TightRopes were then inserted using standard techniques. External rotation stress test under fluoroscopy was used to confirm stability.

Follow-up and Evaluation: Postoperatively ankle mobilisation was initiated from the second week and non-weight bearing status was maintained until 6 weeks. Patients were followed postoperatively at standardised time intervals of 3, 6 and 12 months for clinical and radiological assessment (anteroposterior, lateral and mortise views) (Figure 2E). Postoperative complications (wound infections and thromboembolic complications) and length of hospital stay was also recorded. Functional evaluation was performed using the American Orthopaedic Foot and Ankle Society (AOFAS) scoring system. All eight patients were followed for a mean duration of 21 months (range 7-46 months).

Data Analysis: Patient demographics (age, gender), injury characteristics (mechanism of injury and displacement), ASA classification of operative risk, comorbidities of the patients were recorded (Table-1).⁽⁸⁾ The fractures were classified based on Weber, Lauge Hansen classification and the presence of a posterior malleolar fracture was recorded.⁽⁹⁾

Case No.	Age	Gender	Mode of Primary Injury	ASA Grade	Comorbidities	Type of Injury	Type of Primary Fixation	Time to Failure after Primary Fixation
1	23	F	RTA	1	Nil	Weber C Pronation external rotation	One tricortical screw fixation	2 weeks
2	29	M	Fall while running	1	Nil	Pronation external rotation	Lat 1/3d tubular plate Two tricortical screw	14 weeks
3	37	F	Fall on high heels	1	Depression	Weber C Pronation external rotation	Medial malleolar fixation One tricortical screw	Intra-operative error
4	57	F	Fall	1	Nil	Weber B Supination external rotation	Two tricortical screw	12 weeks
5	59	M	Fall whilst walking	2	Smoker	Weber C Pronation external rotation	One tricortical screw	6 weeks
6	84	F	Fall on ice	2	HT Hyperlipidaemia	Weber C Pronation Abduction	Lat 1/3d tubular plate Two tricortical screw	12 weeks
7	55	M	Fall while walking	1	Nil	Weber C Pronation external rotation	Two tricortical screw	6 weeks
8	44	F	Fall on to the floor	2	Smoker	Weber C Pronation external rotation	Two tricortical screw	12 weeks

Table 1

RESULTS: Of the 8 patients, one patient was treated with revision of the fibular fixation along with syndesmotic fixation. Five patients had good results, one satisfactory and two had poor outcomes (based on the AOFAS scoring system). Case numbers 1, 2, 3, 4, 6 had good results. Case number 5, the result was satisfactory. Case numbers 7 and 8 had poor outcomes. The mean AOFAS score calculated for all the 8 patients improved from 56 preoperatively to 78 at 12 months post revision surgery. This was primarily due to the 5 cases out of 8 which showed good results.

Case Number 5: Result was categorised as satisfactory based on AOFAS scoring. Patient had persistent pain in the ankle. MRI of the ankle showed talar dome osteochondral defect. He settled well with single dose of steroid injection in the ankle and is currently symptom free.

Case Number 7: Result was categorised as poor based on AOFAS scoring. This patient had recurrent pain in the ankle and MRI showed evidence of distal tibial osteonecrosis secondary to posterior capsular avulsion. Fluoroscopic guided drilling of the distal tibia was undertaken which improved his symptoms. However, he had persistent pain and subsequently went on to have distal tibiofibular fusion (Figure 3). He is able to fully weight bear at present without pain.

Case Number 8: Result was categorised as poor based on AOFAS scoring. One ankle developed deep-seated infection, which required open debridement on two occasions. The TightRope® was removed at 3 months post revision surgery. Currently, she has pain-free ankle movements at 6 months follow-up post revision surgery.

DISCUSSION: It has been demonstrated that 13% of all ankle fractures and 20% of all operative ankle fractures have a disrupted syndesmosis.⁽¹⁾ Complete disruption of the syndesmosis combined with a tear of the deltoid ligament causes a decrease of 40% in tibiotalar contact area and increase in 36% contact pressure.⁽³⁾

Ankle fractures involving the syndesmosis require anatomical reduction to provide optimal functional outcome.^(2,3) Syndesmotic injuries present a challenge in operative decision-making and reduction. Malreduction of the syndesmosis has been reported to cause late arthritis and instability that is correlated with poor subjective and objective outcomes.^(2,4,5) Weening et al found that the only significant predictor of functional outcome was reduction of the syndesmosis despite the variability in technique of fixation.⁽¹⁰⁾ In a study by Egol et al, poorer outcomes were observed at one year follow-up compared to patients who had malleolar fixation alone.⁽¹¹⁾ A significant association between syndesmotic malreduction and poor subjective and objective outcomes was also reported by Kennedy et al.⁽¹²⁾

Although the literature is replete with studies involving the syndesmosis, there are very few studies that have looked into revision syndesmosis fixation. Harper reported results on definitive re-fixation and stabilisation of chronic

persistently widened syndesmosis in six cases.⁽¹³⁾ The revision fixation was carried out using one or two large cannulated screw engaging four cortices in all cases except one. Four out of six patients reported satisfactory results at 12-month follow-up. One patient required syndesmosis fusion because of persistent residual incongruity and associated pain. Beals and Manoli described a case of late syndesmotic reconstruction using cancellous screw and reported excellent outcome.⁽¹⁴⁾ Bone graft was used to fix through holes in the tibia and fibula by Outland.⁽¹⁵⁾ Castaing et al. performed reconstruction of the anterior and posterior tibiofibular ligament with peroneus brevis tendon for late syndesmotic instability.⁽¹⁶⁾ Rene Grass et al reported good results using peroneus longus ligamentoplasty in chronic instability of the tibiofibular syndesmosis.⁽¹⁷⁾ In our study, six out of eight patients had good to satisfactory outcome following the use of Ankle TightRope®.

In our study, in spite of accurate revision fixation of the syndesmosis, two patients had poor results on subsequent follow-up. One patient required a tibiofibular fusion as he had a persistently painful syndesmosis. He is currently pain free. The other developed deep-seated infection, which required open debridement on two occasions and eventual removal of TightRope® at 3 months post revision surgery. Currently, she has pain-free ankle movements at 6 months follow-up post revision surgery.

The limitations of our study was its small sample size due to the rare nature of the cases and the absence of comparable controls.

Ankle TightRope® has also been used as an alternative to screws in primary syndesmosis fixation. In a study by Cottom et al, intraosseous fixation with Endobutton resulted in comparable results in terms of subjective score compared to traditional primary syndesmosis screw fixation.⁽¹⁸⁾ The advantage of suture button construct when compared with screw fixation system is the ability to resist diastasis and also to maintain physiological movement of the fibula in relation to the tibia when the ankle is subjected to external rotation or axial loading.⁽¹⁹⁾

Functional outcomes were improved in fractured, loosened, or removed screws compared to those with intact syndesmosis screws.²⁰ This further adds to the point that the syndesmosis must be fixed using suture button fixation to preserve syndesmosis movement during the process of healing.⁽²¹⁾ Removal of the syndesmosis screw involves a second surgery and incision into an incompletely healed wound may contribute to higher rates of infection.⁽²²⁾

All patients in our study except one had technically sound primary fixation of syndesmosis. One patient who had technically incorrect fixation (Case 2) required re-fixation to lengthen the fibula to correct length and had syndesmosis fixation using Ankle TightRope®. Four out of eight of our patients had syndesmotic separation after screw removal ten weeks after primary fixation.

We advocate intraoperative stress radiographs of the syndesmosis during removal of syndesmosis screws (Figure 1D). We also advocate the use of direct visualisation and reduction of the syndesmosis, particularly in the revision

situation as this allows for accurate reduction of the syndesmosis as shown by Miller et al.⁽²³⁾ As a direct consequence of this study, it has become our routine practice to reduce the syndesmosis by direct visualisation before fixation, for both primary and revision cases.

Our study demonstrates that syndesmotic injuries are difficult to treat and that even with technically correct fixation, failure of the syndesmosis in the postoperative period can occur. Ankle TightRope® is a viable alternative that can be used in revision syndesmosis fixation over screws. This has the advantage of preventing further surgery to remove screws in already scarred soft tissues. Ankle TightRope® also maintains physiological motion whilst allowing for healing of syndesmotic ligaments.



Figure 1

Figure 1: TightRope® revision fixation – Anteroposterior and Lateral radiographs showing a #5 FiberWire loop which is tensioned and secured between metallic buttons placed against the outer cortices of the tibia and fibula, providing physiologic stabilisation of the ankle mortise.



Figure 2A

Figure 2A: Syndesmotic disruption in a case of ankle fracture.



Figure 2B

Figure 2B: Primary stabilisation failure (fixation using screws) diagnosed in accordance with the Inclusion Criteria. Requires revision of syndesmotic fixation.



Figure 2C

Figure 2C: Removal of the previous syndesmotic screws during revision surgery.



Figure 2D

Figure 2D: Intraoperative stress eversion radiographs after removal of syndesmotic screws. Stress radiographs and direct visualisation help in accurate reduction, particularly in revision.



Figure 2E

Figure 2E: Revision stabilisation with TightRope®. 6 months follow-up radiograph shows an anatomically stable ankle mortise. No evidence of syndesmotic disruption.



Figure 3

Figure 3: Case 7 - Poor outcome post TightRope® revision fixation – Refractory pain due to distal tibial osteonecrosis for which a distal tibiofibular fusion was performed.

CONCLUSION: Ankle TightRope® fixation is a viable alternative method of syndesmotic stabilisation in patients who require revision syndesmosis fixation. Further studies are required to evaluate this method of revision stabilisation as compared to screws.

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