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CASE REPORTS
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Ankle Fractures With Syndesmosis Sprain Repaired With a Novel Screw-Suture Construct: A Report of 2 Cases

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Summary: The distal tibiofibular syndesmosis is composed of 4 ligamentous structures that tether the fibula to the tibia in the incisura, thereby maintaining congruity of the ankle mortise. Violation of these ligaments can and frequently do lead to ankle instability, even after the bony components of ankle fractures are surgically corrected and repaired. When ligamentous instability of the ankle is present, syndesmotic fixation remains a foundational operative technique in reconstructing the ankle’s stability. Standard transsyndesmotic surgical options for the treatment of syndesmotic instability include screw fixation and/or fixation with a suture button. However, syndesmotic implants, particularly screws, frequently require removal; suture button tension consistency remains inconsistent; and certain complex ankle fractures increase the difficulty of inserting syndesmotic fixation without interfering with implants required to stabilize the bony fragments. In this series, 2 cases are presented in which a new method of syndesmotic fixation is used and demonstrates restoration of the distal tibiofibular articulation via a modular system with which tension can be adjusted. Indications considered for each case, surgical technique, technical tips, and limitations with the use of this technique will be discussed. Level of evidence for this series is IV.

Key Words: syndesmosis, fixation, ankle fracture, ankle instability, FIBULINK

INTRODUCTION

Ankle fractures with syndesmosis injury requiring repair occur commonly. Standard surgical practice includes repairing the bony components of the ankle fracture and subsequently addressing any residual instability of the distal tibiofibular syndesmosis when present. In this case report, we focus specifically on the syndesmotic repair component of ankle fracture surgery. The syndesmosis is composed of 4 distinct ligaments including the anterior–inferior tibiofibular ligament, posterior–inferior tibiofibular ligament, interosseous ligament, and the inferior transverse ligament. After successful fixation of the bony components of an ankle fracture, failure to recognize and appropriately treat an associated syndesmotic injury has been associated with poor outcomes. Once fracture fixation is complete, integrity of the syndesmosis can be assessed using a dorsiflexion/external rotation stress test or a hook (Cotton) test. When positive, the most common treatment strategies include transsyndesmotic screw and/or suture button fixation, with ongoing debate regarding the indications and outcomes between the two. Syndesmotic screws were originally considered the superior fixation technique due to their stability and ease of placement, but the literature on outcomes and ankle biomechanics have noted complications involving implant failure and soft tissue irritation, suggesting that screw removal may be indicated in select patients. In response to this, suture fixation via suture button techniques have gained popularity because they provide a stable construct while allowing some movement of the fibula in the tibial incisura that more closely approximates movement of the intact joint than screws. However, differences in functional outcomes and long-term outcomes between suture and screw fixation remain under question. Notably, screws have been demonstrated to maintain malreduction of the distal tibiofibular joint when iatrogenically created at the time of surgery. The suture button reduces this complication but requires placement of the construct on the medial tibial cortex, which introduces the risk of saphenous nerve irritation and often requires a medial approach to seat the implant properly on the cortex. Furthermore, the knotless version of the
suture button can only be tightened and may result in overcompression of the fibula in the incisura.

A novel method of syndesmotic fixation, the FIBULINK Syndesmosis Repair System by Depuy Synthes (West Chester, PA) aims to reduce the risk of complications, such as the need for implant removal and broken syndesmotic screws, while also providing flexible fixation without the need for an implant on the medial cortex or a medial approach. Specifically, the implant’s design allows for fine adjustment of the suture tension across the syndesmosis, avoids violation of the medial anatomical structures, and provides a small but considerable degree of movement to allow for physiologically appropriate ankle motion.

This report presents 2 cases of ankle fractures with associated syndesmotic instability, as verified with intraoperative radiographic assessment, which required adjunct syndesmotic fixation. In each of these cases, FIBULINK System was implemented and placed in conjunction with a plate.

**CASES**

**Case 1**

**Patient Information**

A 57-year-old woman with history of hypertension and osteoporosis sustained a closed, neurovascularly intact trimalleolar ankle fracture with comminution of the posterior malleolus and a Weber C fibula fracture after slipping down a set of snowy stairs (Fig. 1). Her ankle was closed reduced and splinted, and surgery

**FIGURE 1.** Injury film before reduction.

**FIGURE 2.** Axial computed tomography scan postreduction and splinting demonstrating displacement of the posterior malleolus with an impacted articular fragment. The medial malleolus is also seen displaced anteriomedially.

**FIGURE 3.** Anteroposterior and lateral films of the ankle demonstrating anatomical reduction and internal fixation of all bony components of the trimalleolar ankle fracture.

**Figure 4.** Cotton (laterally applied force) stress testing with a pointed bone reduction forceps applied to the fibular plate demonstrates widening of the distal tibiofibular joint space indicative of syndesmosis instability.
was delayed 1 week until soft tissue swelling improved. Preoperative computed tomography scan revealed a large posterior malleolar fragment with an impacted articular fragment (Fig. 2). Open reduction and internal fixation of this unstable injury was indicated based on her imaging.

Surgical Technique
The surgical tactic included reduction and fixation of the posterior malleolus to restore the articular surface and repair avulsion of the posterior–inferior tibiofibular ligament. In addition, the fibula fracture was reduced to restore proper length for congruency of the ankle mortise. The medial malleolus was repaired with retrograde screws, and then, integrity of the distal tibiofibular syndesmosis was evaluated with stress testing under fluoroscopy. Syndesmosis reduction and fixation was then provided with FIBULINK transsyndesmotic fixation. Surgery was performed with the patient positioned lateral on a radiolucent table. Preoperative block, general anesthesia, and a tourniquet were used. A posterolateral approach was performed and the posterior malleolus was reduced and repaired with a buttress plate and raft screw supporting the articular fragment. The transverse fibula fracture was then fixed with a one-third tubular plate applied using dynamic compression. The bean bag was released under the drapes, and the patient was repositioned sloppy lateral to allow external rotation of the limb for a medial approach to the medial malleolus. It was open

FIGURE 5. Anteroposterior and lateral images of the distal tibiotalar joint after reduction and provisional fixation with a k-wire.

FIGURE 6. Lateral image demonstrates a corridor between the 2 medial malleolar screws for placement of the guidewire. Anteroposterior image demonstrates placement of this guidewire parallel to the plafond with partial deflection off a medial malleolar screw. Placement of transsyndesmotic fixation in high-trafficked areas such as this present increased challenge, especially when using an all suture construct that may be at risk for rupture when in contact with other implants.

FIGURE 7. Anteroposterior image demonstrating proper seating of the head of the FIBULINK screw at the level of the subchondral bone of the tibial incisura. Tangential view of the incisura can best be obtained by overlapping the anterior and posterior cortical edges of the incisura. This view is similar to but not the same as the mortise view. Typically, additional internal rotation is needed to obtain this view but was not possible in this case due to the posterior malleolar plate obstructing view of the screw head. This view is demonstrated in Fig. 16D.

FIGURE 8. Clinical photograph demonstrating how to hold the outer silver portion of the insertion device to “pull” the link portion of the FIBULINK laterally and hold it there to provide tension to allow the “Cap” to be screwed onto it.
reduced and repaired with retrograde cannulated screws (Fig. 3). Stress testing of the ankle now revealed instability of the distal tibiofibular syndesmosis (Fig. 4). The fibula was reduced in the tibial incisura using finger reduction and was held with a 1.6-mm Kirshner wire (k-wire) (Fig. 5). Reduction quality was judged by comparing anteroposterior, mortise, and lateral images with those of the intact contralateral ankle. Transsyndesmotic fixation with the FIBULINK was now performed to help improve reduction and to maintain reduction of the joint with dynamic fixation.

Lateral imaging identified a corridor of bone between the 2 medial malleolus screws for the placement of transsyndesmotic fixation. The guidewire for the FIBULINK was placed in this corridor and parallel to the tibial plafond (Fig. 6). The step cut cannulated drill was then passed over the guidewire. The larger diameter portion of the drill was passed through the fibula only and not into the tibia. This allows the smaller diameter screw to tap properly into the tibia and also allows the larger-diameter Cap, the device used to compress the fibula to the tibia, to fit in the fibula. Proper seating of the screw in the tibia can be felt as the larger-diameter head portion of the screw contacts the subcondral bone of the tibial incisura (Fig. 7). This should also be verified with fluoroscopy taken tangential to the incisura. Slight over-rotation of the mortise view provides this image. Once properly seated, the black insertion handle is removed, and the link portion of the device is deployed by pulling laterally on the silver portion of the insertion device with a hemostat (Fig. 8). While holding the link laterally with mild tension (Fig. 9), the Cap is now twisted clockwise onto the link to draw the fibula closer to the tibia as indicated and judged by the

**FIGURE 9.** Mortise image demonstrating initial threading of the “Cap” onto the “Link”.

**FIGURE 10.** Once the “Cap” has been screwed onto the “Link” and is in contact with the plate, the fibula can then be drawn deeper into the tibial incisura to the desired depth.

**FIGURE 11.** Anteroposterior and lateral images demonstrating the final construct with the FIBULINK “screw” seated flush with the subcondral bone of the incisura and reduction of the distal tibiofibular joint space.

**FIGURE 12.** Anteroposterior and lateral views of case 2 demonstrating displacement of the fibula fracture.
surgeon. This is a similar move to that of tightening a suture button to draw the fibula deeper into the tibial incisura (Fig. 10). Of note, the Cap can be unscrewed to release overcompression if the surgeon feels this is indicated. The final construct is seen in Fig. 11. The wounds can be closed as indicated, and postoperative care is provided in standard manner.

Case 2

Patient Information

A healthy 44-year-old woman sustained a closed, right Weber B/supination external rotation type distal fibula fracture as a result of tripping on a rug at home (Fig. 12).

FIGURE 13. External rotation stress testing demonstrating lateral translation of the talus with widening of the medial clear space of the mortise and diastasis of the distal tibiofibular clear space suggesting sprain of the ankle syndesmosis.

Manual external rotation stress testing revealed medial clear space widening indicative of deltoid ligament sprain and diastasis between the fibula and tibia at the incisura, suggesting syndesmosis sprain (Fig. 13). She was indicated for ORIF of the fibula and repair of the distal tibiofibular syndesmosis.

Surgical Technique

In the supine position, a direct lateral approach was made, to the fibula. Fracture hematoma and the torn anterior tibiofibular ligament were debrided sharply. The distal tibiofibular joint was cleared of hematoma and any fracture debris. The fracture was reduced anatomically and repaired with an interfragmentary screw and neutralization plate (Fig. 14). Cotton stress confirmed syndesmosis instability (Fig. 15).

Using finger reduction technique, the fibula was then reduced into the tibial incisura and held with a k-wire. Fluoroscopic images of the contralateral ankle were obtained and compared with judge fibular position in the incisura before proceeding with trans-syndesmotic fixation. The FIBULINK was inserted using the same sequence as in case 1 (Fig. 16). In this case, with no posterior and medial malleolar fixation needed, the position of the FIBULINK screw flush with the subchondral bone is more clearly seen.

For both cases, routine postoperative care was implemented, including prophylactic antibiotics, deep vein thrombosis prophylaxis, multimodal pain management, early ankle range of motion after splint removal at the 2-week interval, and progressive weight-bearing beginning 6 weeks post surgery.

DISCUSSION

Syndesmotic injuries are common among ankle fractures and are important to identify to determine appropriate operative fixation. Although 2 standard techniques for syndesmotic fixation, screw fixation and fixation with suture button, are widely accepted, there are well-documented limitations and complications with these methods. Screws provide rigid fixation with durable bony purchase but have been demonstrated to maintain
malreduction of the distal tibiofibular joint should the surgeon fail to achieve reduction. The rigidity of screw fixation also prevents normal distal tibiofibular joint kinematics and can restrict ankle range of motion. As such, screw removal is fairly common. Suture button constructs reduce malreduction by providing flexible fixation. However, placement of the suture button construct on the medial tibial cortex introduces the risk of saphenous nerve irritation and often requires a medial approach to seat the implant properly. The suture button is all suture throughout its path in the fibula and tibia. This makes placement of the device challenging if not impossible in high-trafficked areas such as in case 1. Furthermore, engagement of the suture on instrumentation in these cases may result in suture failure. Finally, tensioning of suture construct is imprecise and can be difficult to release should overtightening occur. The FIBULINK System aims to address some of these limitations while still providing an effective option for syndesmotic stability. Trans-syndesmotic fixation has been traditionally accomplished using screws or suture button constructs. Each has benefits and limitations, some of which may be addressed with this novel screw-suture device. When choosing an effective surgical construct, the surgeon may choose any one of these devices deemed appropriate given the specific needs of the patient and injury.

CONCLUSION
Ankle fractures with syndesmotic injury occur with great variety and require thoughtful fixation constructs to repair anatomy and render stability. Trans-syndesmotic fixation has been traditionally accomplished using screws or suture button constructs. Each has benefits and limitations, some of which may be addressed with this novel screw-suture device. When choosing an effective surgical construct, the surgeon may choose any one of these devices deemed appropriate given the specific needs of the patient and injury.

REFERENCES


