Deep Infections After Syndesmotic Fixation With a Suture Button Device

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abstract

Suture button devices such as the TightRope (Arthrex, Naples, Florida) have been increasingly used for syndesmotic fixation of ankle fractures. Despite proposed advantages, prior studies have shown equivalent outcomes, with a theoretical decreased need for removal of hardware. Complications of suture button fixation of syndesmotic instability may be underreported and include lateral suture knot inflammation with or without granuloma formation, infection, aseptic osteolysis with widening of the tibial drill tunnels, heterotopic ossification, and osteomyelitis. In this case series, the authors review the current literature and describe 3 patients with TightRope fixation for syndesmotic instability who developed deep infection. The authors believe that braided suture within suture button devices may provide an environment conducive to the propagation of infection across the syndesmotic fixation tract. Evidence of suture button migration or osteolysis of the TightRope tract should prompt an infectious workup and removal of hardware. If there is concern for infection associated with the TightRope, the authors recommend removing both metallic buttons and the entirety of the suture to prevent harboring a nidus for further infection. [Orthopedics. 2017; 40(3):e541-e545.]

Syndesmotic injuries are estimated to occur in up to 10% of ankle fractures, typically with Lauge-Hansen pronation injuries or Weber C fibular fractures following an external rotation force.¹ The ideal method to fix the syndesmosis remains elusive; the number of screws necessary, the number of cortices needed, the size of the screw to be used, and the appropriate method by which to judge the syndesmotic reduction all remain controversial. Disadvantages to rigid syndesmotic fixation include the lack of motion at a normally mobile articulation, the risk of screw breakage or the necessity of screw removal, and prolonged protected weight bearing.²⁻⁵ The rate of syndesmotic malreduction with screw fixation has been reported to be as high as 52% in Weber C ankle fractures.⁶

Syndesmotic instability has been historically addressed with prolonged immobilization or screw fixation, although suture button systems such as the TightRope (Arthrex, Naples, Florida) have been increasingly used. In 2010, approximately 10% of syndesmotic disruptions were fixed with a suture button device.⁷ The TightRope is a system composed of 2 No. 5 braided polyester sutures and 2 metallic buttons (stainless steel or titanium) that work by tensioning the 2 metal buttons against the outer cortices of the tibia and the fibula to maintain physiologic stabilization.⁸

Touted benefits of the TightRope include a higher likelihood of anatomic reduction, stable fixation that allows physiologic motion, decreased need for hardware removal, earlier weight bearing, and faster return to work.³⁻⁴⁻⁹⁻¹⁰ Despite these proposed advantages, a systematic review in 2012 showed similar outcomes between prolonged immobilization or screw fixation and use of the TightRope system, although the patients with the TightRope did have a significantly lower rate of...
A prospective, multicenter study published in 2015 randomized patients to either 1 quadricortical screw or 1 TightRope. The study showed a trend toward better radiographic and clinical outcomes for patients fixed with dynamic rather than static stabilization, although few of the measured parameters were statistically significant.

Additional complications associated with suture button fixation include lateral suture knot irritation with or without granuloma formation, infection, aseptic osteolysis with widening of the tibial drill tunnels, heterotopic ossification, and osteomyelitis.\textsuperscript{2,4,12-14}

The current authors present a case series of 3 patients who underwent open reduction and internal fixation of an ankle fracture with TightRope fixation for syndesmotic instability. Each developed a deep infection associated with bone erosion with the TightRope.

**Case Reports**

**Patient 1**

A morbidly obese 37-year-old woman presented to the emergency department and reported left ankle pain after falling down the stairs. Imaging revealed left lateral and posterior malleolus fractures with dislocation of the tibiotalar joint (Figure 1). The patient was initially evaluated, reduced, and splinted. She returned for operative fixation approximately 2 weeks later and lag screw fixation and a neutralization plate were used to stabilize her lateral malleolus fracture. Both external rotation and Cotton tests confirmed syndesmotic instability. A single TightRope was placed to maintain syndesmotic reduction (Figure 2).

The patient presented to the emergency department approximately 3 months postoperatively with 1 week of increasing drainage from her lateral ankle wound. Because her fracture appeared healed both clinically and radiographically, the decision was made to remove all hardware following surgical debridement, including her TightRope construct. Multiple cultures obtained at the time of surgery were consistent with a polymicrobial infection and the patient was treated with intravenous antibiotics for 6 weeks. The patient had no further complications and her syndesmosis remained stable at more than 8 months postoperatively.

**Patient 2**

A 26-year-old man had undergone open reduction and internal fixation of his right ankle with a lateral plate, a medial malleolus screw with a washer, and a TightRope...
at an outside facility more than 1.5 years prior to presentation in the emergency department. He reported 3 days of ankle pain with drainage from both the medial and lateral ankle incisions. The patient had significantly elevated inflammatory markers on laboratory tests and imaging revealed migration of the medial TightRope button within the tibia, bone erosion in the suture button tract, and changes consistent with osteomyelitis (Figure 3).

The patient was taken to the operating room and underwent irrigation and debridement of his medial and lateral ankle wounds with removal of all hardware, including the tibial and fibular metallic buttons and the retained FiberWire (Athrex). His postoperative course was complicated by lateral wound dehiscence that required a skin graft. The patient was treated for polymicrobial osteomyelitis with 9 weeks of intravenous antibiotics.

At his most recent follow-up, the patient was able to ambulate without assistive devices and had returned to work as a bartender. Imaging revealed no syndesmotic widening and he was discharged.

**Patient 3**

A 29-year-old man presented to the emergency department with medial ankle erythema and drainage 6 weeks after undergoing open reduction and internal fixation of a left ankle fracture at an outside facility. He had undergone surgery for a lateral malleolus fracture with medial clear space widening and syndesmotic instability and was treated with a lag screw, a lateral plate, and a TightRope. After discussion with his surgeon, the patient was discharged from the emergency department with oral antibiotics (cephalexin) and planned to follow up with his surgeon. However, he presented again to the emergency department 3 days later with new onset lateral ankle erythema. Inflammatory markers were within normal limits and radiographs revealed no abnormalities with all hardware in appropriate position (Figure 4).

Intraoperatively, pus was encountered when an incision was made over the medial suture button and concern existed for infection within the TightRope tunnel, which was thoroughly debrided. The patient’s TightRope was removed intraoperatively and the decision was made to retain the remaining lateral hardware because his fracture was not yet healed. Five cultures obtained intraoperatively all grew *Pseudomonas aeruginosa*. A peripherally inserted central catheter was placed and the patient was administered piperacillin/tazobactam with a planned course of 6 to 8 weeks of intravenous antibiotic therapy at the recommendation.
of the authors’ infectious disease department.

At the most recent follow-up with his initial surgeon, the patient’s fracture had healed and he had undergone removal of hardware, was ambulating without assistive devices, and required no further syndesmotic fixation.

**DISCUSSION**

Suture button systems have been shown to offer syndesmotic stabilization while allowing physiologic motion. Although the TightRope device is used with increased frequency for the treatment of syndesmotic instability, further data are needed to accurately determine long-term outcomes and complications of this technique.

A purported advantage of TightRope fixation is a decreased need for a second surgery to remove hardware; however, 25% of patients in a recent study required removal of their suture button. These authors have since changed their surgical discussion with patients and now inform them that this device may require removal. An additional study reported 2 of 6 patients (33%) required removal because of soft tissue irritation. A systematic review examined the need for implant removal and found that of the 220 patients treated with a TightRope, 22 (10%) required implant removal. These rates remain significantly lower than those previously reported for syndesmotic screw fixation; nonetheless, patients should be counseled that the TightRope may require removal. A cost analysis is outside the scope of this article, but additional study would be worthwhile. Although it may be possible to remove syndesmotic screws in the office, thus eliminating the necessity of a second operative procedure, removal of a TightRope requires a return to the operating room for adequate debridement.

Lateral suture prominence with skin irritation has been reported, with the lateral wound undergoing a foreign body reaction that may cause granuloma formation. A technique to avoid suture knot prominence includes tying 10 half-hitch knots and then securing the longer knotted suture in a periosteal flap elevated off the posterior fibula. No further prominent suture complications were noted with this modified technique, although follow-up duration was not specified within the article.

The current case series highlights the risk of infection following the use of a TightRope for syndesmotic stabilization. Importantly, 2 of 3 patients presented with both medial and lateral erythema and/or drainage. This signifies the ability of an infection to colonize the entire suture button tract. The authors believe that the braided nature of the polyester jacket surrounding the ultra-high-molecular-weight polyethylene suture provides a high surface area for bacteria to adhere to and propagate the infection across the suture path. A study investigating bacterial adherence to suture supports this hypothesis, as sutures with braided jackets had significantly higher rates of adherence than those with a monofilament core without a braided jacket. A previously published case series presented a group of lower extremity traumatic amputees who had a foreign body reaction to FiberWire with sinus tract formation. The authors subsequently ceased using FiberWire to secure their myodeses. They hypothesized that the silicone coating applied to the suture to facilitate easier handling contributes to this inflammatory reaction, and infrared spectroscopy confirmed the presence of silicone granulomas within giant cells.

There are no known risk factors for suture button device infections. The authors believe that the large bone tunnel (3.5 mm) filled with a coated suture may create an environment conducive to bacterial growth or a foreign body reaction. Perhaps the superficial nature of the hardware predisposes the device to hardware irritation and infection in an anatomical location already fraught with wound healing issues and complications.

Further, if there is concern for an infection associated with the TightRope, the authors recommend removing both metallic buttons and the entirety of the suture to prevent harboring a nidus for further infection. If the syndesmotic instability is associated with an ankle fracture, removal of the remaining hardware is left to the discretion of the treating surgeon, who must determine if the fracture is sufficiently healed to warrant complete hardware removal.

The authors recommend that syndesmotic injuries treated with a TightRope undergo continued radiographic evaluation because aseptic loosening with osteolysis in the suture tract and subsidence of the suture button has also been reported. Evidence of suture button migration or osteolysis of the TightRope tract should prompt an infectious workup and removal of hardware. Symptoms or radiographic findings consistent with osteomyelitis may require multiple procedures to debride the wound and bony tunnels to ensure appropriate eradication of the infection in conjunction with intravenous antibiotics.

**CONCLUSION**

A TightRope provides an alternative to syndesmotic screw fixation in tibiofibular diastasis. However, use of this device does not obviate the need for routine screw removal as initially reported. Infection associated with the suture button tract has been shown to cause tract widening, subsidence of the implant within the cortex, and osteomyelitis extending to the medial cortex. The authors believe that the braided FiberWire suture provides an environment conducive to the propagation of infection across the suture button tract and that removal of hardware associated with the TightRope is critical in eradicating infection.

**REFERENCES**

1. Court-Brown CM, McBirnie J, Wilson G. Adult ankle fractures: an increasing prob-


