A Biomechanical Comparison Between TightRope and Suture-Post Fixation: A Novel Technique

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Purpose: Screw fixation for syndesmotic repair is widely accepted and remains the primary surgical method of choice for ankle syndesmotic injury fixation. However, flexible implants such as the TightRope (Arthrex) have gained tremendous popularity given lower hardware removal rates and theoretically allowing more consistent reduction and physiologic motion. A primary argument against the use of flexible implants is cost. The purpose of this study was to evaluate a novel suture-post construct using cost-effective materials and compare biomechanical stability with the TightRope device.

Methods: Eight matched pairs, 16 fresh-frozen cadaveric through-tibia/fibula specimens, were used. The specimens were fitted with positional reference markers at the mid-tibia and mid-fibula. Radiographs were obtained with the specimens intact (pre-test), with severed syndesmosis (severed), and after syndesmotic repair (fixed) with either a TightRope or novel suture-post fixation. TightRopes were applied per manufacturer recommendations. Suture-posts were created by drilling a 2.5-mm transosseous tunnel 1-2 cm proximal and parallel to the tibiotalar joint line. Then, a single 15-mm × 3.5-mm unicortical screw was placed in the tibia and the fibula each 1 cm proximal to the medial and lateral drill holes. #5 FiberWire was passed from lateral to medial, wrapped twice around the medial suture-post tightened, then the suture was passed back laterally where it was tied around the fibular screw. The fibular screw was then tightened, placing tension on the construct and applying a reduction force. A moderate 100-N axial load and a 6.5-Nm external torque was applied to pre-test, severed, and fixed specimens. Torque to failure was completed at 0.7°/sec up to the yield strength.

Results: Syndesmosis disruption was confirmed with external stress radiographs. The average external rotation required to achieve a 6.5-Nm torque was similar between the TightRope and suture-post groups, 23.56° (standard deviation [SD] 1.61) and 22.88° (SD 3.39), respectively ($P = 0.550$). Torque to failure was also equivalent between groups at 20.2 (SD 11.17) and 16.9 Nm (SD 5.61) for the TightRope and suture-post, respectively ($P = 0.375$), with an average of 77.8° (SD 37.6) and 68.1° (SD 10) of external rotation ($P = 0.565$) at failure. The most common mode of failure in both groups was fibula fracture. Suture cut-out was seen in 50% of suture-post group and fracture at the suture button insertion was seen in 37.5% of cases in the TightRope group.

Conclusion: The suture-post construct performed similarly to the TightRope in all metrics. The failure mode most commonly involved a fracture of the fibula in both groups. There was no significant difference in the degree of biomechanical stability between constructs. The suture-post construct provides similar biomechanical stability and can be considered a suitable alternative to the TightRope device at one-fifth the cost.