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3-D CT Analysis of Screw and Suture-Button Fixation for Syndesmosis Repair

Presenting Author:
Jason M. Schon, BS

Additional Authors:
Brady T. Williams, BS, Melanie B. Venderley, Jonathon D. Backus, MD, Grant J. Dornan, Travis L. Turnbull, PhD, Robert Laprade, MD, PhD, Thomas O. Clanton, MD

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Introduction/Purpose: Historically, unstable injuries to the distal tibiofibular syndesmosis have been repaired with syndesmotic screws. However, newer repair techniques with inherently flexible implants, including suture-button constructs, may be less susceptible to malreduction and more reliably restore the native anatomy. The purpose of this study was to compare the anatomic accuracy of reduction between a syndesmotic screw and suture-button constructs for syndesmosis repair using a pre-injury and postoperative 3-D model assessment. We hypothesized significant differences would be observed among repair techniques and suture-button constructs would most accurately restore the pre-injury syndesmotic volume.

Methods: Twelve matched pairs of cadaveric specimens were dissected to identify the syndesmotic ligaments. Specimens were imaged with CT prior to the creation of a complete syndesmosis injury. The disrupted syndesmosis of each specimen was subsequently reduced using one of three randomly assigned repair techniques: (1) tri-cortical syndesmosis screw (3.5 x 50 mm), (2) one suture-button construct and (3) two suture-button constructs. Specimens were imaged postoperatively with CT. 3-D models of all scans and tibiofibular joint space volumes were created to assess restoration of the native syndesmosis (Figure 1). Volumetric joint space measurements were made starting at the distal aspect of the tibiofibular articulation and extended proximally with four 1 cm sections measured separately.

Results: For each of the three fixation methods, the adjusted least squares means for total post-operative volumes of the syndesmosis were significantly decreased relative to the intact state. Total overall decreases in volume compared to the intact state for the one suture-button construct, two
suture-button constructs, and syndesmotic screw were -561 mm³, -964 mm³ and -377 mm³, respectively. Fixation with one suture-button construct was not significantly different from screw or two suture-button fixations. However, the total decrease in volume was significantly greater with the two suture-button repair compared to screw fixation (p < .05).

**Conclusion:** The most important finding of this study was that fixation with one suture-button construct was not significantly different from screw or two suture-button fixations. All repairs significantly reduced the volume of the syndesmosis postoperatively compared to the intact state. Fixation with two suture-buttons resulted in significantly greater decreased volume than screw fixation. The data from the present study suggests that syndesmotic over-compression at time zero, particularly when using multiple suture-button implants, may be another potential factor contributing to malreduction of syndesmosis injuries that deserves further investigation.

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**Figure 1:** 3-D reconstruction model of the distal tibiofibular syndesmosis bony anatomy and joint space volumes separated into four 1 cm sections.