

Use of a Suture Button Device for Stabilization of Syndesmosis Injury: A Biomechanical Investigation

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Summary:

The suture button device restores tibiofibular syndesmosis kinematics, but does not restore the abnormal talar external rotation that occurs after complete syndesmosis injury. In addition to surgical stabilization, a period of immobilization and protected weight-bearing should be considered for athletes suffering from complete syndesmosis injuries to allow healing of the deltoid ligament.

Abstract:

INTRODUCTION:

High ankle sprains and ligamentous injuries to the distal tibiofibular syndesmosis are predictive of long-term ankle dysfunction. For complete injuries, appropriate reduction of the tibiotalar and syndesmosis joints is necessary to restore normal ankle joint function. Suture button devices are available for surgical stabilization of complete syndesmosis injuries with several advantages over screw fixation, including accelerated rehabilitation and alleviating the need for implant removal. We hypothesize that repair of a complete syndesmosis disruption with a suture button device will restore ankle and syndesmosis kinematics to a point that mimics baseline values. Using a cadaveric model, we determine the: 1) radiographic changes, and 2) rotational and linear displacement of the talus and fibula relative to the tibia with sequential syndesmosis ligament injury, and after repair with two suture button devices.

METHODS:

Eight cadaveric specimens underwent sequential sectioning of the anterior-inferior tibiofibular (AITFL), interosseous and transverse (IOL/TL), posterior-inferior tibiofibular (PITFL), and deltoid ligaments. After each ligament release, specimens underwent lateral translation to 150 N (i.e., hook test) followed by external rotation stress testing to 20 N·m. Kinematic data (using a validated infrared LED motion capture system) and radiographic measurements were obtained for each test. The tibiotalar and syndesmosis joints were then manually reduced and the syndesmosis repaired with two suture button devices (Arthrex tightrope) using the standard technique. Lateral translation and external rotation testing were repeated and kinematic and radiographic measurements were obtained. Repeated measures ANOVA with a Bonferroni/Dunn post hoc test was calculated for interspecimen comparisons.

RESULTS:

With lateral translation testing, significant syndesmosis gapping and medial clear space widening occurred only after release of the PITFL and deltoid ligaments. Both parameters were restored to baseline values after tightrope fixation. There was a high degree of correlation between motion capture and radiographic data.

During external rotation testing, talar external rotation relative to the tibia increased significantly with each ligament sectioning after AITFL. Fibular external rotation increased after release of the AITFL and IOL. Posterior displacement of the fibula began to occur following AITFL release. Significant radiographic widening of the medial clear space and syndesmosis occurred only after release of the deltoid ligament. Tightrope fixation restored the syndesmosis gap and fibula rotation to baseline levels, but did not reduce talar rotation or medial clear space widening relative to deltoid release.

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CONCLUSIONS:

Stress radiography does not appear to be a reliable indicator of mild or moderate syndesmosis injuries. Significant talar rotation and posterior fibular displacement occur during external rotation, even with moderate syndesmosis injury, and prior to disruption of the deltoid ligament. The change in joint kinematics may explain why athletes with even mild-to-moderate syndesmosis injuries take longer to heal and are more likely to develop long term dysfunction. In cases of complete disruption of the syndesmosis and deltoid ligaments, stabilization with a suture button device restores the tibiofibular syndesmosis but does not restore talar rotation and medial clear space widening during external rotation testing. In addition to surgical stabilization, a period of immobilization and protected weight-bearing should be considered for athletes suffering complete syndesmosis injuries to allow healing of the deltoid ligament. Future investigation is necessary to determine whether moderate injuries can safely undergo accelerated rehabilitation after suture button stabilization.