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# Syndesmosis Fixation with Suture Button Constructs May Lead to Tibio-Talar Joint Instability in the Setting of Early Post-Operative Weightbearing

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**Summary**:
Single and double tricortical screw fixation restored native tibiotalar motion during weightbearing without overconstraint, while suture button constructs were unable to restore native motion. Thus, for earlier weight bearing and recovery, surgeons may consider surgical fixation of the syndesmosis with tricortical screw constructs.

**Abstract**:

## Introduction

Injury to the anterior inferior tibiofibular ligament (AITFL), posterior inferior tibiofibular ligament (PITFL), and interosseous membrane (IOM) has been shown to be predictive of post-traumatic osteoarthritis in the setting of syndesmotic instability. A previous study has shown that even a small, 1 millimeter (mm) lateral shift in the talus relative to the tibia can cause a 42% decrease in the joint contact area under axial compression. Additionally, recent studies have shown early return to sports with aggressive post-operative rehabilitation with early weight bearing. Thus, the purpose of this study is to quantify tibiotalar kinematics after different fixation methods during simulated weightbearing.

## Methods

Nine fresh-frozen human cadaveric specimens (mean age: 65.1±17.3 years) were tested using a six degree-of-freedom robotic testing system. After subtalar joint fusion, the calcaneus was potted in an epoxy compound and rigidly fixed to the robotic manipulator through a universal force/moment sensor, which was used to precisely measure tibiotalar motion. A constant 200N compressive load was applied while a 5Nm external rotation and 5Nm inversion moment were applied independently to the ankle at 0° flexion, 15° and 30° plantarflexion, and 10° dorsiflexion. Outcome variables included talar medial-lateral translation, anterior-posterior translation, and internal-external rotation relative to the tibia in the following states: 1) intact ankle, 2) AITFL, PITFL, and IOM transected ankle 3) single tricortical screw, 4) double tricortical screw, 5) hybrid (single screw and single suture button), 6) single suture button, and 7) divergent suture button fixation. Repeated measures ANOVA with a Bonferroni correction was performed for statistical analysis (*$p < 0.05$).

## Results

In response to axial compression alone, divergent suture button fixation also resulted in increased lateral translation

of the talus compared to the intact ankle in response to axial compression by 1.1 mm at both 15° and 30° plantarflexion ($p < 0.05$). In response to axial compression and external rotation, hybrid, single suture button, and divergent suture button fixation all increased external rotation of the talus compared to the intact ankle under the same loading condition at 10° dorsiflexion by 2.6°, 4.2°, and 4.2°, respectively ($p < 0.05$). Both single suture button and divergent suture button fixation also increased external rotation of the talus compared to the intact ankle under the same loading condition by 4.2° at 0° flexion ($p < 0.05$). Single tricortical screw and double screw fixation did not have any significant differences in tibiotalar motion compared to the intact ankle under any loading conditions.

## Discussion

Suture button fixation constructs resulted in increased lateral translation and external rotation of the talus compared to the intact ankle during weightbearing, while there were no significant differences in tibiotalar motion between the tricortical screw fixation constructs and the intact ankle. This suggests that the tibiotalar contact area could be significantly decreased with suture button fixation, especially with early weightbearing, and potentially predispose to increased risk of post-traumatic osteoarthritis. Thus, surgeons may consider surgical fixation of the syndesmosis with tricortical screw constructs for earlier weight bearing and recovery.