A Biomechanical Analysis of a Tensioned Suture Device in the Fixation of the Ligamentous Lisfranc Injury

Presenting:

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Summary:
This study investigated the ability of a tensioned-suture device (Tightrope, Arthrex, Naples, FL) to maintain a reduction and restrain motion similarly to rigid screw fixation (the current gold standard treatment) in a cadaveric model of a transverse ligamentous Lisfranc disruption. We found no significant difference in either fixation methods' ability to restrain motion with abduction or axial stress testing.

Abstract

BACKGROUND:
The ligamentous Lisfranc injury continues to challenge physicians due to the relatively high rate of poor patient outcomes after nonoperative and open treatment and controversy continues regarding optimum management. Anatomic reduction is the most consistent feature of good patient outcomes. Using a cadaveric model, we tested the hypothesis that when treating transverse ligamentous Lisfranc disruptions, the use of a rigid screw fixation construct maintains an anatomic reduction while constraining motion of the Lisfranc complex to a greater degree than a tensioned suture-button device in both axial and abduction loading conditions.

MATERIALS AND METHODS:
Utilizing an optical motion capture device, three-dimensional motion between the medial cuneiform (MC1) and the base of the second metatarsal (MT2) was measured in five matched fresh frozen pairs of human cadaveric feet. Specimens were tested prior to injury and following a transverse ligamentous injury of the Lisfranc complex. The pairs were randomized so that one specimen received screw fixation and its contralateral specimen received suture-button fixation. Anatomic reduction was documented by visual inspection and fluoroscopy. Axial loads (300N) then abduction loads (55N) were applied to each specimen while motion was recorded for each of these four conditions. Measurements were also repeated after one thousand loading cycles.

RESULTS:
With axial loading, screw fixation did not restrain motion of MC1 and MT2 to a greater degree than the suture-button fixation. No statistically significant differences were detected for the pre-injury motion (0.8mm, SD=0.5mm), post-injury motion (2.0 mm, SD=1.1mm), screw fixation (2.0 mm, SD=1.4mm), or suture-button fixation (1.8mm, SD=1.1mm). With abduction loads, a statistically significant difference (p

CONCLUSION:
Our results indicate that small amounts of motion are created between MC1 and MT2 with axial loading in a cadaveric Lisfranc injury model and, therefore, no significant difference in motion is created between pre-injury, post-injury and either fixation technique. With abduction stress, however, we were able to show a significant difference between pre-and post-injury motion and the ability of either the screw or the
suture-button fixation to restore motion to pre-injury levels, suggesting similar efficacy in maintaining an anatomic reduction under these test conditions.

**CLINICAL RELEVANCE:**
Our results indicate that axial loading of cadaveric specimens may be inadequate to demonstrate Lisfranc instability, and confirm the fact that abduction stress may be a more appropriate test when diagnosing the transverse ligamentous Lisfranc injury. Additionally, we have shown that with abduction stress testing, suture-button fixation is as effective as screw fixation in restoring the motion to preinjury levels between the medial cuneiform and the base of the second metatarsal. These data provide valuable information that can be used as support for future clinical trials.