Location, Location, Location: Does the Distance of Fixation From the Plafond Affect Reduction of the Syndesmosis?

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Purpose: We aimed to determine if the level of fixation with regard to the physeal scar has an effect on malreduction in syndesmoses repaired with a 3.5-mm quadcortical screw or suture tightrope fixation.

Methods: A priori power analysis to detect a 1-mm difference between techniques was based on previous literature describing the normal syndesmosis and exhibited a need for 5 specimens per group. 6 cadaveric specimens, without apparent previous ankle injury or arthritic change, were placed into a nonmetallic ankle-foot orthosis to hold neutral position throughout the study. Specimens underwent initial 1-mm slice CT scans to determine the uninjured relationship of the distal tibiofibular joint (DTFJ). Two pilot holes were then created using a custom jig prior to ligament resection. Pilot hole 1 was placed at the level of the physeal scar, beginning lateral on the fibula and passing parallel to the plafond and parallel to the dissection table with the specimen in position for a mortise radiograph. The second hole was performed utilizing the same technique, but was placed at 2.5 cm proximal to the physeal scar. A radiopaque marker was placed on each tibia between the pilot holes to ensure measurements were made at the same level without revealing fixation methods to the observer. All three ligaments of the syndesmosis and the interosseus membrane were then sharply divided. The fibula was manually reduced into the incisura, with direct visualization of the anterior DTFJ, and each specimen underwent fixation in succession: (1) tightrope fixation 2.5 cm proximal to the physeal scar; (2) tightrope fixation at the physeal scar; (3) screw fixation 2.5 cm proximal to the physeal scar; and (4) screw fixation at the physeal scar. After each technique, specimens underwent CT scanning. The previous implant was then removed and the fibula was again displaced prior to proceeding. Single CT scan slices at the level of the marker were then randomized and all images were reviewed by three fellowship-trained orthopaedic traumatologists. The anterior incisura (AI), posterior incisura (PI), and fibular rotation (R) measurements were performed as described by Warner et al. Interrater reliability was verified using intraclass correlation coefficients (ICCs). Fixation measurements were compared to anatomic measurements using Student's t test for paired samples.

Results: Interobserver repeatability was good for all measures at 0.76, 0.72, and 0.62 for AI, PI, and R, respectively. The proximally placed tightrope device performed best, with no measurement showing a statistically significant difference from anatomic measurements (Table 1). Both screw fixation techniques resulted in posterior translation of the fibula, which increased the AI measurement and decreased the PI measurement. Proximal screw placement

performed worst, with all three measurements showing a statistically significant difference from anatomic measurements. While placement at the level of the physeal scar decreased the rotational deformity after positional screw placement, it did not show the same effect on those fixed with tightrope devices.

	Anatomic	Proximal Tightrope	Physeal Tightrope	Proximal Screw	Physeal Screw
Anterior Incisura (mm)	3.5 (1.9)	4.2 (1.8)	3.8 (1.3)	4.5 (1.7)*	4.5 (1.6)*
Posterior Incisura (mm)	4.4 (0.5)	3.2 (1.1)	3.6 (0.6)*	2.8 (1.4)*	3.4 (0.7)*
Rotation (degrees)	5.9 (4.0)	4.4 (3.3)	3.7 (3.5)	-0.2 (2.9)*	3.5 (4.7)

*Indicates $p<0.05$ when compared to anatomic measurements.

Conclusion: Likely the most common method of syndesmotic fixation utilized by traumatologists to date, screw fixation 2.5 cm proximal to the physeal scar performed significantly worse than a tightrope at either level; however, placement of a screw at the level of the physeal scar significantly decreased malrotation of the fibula in the incisura.

See pages 49 - 106 for financial disclosure information.