Anatomic Syndesmotic Reduction: Using Intraoperative Fluoroscopic Imaging to Ensure Accurate Clamp Position

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Background/Purpose: Ankle fractures are one of the most common injuries managed by orthopaedic surgeons, many of which have concomitant syndesmotic disruption. Numerous studies indicate that syndesmotic malreduction portends poorer prognosis in pain and function scores. The most common technique for syndesmotic reduction involves reduction forceps with fluoroscopic assessment. However, reports of malreduction range from 12% to 52%. This is likely due to eccentric clamp placement leading to translation or rotation of the fibula within the incisura. In the current study we sought to determine the true "trans-syndesmotic axis" (TSA) that could subsequently be used to describe a reliable technique to perform anatomic clamp reduction of the syndesmosis using intraoperative fluoroscopy.

Methods: CT scans of uninjured lower extremities were analyzed to measure the TSA in 45 adult patients. This angle was measured 1 cm proximal to the tibiotalar joint and was defined as the angle between the plane of a lateral ankle radiograph and a line perpendicular to the distal tibial incisura. Three-dimensional (3D) reconstructions of the CT scans were generated using Vitrea Core software and were used to demonstrate clamp placement collinear with the patients' true syndesmotic angles at 1 cm proximal to the tibiotalar joint line. The 3D reformats with anatomic clamp placement were used to study clamp appearance as would be seen on intraoperative lateral ankle fluoroscopy.

Results: The average syndesmotic angle measured 21° ± 5°. When the position of the reduction clamp was simulated on the 3D reconstructions, the lateral tine was placed on the fibular ridge and the clamp was oriented along the TSA. The medial tine was, on average, 23% ± 7% of the distance from the anterior tibial cortex to the posterior tibial cortex and was within the anterior one-third of the tibia 93% of the time. When referencing the anterior cortex of the fibula, the medial tine rested 53% ± 17% of the distance between the anterior cortex of the tibia and the anterior cortex of the fibula. The medial tine was within the central third of this space 71% of the time.

Conclusion: Ankle fractures with syndesmotic disruption are associated with a poorer prognosis than those without such an injury. Despite the importance of anatomic reduction of the syndesmosis to optimize recovery, malreduction is common. These results demonstrate that despite variability in the anatomy of the ankle syndesmosis, routine intraoperative use of a true lateral fluoroscopic view can guide clamp placement based on the TSA, and thereby minimize the risk of malreduction. Placing the medial clamp tine in the anterior third of the tibial length, or halfway between the anterior tibial cortex and anterior fibular cortex, appears to be the most accurate position for reduction.

See pages 47 - 108 for financial disclosure information.

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.

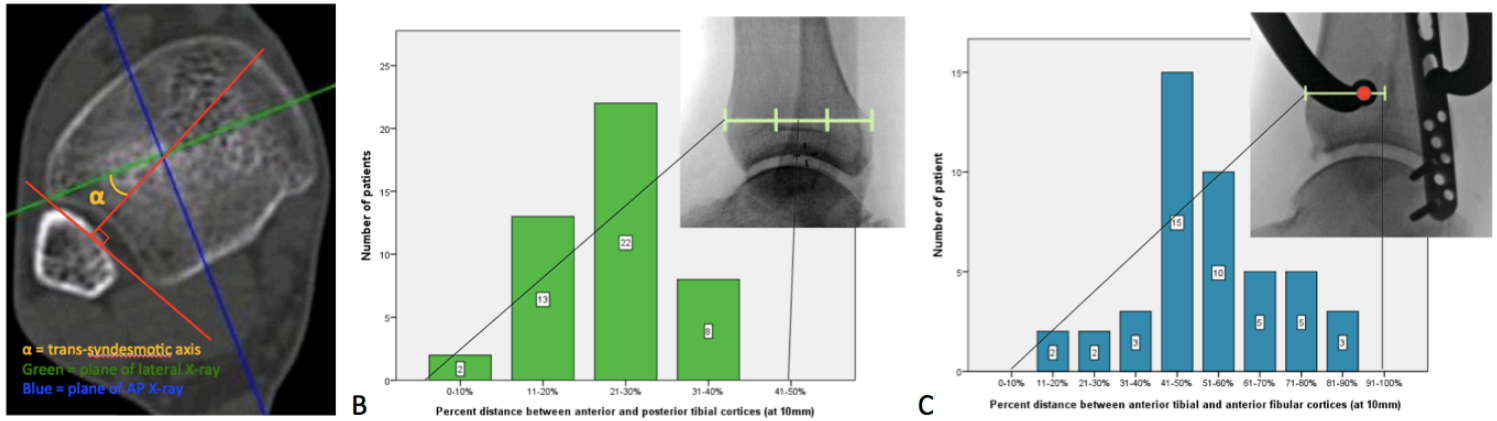

Figure 1. The trans-syndesmotic axis (TSA) was measured (A) on an axial CT at 10 mm proximal to the joint line. Using a three-dimensional reconstruction, the lateral tine of a reduction forceps was positioned on the lateral fibular ridge, and, with the clamp positioned along the TSA, the location of the medial tine on a simulated lateral fluoroscopy image was noted with respect to its position (B) from anterior to posterior along the tibia and (C) in the space between the anterior cortices of the tibia and fibula.