Identifying and Reproducibly Clamping Along the Trans-Syndesmotic Axis Using Preoperative CT and Intraoperative Fluoroscopy for Ankle Syndesmotic Reduction

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Purpose: The use of reduction clamps may cause syndesmotic malreduction when an off-axis clamping vector is established. We describe a novel technique for utilizing preoperative CT imaging to plan reduction clamp tine placement along the trans-syndesmotic axis (TSA). The hypothesis of this project is that there exists a way to methodically use preoperative CT to plan clamp placement to reproducibly position an optimal clamping vector across the syndesmosis, using only 2-dimensional (2D) fluoroscopy intraoperatively.

Methods: 25 paired cadaveric, through-knee specimens were imaged using CT. Using a series of standardized measurements, the projected location of the medial clamp tine along the TSA was calculated. This position was recorded as a percentage of the distance between the anterior to posterior cortices of the tibia (tibial line), as would be seen on a true talar-dome lateral using 2D radiography. Syndesmoses were then reduced with the lateral clamp tine placed on the fibular ridge and the medial clamp tine placed on the templated location along the tibial line. Specimens were then reimaged using CT and assessed for the difference between the desired and actual clamping vectors.

Results: The intraobserver reliability for this novel series of measurements was determined to be highly reproducible with an intraclass correlation coefficient (ICC) of 0.979 for measuring the TSA angle and an ICC of 0.980 for the medial clamp tine position along the tibial line. On average, the trans-syndesmotic angle in these specimens measured 22° ± 3° and 19 ± 9% along the tibial line. The average TSA angle difference was 3° ± 2° between paired specimens. The average angle difference between the measured TSA and actual reduction clamp vector was 3° ± 2°, corresponding to 5 ± 4% along the tibial line.

Conclusion: Reduction clamp placement directly along the TSA can be facilitated by preoperative CT measurements to determine the required position of the medial clamp tine using a true talar dome lateral fluoroscopic image as intraoperative guidance. Importantly, this standardized measurement technique demonstrated high reproducibility and paired specimens had similar TSA angles between sides, allowing for the use of the contralateral uninjured ankle in a clinical scenario. On average, we were able to position our reduction clamp vector within 3° ± 2° of the TSA angle calculated preoperatively.