Validation of the Center-Center Technique for Intraoperative Syndesmosis Fixation Alignment

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Category: Ankle

Keywords: syndesmosis, fixation, malreduction, alignment, centroid, center-center, surgery, technique

Introduction/Purpose: Distal tibiofibular syndesmosis sprain has been reported among 13% to 23% of all ankle fractures, often requiring surgery. However, post-operative malreduction rates have been reported to range from 0 to 54%. Optimal reduction is a significant predictor of overall functional outcome. The centroids of the tibia and fibula align the theoretically ideal axis of syndesmosis fixation alignment. The “Center-Center” method for syndesmosis fixation is a recently described intraoperative technique for aligning the central axes of the tibia and fibula on the ankle lateral fluoroscopic view, seemingly aligning the centroids. There is a lack of validation and outcomes data to support this technique. This study was performed in order to determine how reliably the “center-center” technique aligns with the centroid axis of the fibula and tibia.

Methods: This was a quantitative descriptive study utilizing 30 axial computed tomography scans from July 1, 2016 to June 30, 2018. Eighteen males and 12 females were included with an average age of 44-years-old. CT measurements were made using Visage 7. Three observers measured the maximum difference in degrees between the Center-Center and Centroid measurements at 10 mm, 20 mm, and 30 mm proximal to the tibial plafond for each patient. The Center-Center axis was established by internally rotating the CT image until the fibula aligned within the center of the tibia. The centroid measurement was established using a tool that calculated the centroid of each bone. Finally, the difference in external rotation required to obtain the Center-Center measurements were observed at levels 10 mm versus 20 mm, 20 mm versus 30 mm, and 10 mm versus 30 mm.

Results: The Center-Center and Centroid axes were highly consistent within and between subjects and levels, differing on average by a mean 0.39 degrees (95% CI 0.29 to 0.49 degrees) across all comparisons. These axes externally rotated a mean 3.10 degrees (95% CI 2.56 to 3.64 degrees) from 10 mm to 20 mm and a mean 2.72 degrees (95% CI 2.35 to 3.09 degrees) from 20 mm to 30 mm. There were no statistically significant differences in the mean values obtained between observers for any axis at any height (p-value range 0.4 to 1.0) and intraclass correlation indicated excellent to near perfect interobserver agreement (ICC range, 0.876 to 0.988).

Conclusion: The Center-Center technique consistently and closely aligns the fibula and tibia along the Centroid axis. These two axes externally rotate approximately 3 degrees for each 10 mm above the plafond. The Center-Center technique may offer the highly accurate means sought for achieving accurate and consistent intraoperative syndesmosis fixation alignment due to its highly consistent relationship to the Centroid axis. Surgeons should be aware of the external rotation of these axes between heights as the axes externally rotated a mean 3 degrees for each 10 mm height increase. Failure to correct limb rotation for each height could result in iatrogenic malreduction.
