Measurement of 91 Normal Distal Tibiofibular Syndesmoses by Computed Tomography

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Purpose: Anatomic reduction of the distal tibiofibular syndesmosis is essential to achieving a good functional outcome after injury. Plain radiographic assessment for diagnosis and reduction of syndesmotic injures is of limited value. CT is a more reliable method of assessment; however, study of the normal CT parameters of the ankle syndesmosis has been limited. The purpose of this study was to test the hypotheses that the syndesmosis is asymmetric from anterior to posterior and that there are side-to-side differences in syndesmotic morphology.

Methods: Ankle CT scans from 71 patients (51 unilateral, 20 bilateral; 91 ankles) without a known ankle injury were reviewed retrospectively from our institution's morphomics registry database by two orthopaedic surgeons. CT scans were reformatted along the tibial axis. For each ankle, 6 measurements were taken each at 5 mm, 10 mm and 15 mm above the tibiotalar joint. The articulating portion of the distal tibiofibular joint was divided into 3 equal sections and the distance between the tibia and fibula was measured by drawing a line perpendicular to the fibula at the center of each section. The depth of the tibial incisura was measured by drawing a line between the lateral extents of the anterior and posterior facets of the tibial incisura and measuring the greatest distance to the incisura perpendicular to this line. For tibial incisurae with two concavities, an additional measurement was taken. *P* values were determined using the 90th percentile of the absolute value of the differences in means over standard deviations.

Results: Average age was 41.3 years (18.1 SD). 38% (27/71) were female, 62% (44/71) male. Among all ankles, the mean difference between the anterior and posterior thirds was 1.1 mm (0.7 SD) at 5 mm, 1.4 mm (0.9 SD) at 10 mm, and 1.6 mm (1.1 SD) at 15 mm. A greater than 2-mm difference between the anterior and posterior thirds was noted in 12% (11/91) at 5 mm, in 23% (21/91) at 10 mm, and 32% (29/91) at 15 mm. The depth of the incisura was 3.3 mm (1.12 SD, 0.8-5.7 mm) at 5 mm, 3.9 mm (1.2 SD, 1.3-6.0 mm) at 10 mm, and 3.4 mm (1.4 SD, 0.2-7.9 mm) at 15 mm. Overall, 44% (40/91) had biconcave distal fibula incisurae at 5 mm, 15% (14/91) at 10 mm, and 2% (2/91) at 15 mm. Among bilateral ankles, the mean side-to-side difference in the anterior third was 0.94 mm (0.74 SD) at 5 mm ($P = 0.052$), 0.64 mm (0.39 SD) at 10 mm ($P = 0.025$), and 0.68 mm (0.54 SD) at 15 mm ($P = 0.053$). Mean posterior difference was 0.68 mm (0.46 SD) at 5 mm ($P = 0.034$), 0.61 mm (0.46 SD) at 10 mm ($P = 0.047$), and 0.64 mm (0.46 SD) at 15 mm ($P = 0.042$). The mean difference in depth of the incisura was 0.63 mm (0.42 SD) at 5 mm ($P = 0.034$), 0.85 mm (0.66 SD) at 10 mm ($P = 0.049$), and 0.86 mm (0.88 SD) at 15 mm ($P = 0.083$).

Conclusion: Among our bilateral ankles, there was a mean side-to-side difference of <1 mm at all levels in each third, suggesting the contralateral ankle may be used as a guide for reduction. The depth of the tibial incisura varied greatly between patients. This may influence the ease of reduction and should be considered during preoperative planning. It

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has been suggested that an anterior-posterior difference in the syndesmosis of >2 mm on CT should be considered a malreduction. Depending on the level measured, however, 12% to 32% of ankles in this study had a normal difference of greater than 2 mm. This suggests that using this evaluation for reduction may overestimate the rate of malreduction and a different evaluation should be considered.

See pages 99 - 147 for financial disclosure information.