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Radiographic Identification of the Primary Structures of the Ankle Syndesmosis

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Summary:
The present investigation defined quantitative guidelines for identifying the origins and insertions of the syndesmotic ligaments and tibiofibular articulating cartilage surfaces on standard radiographic views with respect to radiographic landmarks and reference axes.

Abstract:
BACKGROUND
Syndesmotic ligament sprains, colloquially termed high ankle sprains, can result in significant time lost from sport and can lead to chronic pain and instability. While syndesmotic anatomy has been well described, quantitative radiographic guidelines for identifying the anatomic ligament attachment sites and tibiofibular cartilage surfaces are currently inadequately defined.

HYPOTHESIS/PURPOSE
The purpose was to define quantitative guidelines for identifying the origins and insertions of the syndesmotic ligaments and tibiofibular articulating cartilage surfaces on standard radiographic views with respect to radiographic landmarks and reference axes.

METHODS
Twelve non-paired fresh-frozen ankles were dissected to identify the attachments of the anterior inferior tibiofibular ligament (AITFL), posterior inferior tibiofibular ligament (PITFL), interosseous tibiofibular ligament (ITFL), and the cartilage surfaces of the tibiofibular articulation. The center of each structure was marked with a 2 mm radiopaque sphere at the level of the cortex. Standard lateral and mortise radiographs were obtained using a fluoroscopy c-arm and calibrated using a 25.4 mm diameter radiopaque sphere positioned in the field of view. Using a picture archiving and communications system, measurements were performed twice by two independent raters to calculate intra- and inter-rater reliability via intraclass correlation coefficients (ICCs).

RESULTS
Measurements demonstrated excellent agreement between raters and across trials (All inter- and intra-rater ICCs > 0.95) for all structures and radiographic views.

On the lateral view, the AITFL tibial origin was 9.6 ± 1.5 mm superior and posterior to the anterior tibial plafond. Its fibular insertion was 4.4 ± 1.7 mm superior and posterior to the anterior fibular tubercle. The superficial PITFL originated 7.4 ± 1.6 mm superior to the posterior plafond and inserted 22.0 ± 2.3 mm superior and posterior to the lateral malleolus. The corresponding measurements for the deep PITFL were 3.2 ± 1.5 mm superior and 15.4 ± 3.4 mm superior and posterior, respectively. The proximal and distal extremes of the ITFL tibial origin were 45.9 ± 7.9

mm and 12.4 ± 3.4 mm proximal to the central aspect of the plafond respectively. The center of the tibiofibular contact area was 8.4 ± 2.1 mm posterior and superior to the anterior plafond.

On the mortise view, the AITFL tibial attachment was 5.6 ± 2.4 mm lateral and superior to the lateral extent of the plafond and its fibular insertion was 21.2 ± 2.1 mm superior and medial to the lateral malleolus. The corresponding superficial PITFL measurements were 2.7 ± 1.7 mm medial and superior and 21.5 ± 3.2 mm superior and medial respectively. The ITFL distal tibial margin was 11.1 ± 3.5 mm proximal to the tibial plafond.

CONCLUSION

Radiographic measurements demonstrated excellent agreement among reviewers and across trials suggesting clinical reproducibility and surgical utility of the defined parameters. Regardless of the type of surgical treatment, these parameters will assist with preoperative planning, augment intraoperative navigation, and provide additional means for objective post-operative assessment. Furthermore, radiographic landmarks may be of particular use in revision or arthroscopically assisted cases where surgical landmarks may be obscured or not readily visible.