

Radiographic Identification of the Primary Structures of the Ankle Syndesmosis

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My disclosure is in the Final AOFAS Mobile App.

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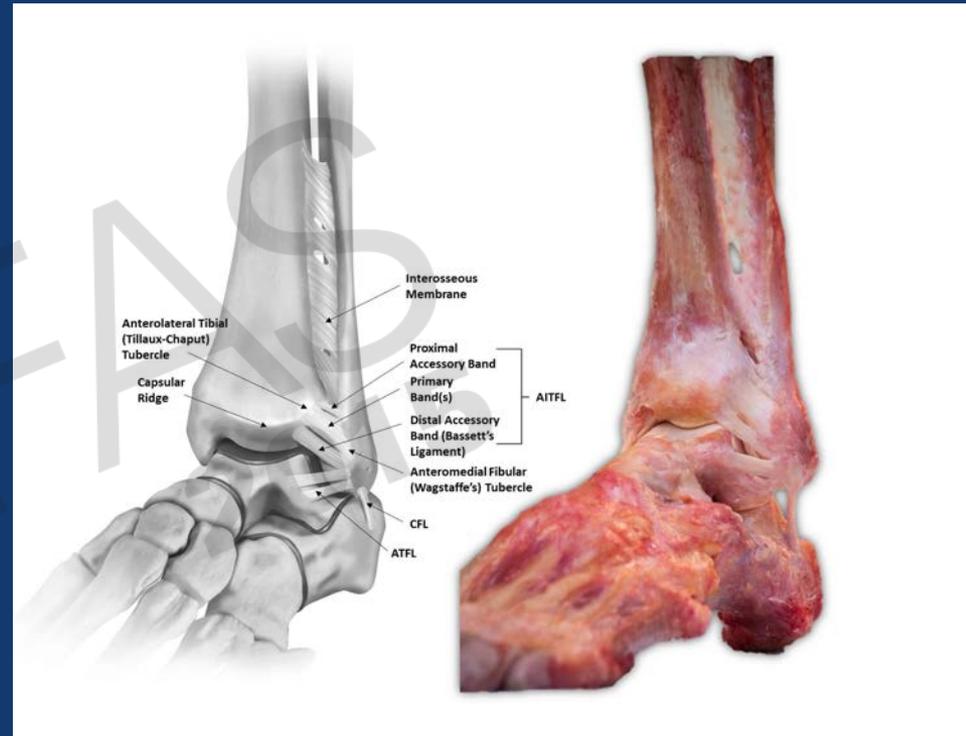
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Background

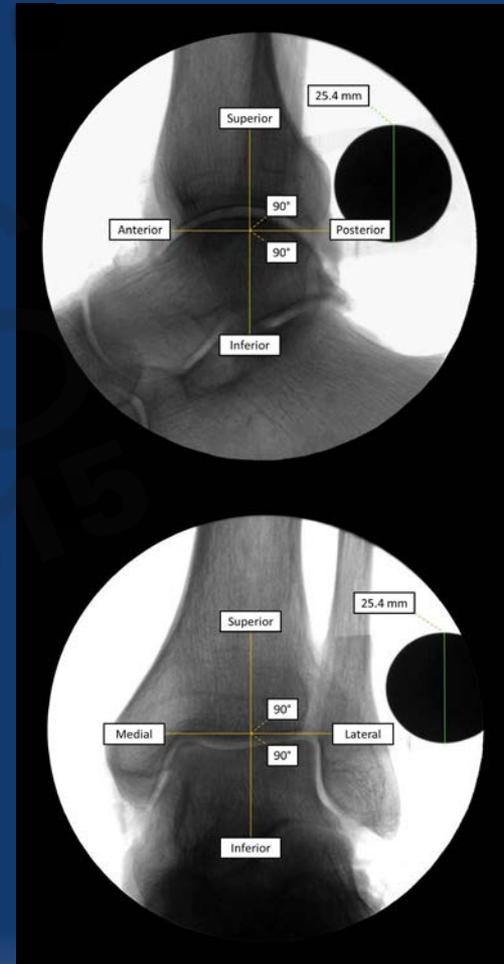
- Syndesmotic injuries can result in significant time lost from sport and can lead to chronic ankle pain and instability.⁵
- Quantitative anatomy has been well defined^{1,4,10} including:
 - Anterior inferior tibiofibular ligament (AITFL), Interosseous Tibiofibular Ligament (ITFL), Superficial and Deep Posterior Inferior Tibiofibular Ligament (PITFL), and tibiofibular articular surfaces
- Similar radiographic descriptions of the same structures have not yet been well defined.



Williams et al¹⁰, AJSM 2015

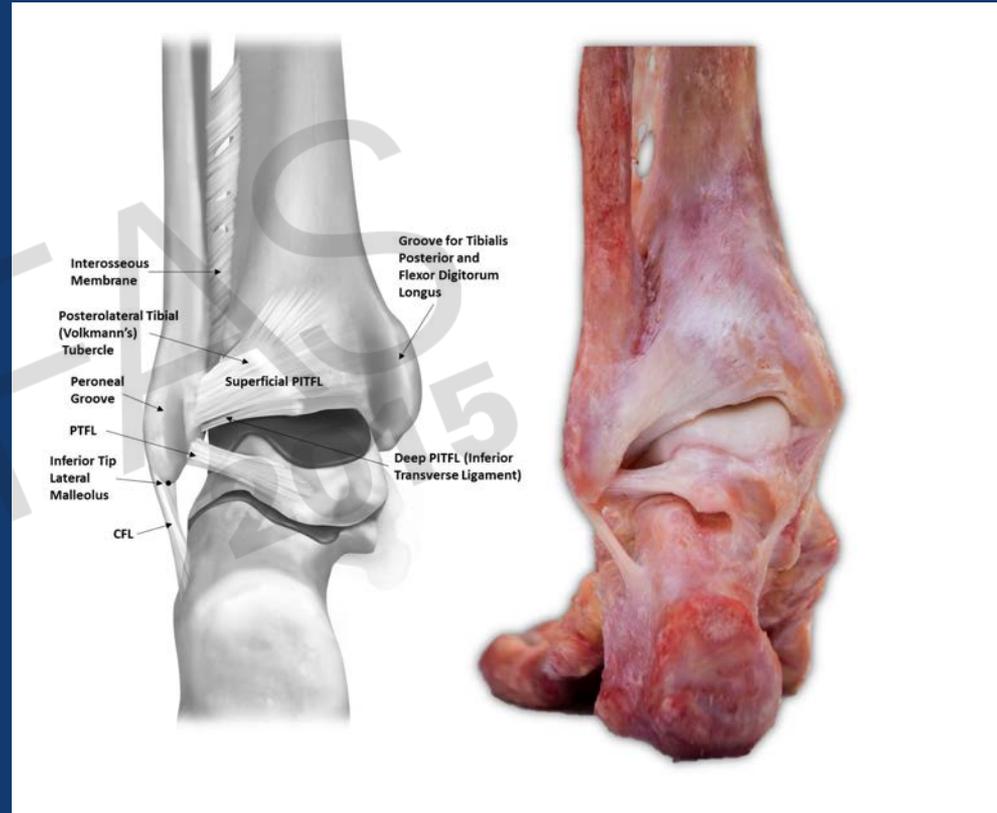
Purpose

- The purpose of this study was to establish qualitative and quantitative radiographic guidelines for identifying the tibial and fibular attachments of the three main syndesmotic ligaments and the articulating surfaces of the syndesmosis using standard ankle radiographic views.
- It was hypothesized that these sites could be reproducibly defined in relation to osseous landmarks and superimposed radiographic axes.



Materials & Methods

- Twelve non-paired, fresh-frozen foot and ankle specimens
 - mean age 56, range 38 - 82 years; 4 female and 8 male; 8 left and 4 right
- Soft tissue dissections were performed to identify the ligamentous structures of the syndesmosis and to expose the origin and insertion sites of the AITFL, PITFL, and ITFL in accordance with previous anatomic literature.^{1,4,10}



Williams et al¹⁰, AJSM 2015

Radiographic Measurements

- Structures of interest were marked with 2-mm stainless steel spheres embedded at the level of the cortical bone
- Standard lateral and mortise radiographs of each specimen were obtained using a fluoroscopic mini-C-arm.⁸
- A 25.4 mm diameter radiopaque stainless steel sphere was placed at the level of the ankle joint for image calibration.
- Images were then imported into a picture archiving and communications system for measurements.
- Measurements were made by two independent reviewers to assess measurement reliability and reproducibility via intraclass correlation coefficients (ICCs).
- Measurements demonstrated excellent agreement between observers and across trials (all interobserver and intraobserver ICCs ≥ 0.960).

AITFL Measurements

- Lateral view:
 - Tibial center (A_{T2}) was 9.6 ± 1.5 mm superior and posterior to the anterior tibial plafond.
 - Fibular center (A_{F2}) was 4.4 ± 1.7 mm superior and posterior to the anterior fibular tubercle.
- Mortise view:
 - Tibial center (A_{T2}) was 5.6 ± 2.4 mm lateral and superior to the lateral extent of the plafond (4.3 mm lateral, 3.3 mm superior)
 - Fibular center (A_{F2}) was 21.2 ± 2.1 mm superior and medial to the inferior tip of the lateral malleolus.



PITFL Measurements

- Lateral view:
 - The center of the superficial PITFL (P_{T2}) originated 7.4 ± 1.6 mm superior to the posterior plafond and inserted (P_{F2}) 22.0 ± 2.3 mm superior and posterior to the inferior tip of the lateral malleolus.
 - The deep PITFL (P_{TD}) originated 3.2 ± 1.5 mm superior to the posterior plafond and inserted (P_{FD}) 15.4 ± 3.4 mm superior and posterior to the inferior tip of the lateral malleolus.
- Mortise View:
 - Superficial PITFL centers were (P_{T2}) 2.7 ± 1.7 mm medial and superior to the lateral plafond and (P_{F2}) 21.5 ± 3.2 mm medial and superior to inferior tip of the lateral malleolus.



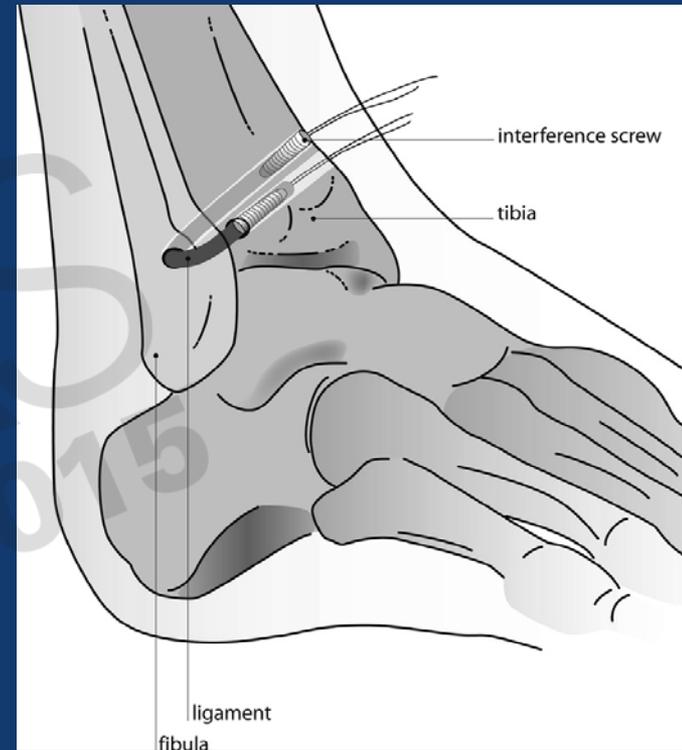
ITFL and Articular Cartilage Measurements

- Lateral View:
 - The proximal (I_{T1}) and distal (I_{T2}) aspects of the ITFL tibial attachment 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 tibial cartilage facet (CZ_T) of the tibiofibular contact area was 8.4 ± 2.1 mm posterior and superior to the anterior plafond.
- Mortise View:
 - The ITFL proximal (I_{T1}) and distal (I_{T2}) tibial margins were 45.0 ± 9.9 mm and 11.1 ± 3.5 mm proximal to the tibial plafond, respectively.



Clinical and Surgical Applications

- Radiographic measurements recommend screws or suture-button fixation devices be placed at least 12.4 mm and no more than 45.9 mm proximal to the central plafond on lateral projections to land within the footprint of the ITFL fibers and to ensure the safety of the synovial recess and articular surfaces.
- Anatomic and non-anatomic repair and reconstruction techniques have been described in the literature to address chronic instability.^{3,6,7,9,11}
 - Established radiographic guidelines will help guide intraoperative placement of guidepins, reconstruction tunnels, or suture-anchors.



Combined AITFL and ITFL reconstruction using a free semitendinosus autograft. Morris et al⁹, FAI 2009

Conclusions

- Radiographic guidelines for identification of the ankle syndesmotic ligaments and syndesmosis-related cartilage surfaces were established and demonstrated excellent agreement among reviewers and across trials.
- In conjunction with current anatomical data, these radiographic guidelines will augment current clinical radiographic diagnostic techniques, improve preoperative planning, assist with intraoperative identification of native anatomy, and facilitate objective postoperative assessment of anatomic-based reduction, repair, and reconstruction techniques.

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