Three-dimensional Analysis of the Talocrural Joint Axis: Relation to the Talar Articular Surface
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Introduction/Purpose: The total ankle replacement (TAR) is increasingly used in cases of severe ankle arthritis. Although the knowledge about joint kinematics is crucial for designing and positioning of TAR there is no consensus about the talocrural joint axis.
The aim of the present study was the determination of the kinematic rotational axis of the talocrural joint as an orientation for prosthesis positioning.

Methods: We analyzed 96 CT-scans of full cadaver caucasian legs. With the software Mimic, 3-Matic (both Materialize) and GOM inspect we generated three-dimensional reconstruction models of the talus and a best fitting cone orientated to the talar articular surface. The kinematic rotational axis was defined to be the axis of this cone.

Results: The determination of the kinematic rotational axis showed a high inter- and intrarater reliability. The kinematic rotational axis of the talocrural joint is orientated from lateral-distal to medial-proximal (84.9° ± 8.5 compared to mechanical tibial axis in frontal plane), from dorsal-proximal to anterior-distal (93.1° ± 42.3 compared to mechanical tibial axis in sagittal plane) and from dorsal-lateral to anterior-medial (169.0° ± 6.7 compared to mechanical tibial axis in axial plane). A high standard deviation especially in the sagittal plane was noteworthy.

Conclusion: With the present study we present a new reproducible single-axis model of the talocrural joint. Our data showed relevant interindividual variations. The consideration of these variations might support the development of patient-specific TAR implantation techniques.

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