computed tomography (CT) and a 3D-digitizer and to evaluate the relationship between cartilage thickness and the underlying subchondral bone plate density.

**Methods:** Sixteen tali and 16 calcanei from 8 cadavers (7 women, 1 man; mean ages 89 years) were scanned with 3D-CT (SOMATOM Spirit, Siemens, Erlangen, Germany) to create bone surface models, and with a contact-type 3D-digitizer (Cyclone, Renishaw, New Mills, UK) to make cartilage surface models. These two surface models were then merged using surface registration method. Articular cartilage thickness was evaluated as the distance between the 2 models, and the distribution was mapped. The intra- and inter-articular comparisons were performed with generalized estimating equations (GEE) followed by a post hoc Bonferroni multiple comparison test. The anatomic cartilage thickness of 5 tali and 5 calcanei was compared with the distance between the cartilage and bone surface models to calculate optimum threshold for extracting the subchondral bone plate from CT images. When using the optimum threshold for 5 tali and 5 calcanei, the mean measurement errors were calculated with GEE. Canonical correlation analysis was performed to determine the strength of association between subchondral bone plate density and the overlying anatomic cartilage thickness in the talocrural and talar-subtalar joint. Statistical significance was accepted for p values of <0.05.

**Results:** Mean cartilage thickness was 0.82±0.12 mm in the talocrural joint, 0.98±0.16 mm in the talar-subtalar joint, and 0.75±0.12 mm in the calcaneal-subtalar joint. The subarticular articular cartilage of the talus tended to be the thickest cartilage of the three joints. In the talocrural joint, the anterior region was the thinnest, and increasing cartilage thickness was seen toward the posterior. In the subtalar joint of the talus, the central region was the thickest while in that of the calcaneus, the cartilage thickness was more uniform. The optimum threshold for the talocrural, talar-subtalar, and calcaneal-subtalar joints were 439 Hounsfield units (HU), 532 HU, and 480 HU, respectively. Mean measurement errors were 0.059±0.066 mm, 0.038±0.040 mm, and 0.018±0.065 mm in the talocrural, talar-subtalar, and calcaneal-subtalar joints, respectively. The canonical correlation coefficient was 0.995 (p<0.001).

**Conclusions:** The present study determined the 3D distribution of articular cartilage thickness in the talocrural joint of the talus, the posterior subtalar joint of the talus, and that of the calcaneus in the elderly cadavers, and also showed the statistically significant correlation between subchondral bone plate density and the overlying cartilage thickness. These findings on the relationship between subchondral bone plate density and the overlying cartilage thickness in the elderly specimens may lead deeper insight into the coupling of cartilage morphology and joint loading, which will assist clinicians in obtaining a better understanding of the ankle and subtalar joint and some of their disorders. Besides, accurate knowledge of the 3D cartilage thickness distribution representing the underlying subchondral bone density can help to understand the delicate structures of subchondral bone and to optimize the prosthetic implant design which warrants the resistance to weight-bearing in the ankle.

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THREE-DIMENSIONAL DISTRIBUTION OF ARTICULAR CARTILAGE THICKNESS IN THE ELDERLY TALUS AND CALCANEUS ANALYSING THE RELATIONSHIP BETWEEN SUBCHONDRAL BONE PLATE DENSITY AND THE OVERLYING CARTILAGE THICKNESS


**Purpose:** In human locomotion, the ankle and subtalar joint have an important role in the complex biomechanics of the hindfoot; however, there is little information regarding the three-dimensional (3D) distribution of cartilage thickness in elderly ankle or subtalar joints. The purpose of the present study was to unveil 3D distribution of talocrural and posterior subtalar articular cartilage thickness in the elderly cadavers using 3D axial radiography of the distal femur, and computed tomography (CT) and a 3D-digitizer and to evaluate the relationship between cartilage thickness and the underlying subchondral bone plate density.

**Methods:** Sixteen tali and 16 calcanei from 8 cadavers (7 women, 1 man; mean ages 89 years) were scanned with 3D-CT (SOMATOM Spirit, Siemens, Erlangen, Germany) to create bone surface models, and with a contact-type 3D-digitizer (Cyclone, Renishaw, New Mills, UK) to make cartilage surface models. These two surface models were then merged using surface registration method. Articular cartilage thickness was evaluated as the distance between the 2 models, and the distribution was mapped. The intra- and inter-articular comparisons were performed with generalized estimating equations (GEE) followed by a post hoc Bonferroni multiple comparison test. The anatomic cartilage thickness of 5 tali and 5 calcanei was compared with the distance between the cartilage and bone surface models to calculate optimum threshold for extracting the subchondral bone plate from CT images. When using the optimum threshold for 5 tali and 5 calcanei, the mean measurement errors were calculated with GEE. Canonical correlation analysis was performed to determine the strength of association between subchondral bone plate density and the overlying anatomic cartilage thickness in the talocrural and talar-subtalar joint. Statistical significance was accepted for p values of <0.05.

**Results:** Mean cartilage thickness was 0.82±0.12 mm in the talocrural joint, 0.98±0.16 mm in the talar-subtalar joint, and 0.75±0.12 mm in the calcaneal-subtalar joint. The subarticular articular cartilage of the talus tended to be the thickest cartilage of the three joints. In the talocrural joint, the anterior region was the thinnest, and increasing cartilage thickness was seen toward the posterior. In the subtalar joint of the talus, the central region was the thickest while in that of the calcaneus, the cartilage thickness was more uniform. The optimum threshold for the talocrural, talar-subtalar, and calcaneal-subtalar joints were 439 Hounsfield units (HU), 532 HU, and 480 HU, respectively. Mean measurement errors were 0.059±0.066 mm, 0.038±0.040 mm, and 0.018±0.065 mm in the talocrural, talar-subtalar, and calcaneal-subtalar joints, respectively. The canonical correlation coefficient was 0.995 (p<0.001).

**Conclusions:** The present study determined the 3D distribution of articular cartilage thickness in the talocrural joint of the talus, the posterior subtalar joint of the talus, and that of the calcaneus in the elderly cadavers, and also showed the statistically significant correlation between subchondral bone plate density and the overlying cartilage thickness. These findings on the relationship between subchondral bone plate density and the overlying cartilage thickness in the elderly specimens may lead deeper insight into the coupling of cartilage morphology and joint loading, which will assist clinicians in obtaining a better understanding of the ankle and subtalar joint and some of their disorders. Besides, accurate knowledge of the 3D cartilage thickness distribution representing the underlying subchondral bone density can help to understand the delicate structures of subchondral bone and to optimize the prosthetic implant design which warrants the resistance to weight-bearing in the ankle.

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DOES RADIOLOGICAL SEVERITY OF KNEE OSTEOARTHRITIS INFLUENCE OUTCOMES OF AXIAL RADIOGRAPHY OF THE DISTAL FEMUR?

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**Purpose:** Rotational alignment of the femoral component for total knee arthroplasty (TKA) is an important factor to form the proper flexion gap and balance. Axial radiography of the distal femur is used for measuring the twist angle (i.e. the angle between the clinical epicondylar axis and the posterior condylar axis), and assessing rotational alignment in TKA. The aim of the study was to compare the twist angle of axial radiography with that of computed tomography and to investigate that the radiological severity of osteoarthritis in influence results of axial radiography.

**Methods:** Axial radiography of the distal femur and computed tomography images were obtained of 105 knees in 54 patients (4 males, 50 females) having total knee or hip arthroplasty between December 2010 and October 2011. Based on the severity of knee osteoarthritis by anteroposterior radiographs of the lower extremity in a standing, weight-bearing position,