Morphometric Evaluation of Talo-Malleolar Incongruity in Varus-Type Ankle Osteoarthritis using 3D-CT Images

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My disclosure is in the Final AOFAS Mobile App.

I have no potential conflicts with this presentation.
Joint deformity in varus–type ankle osteoarthritis (OA) is typically recognized as medial shift of the talus in the medially inclined ankle mortise. However, given the well-congruent geometry of the normal talocrural joint, such a simple deformity may not occur unless involving three-dimensional articular incongruity in the whole joint.
The purpose of this study was to characterize incongruity of the talo-malleolar (lateral gutter) articulations in varus-type ankle OA.
Clinical CT images in moderate to advanced varus-type ankle OA (18 joints in 16 patients), acquired at a neutral non-weight bearing (mimicked standing) position, were subjected to 3-D morphometric measurement, using a DICOM viewer. (AquariusNET®, TeraRecon, Foster City, CA, USA).
For each ankle, two anatomical reference coordinate systems, one for the tibiofibular plafond, the other for the talar dome, were independently established using respective bony landmarks. (Note: Due to talar subluxation associated with OA deformity, these two coordinate systems were typically in a skew relationship.)

[tibiofibular plafond] [talar dome]
Congruity measurement in the coronal plane was executed by determining the inferior opening angle between the medial and lateral (M/L) malleolar surfaces, as well as that between the M/L talar walls, at the mid-coronal section for each.

For transverse congruity, the anterior opening angles for the malleolus and talar walls were similarly determined.
To establish baseline (normative) information, CT images from non-OA subjects were also similarly measured.

Differences in these angular data were statistically tested using a paired or unpaired t-test, with the significant level of p set at 0.05.
In the transverse plane, the anterior opening angle in the OA ankles was significantly larger for the malleolar side than for the talar side, and the talomalleolar discrepancy (7.7 ± 3.5 degrees) was significantly larger than that for the control ankles (0.8 ± 0.6). (P<0.001)
The inferior (coronal) opening angle in the OA ankles was also significantly larger for the malleolar side than for the talar side, and the talomalleolar discrepancy (14.2 ± 6.3) was significantly larger than that for the control ankles (1.4 ± 0.2). (p < 0.001)
The documented data indicate that varus deformity in ankle OA often involves talomalleolar incongruity, being characterized by widening of the crural mortise. This characteristic, presumably due medial malleolar deformity, may be associated with well-recognized anterior talar subluxation in advanced ankle OA.
Clinically, pre-operative evaluation of talomalleolar incongruity should provide helpful information when planning surgical correction of the talocrural congruity by distal tibial osteotomy, and when considering total ankle replacement, particularly using a mobile bearing implant without medio-lateral restraint. The normal talocrural joint is characterized by the cylindrical superior-inferior articulation, being supported by the well-congruent lateral gutter (talo-malleolar) articulations.