Potential Contribution of Abnormal Talar Dome Lateral-Wall Geometry to Development of Ankle Osteoarthritis

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Introduction/Purpose: Abnormal tibial plafond geometry, varus deformity and insufficient talar anterior coverage in particular, is well recognized as congenital factors predisposing ankles to osteoarthritis (OA), both primarily and after lateral ligament injury. Presumably, abnormal geometry of the gutter articulations (for the medial and lateral malleoli) also increases a risk of ankle OA, though this concept has not been well addressed to date. The talar side-wall surfaces, which appears to be less affected by degenerative deformity in ankle OA, may leave the congenital characteristics of the gutter articulation geometry. To identify a type of ankles at higher risk of OA development in this context, the present study explored characteristics of the talar side-wall geometry in OA ankles.

Methods: Clinical CT images, from 21 moderate to advanced OA ankles without critical preceding pathologies and from 29 age-matched non-OA ankles, were subjected to 3-D morphometric evaluation of the talar dome side-wall geometry. Using a DICOM viewer (AquariusNET®, TeraRecon, Foster City, CA, USA), a local coordinate system for each ankle was manually established using talar landmarks. Then, on a transverse section at 3-5 mm distal to the superior aspect of the talar trochlea, the angle between the medial and lateral side-wall tangential lines (regressed from five cortical surface reference points for each) was measured as the “anterior opening angle.” Similarly, the “inferior opening angle” was measured on a mid-coronal section. Differences between groups were statistically tested using a t-test, with the significant level of p set at 0.05.

Results: The anterior opening angle was significantly larger (p = 0.006) in the OA ankles (mean +/- SD: 11.9 +/- 6.0 degrees) than in the non-OA ankles (8.5 +/- 3.2). The inferior opening angle was also significantly larger (p = 0.007) in the OA ankles (30.7 +/- 11.1) than in the non-OA ankles (25.2 +/- 5.5). Defining the range of mean +/- 2SD as “normal” (Figure), 13 out of 21 (62%) OA ankles had both or either abnormally large anterior and/or inferior opening of the talar side-wall surfaces.
**Conclusion:** Anterior and inferior opening trapezoidal shapes are common characteristic of the talar dome geometry. It is also well recognized that the degrees of opening substantially vary across individuals. The present study documented frequent occurrence of excessive anterior and/or inferior opening in OA ankles. Assuming that these abnormalities are inherent characteristics rather than results of degeneration, excessive anterior and inferior openings of the talar dome side-walls could be pathogenetical factors that increase a risk of ankle OA. Clinically, when ankles with excessive anterior and/or inferior opening talar dome side-walls would have ligament insufficiency, surgical repair or reconstruction should be considered to minimize a risk of future OA development.