

The Morphology of the Navicular Bone and Its Talonavicular Articular Surface: A Comparison between Congenital Flatfeet and Normal Controls

Kenneth Pham, Munib Far, Rita Sorrentino, Mingjie Zhu, Wanjun Gu, Michael Boysen, Chengyi Sun, Mingzhu Zhang, Mark Myerson, Shuyuan Li

Foot and ankle deformity

Introduction: A combination of the geometry of the tarsal bones, ligaments, plantar aponeurosis, and muscle-tendon complexes contributes to the medial longitudinal arch structure. It was hypothesized in this study that there might be morphological abnormalities in the bone and joint surfaces of the navicular, the keystone of the medial longitudinal arch, in healthy controls and patients with symptomatic congenital flatfoot deformities.

Methods: Weightbearing CT scans of 8 controls and 8 symptomatic congenital flatfeet were used for 3D segmentation of the navicular bones using Mimics. The morphology of the bone was compared between the two groups using the methods described in Figures 1 and 2. The articular surface of the talonavicular joint was mapped and separated from the rest of the navicular using GeoMagic Studio 10. Each articular surface was oriented to a rectangular shape to measure the length and width and the depth calculated by Pythagorean theorem.

Results There was no statistically significant difference between the congenital flatfoot group and controls in the morphology of the navicular bone and metrics of the talonavicular articulation). (Figure 2, Table 1)

Conclusion In this pilot study with a small sample size, there was no significant difference observed in morphology of the navicular bone and its talonavicular articular surface between the congenital flatfoot group and the controls. Further study with a larger sample size and more detailed information of the articulation contours under investigation by our research group.