Flexible Adult Acquired Flatfoot Deformity: Comparison Between Weightbearing and Nonweightbearing Cone-Beam CT Examinations

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Introduction/Purpose: Adult acquired flatfoot deformity (AAFD) is a biomechanical derangement involving the three-dimensional (3D) midfoot and hindfoot osseous complex, which can be challenging to optimally characterize using conventional two-dimensional (2D) plain radiographs. Weightbearing (WB) Cone-Beam CT (CBCT) can better demonstrate the deformity of the 3D structures during WB. Therefore, we compared validated AAFD measurements between non-weightbearing (NWB) and WB CBCT images.

Methods: In this prospective, IRB approved study, 20 patients were included, 12 males and 8 females, mean age of 54.21 (20-88) years, with clinical diagnosis of flexible AAFD. Subjects were scanned with standing (WB) and seated (NWB) CBCTs. WB and NWB CBCT images were assessed with traditional flatfoot measurements obtained at sagittal, coronal, and axial planes using predefined anatomical landmarks, by two independent observers. Interobserver reliability was calculated using Pearson correlation.

Results: The measurements in patients with AAFD differed significantly between WB and NWB CBCT images. Specifically, WB images showed, when compared to NWB, decreased forefoot arch angle (mean difference: 9.91°, p < 0.0001), increased talus-first metatarsal angle (10.59°, p < 0.0001), increased navicular-medial cuneiform angle (13.89°, p < 0.0001), decreased navicular-floor (coronal 14.05mm/sagittal 14.91mm, p < 0.0001) and navicular-skin distances (coronal 5.87mm/sagittal 8.25mm, p < 0.0001), decreased medial cuneiform-floor (coronal 10.79mm/sagittal 11.07mm, p < 0.0001) and medial cuneiform-skin distances (coronal 4.45mm/sagittal 5.78mm, p < 0.0001), and decreased cuboid-floor (5.78mm, p < 0.0001) and cuboid-skin distances in the sagittal plane (4.60mm, p < 0.0001). Interobserver reliability was calculated using Pearson correlation.
**Conclusion:** Traditional adult acquired flatfoot deformity radiographic measurements are obtainable using high resolution 3D WB CBCT imaging, and can help characterize the biomechanical derangements during weightbearing in subjects with flexible AAFD.