Comparison between Weight Bearing Radiographs and Weight Bearing ConeBeam CT Examinations in the Assessment of Adult Acquired Flatfoot Deformity

Cesar de Cesar Netto, MD, PhD, Lew Schon, MD, Apisan Chinanuvathana, MD, Francois Lintz, MD, Lucas Furtado Da Fonseca, MD

Category: Hindfoot

Keywords: Flatfoot Deformity; Adult Acquired Flatfoot Deformity; Cone Beam CT; Weight Bearing CT

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

Methods: In this prospective, IRB approved and HIPAA compliant study, 20 patients (20 feet, 15 right and 5 left) with clinical diagnosis of flexible AAFD were included, 12 males and 8 females, with a mean age of 52.2 years (range, 20 to 88 years of age), and average BMI of 30.35 kg/m2 (range, 19.00 to 46.09 kg/m2). Involved feet underwent standing (WB) anteroposterior (AP) and lateral radiographs, and were also scanned by WB CBCTs. Both imaging modalities were assessed with traditional AAFD measurements obtained at sagittal (lateral view on radiograph) and axial (anteroposterior view on radiograph) planes using predefined anatomical landmarks, by two independent and blinded foot and ankle fellowship-trained observers. Intra- and Inter-observer reliabilities for both imaging modalities were calculated using Pearson correlation. WB radiograph and WB CBCT measurements were compared by T-Test of the means. P-values < 0.05 were considered significant.

Results: There was good to excellent intra and inter-observer agreements for most of the measurements on both radiographs and WB CBCT images, with slightly better results favoring WBCT measurements. When comparing WB radiographs and WB CBCT images, we found significant differences in the mean values for some of the measurements, including: talus-first metatarsal angle in the sagittal plane (11.34° x 21.73°, p<0.0001), navicular-medial cuneiform angle (13.19° x 7.63°, p<0.0004), medial cuneiform to floor distance (6.70mm x 5.50mm, p<0.0003) and navicular to floor distance (31.34mm x 23.22mm, p<0.0001). No significant differences were found when measuring: talus-first metatarsal angle in the axial plane, talar uncoverage angle, cuboid to floor distance and calcaneal inclination angle.

Conclusion: Traditional adult acquired flatfoot deformity radiographic measurements are obtainable using high resolution 3D WB CBCT imaging. Measurements performed on WB CBCT have similar intra-observer and overall higher inter-observer reliability when compared to WB radiographs. The statistically significant differences found in some of the measurements, when comparing both imaging techniques, might be related to a better characterization of the three-dimensional deformity on WB CBCT images.