The Use of Weight-Bearing CT Scan in the Evaluation of Hindfoot Alignment

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Introduction/Purpose: Multiple techniques have been described in determining the hindfoot alignment radiographically. While these studies have traditionally showed good reliability, the 2-dimensional nature of radiographs fails to consider the contribution of the remainder of the foot on the overall alignment. A new technique has been recently published in which the hindfoot alignment is calculated using the Ground Reaction Force Calcaneal Offset off radiographs. This technique accounts for the individual forefoot contributions on overall alignment, however is still limited by the 2-dimensional nature of plain radiographs. The purpose of this study is to compare two accepted radiographic measurements, the hindfoot moment arm (HMA) and the hindfoot alignment angle (HAA), with a novel technique determining the ground reaction force calcaneal offset (GRF-CT) using 3-dimensional weight bearing CT Scans.

Methods: Retrospective chart review was performed over a two-year period from 2014-2016 to identify patients with weight bearing hindfoot alignment radiographs and PedCat (Curvebeam, Warrington, USA) 3-D weight bearing CT scans. The HMA, HAA, and GRF-CT were measured by three different investigators. Each of these measurements were calculated two times on separate occasions by each investigator to determine the intra- and inter-observer reliability with each of these techniques.

Results: One-hundred and four patients underwent weight bearing hindfoot alignment radiographs and 3-dimensional weight bearing CT scans. There were 33 patients with varus deformities and 71 patients with valgus deformities. There was excellent intra- and inter-observer reliability with all three measurement techniques, however the GRF-CT showed the best intra- and inter-observer reliability with the lowest standard deviation.

Conclusion: The GRF-CT technique is more reliable than traditional radiograph techniques for measuring the hindfoot alignment. While the intra- and inter-observer reliability is good for all three techniques, the GRF-CT technique resulted in the best intra- and inter-observer reliability with the lowest standard deviation. This technique provides the most accurate hindfoot alignment as it takes into account the effect of forefoot on overall alignment, preventing inaccuracies of projection and foot orientation in contrast to traditional radiographic techniques, which may be valuable in surgical decision making.

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