A COMPARISON OF DIFFERENT TECHNIQUES FOR MEASURING THE HINDFOOT MOMENT ARM ON WEIGHT-BEARING CT: AN INTER AND INTRA-OBSERVER RELIABILITY STUDY

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Purpose: The Hindfoot Moment Arm (HMA) has been used to evaluate the hindfoot alignment with the. Saltzman weightbearing XRay images[1], and was recently introduced into the field of weightbearing CT (WBCT) by Saltzman et al[2]. The authors of this study have noticed that when using the Saltzman WBCT HMA technique, it is very difficult to determine the specific "one" image in coronal plane scans with the widest tibial diaphyseal to draw the long axis of the tibia. The purpose of this study was to introduce a modified technique of measuring HMA in WBCT scans and compare the inter and intra-observer reliabilities between the modified and the Saltzman WBCT HMA techniques.

Methods: WBCT scans of ten healthy limbs were loaded in CubeVue software. The foot was aligned in the correct orientation in the transverse plane based on the 2nd ray and the heel and the HMA was evaluated using the modified and Saltzman techniques. Using the modified technique, the sagittal plane thickness of one scan cut was increased to include the full width and length of the tibia and the axis of the distal tibia was identified by connecting two circles tangential to both cortices of the tibia. The weightbearing point of the calcaneus was located and the HMA was evaluated by measuring the perpendicular distance of the calcaneus weightbearing point to the axis of the distal tibia with varus a negative and valgus alignment a positive value. Intraclass correlation coefficient (ICC) model was used to assess the intra- and interobserver reliability of the two HMA techniques in SAS 9.4.

Results: Both techniques had excellent intra- and interobserver reliability (Saltzman WBCT HMA intra-observer ICC=0.97, Saltzman WBCT HMA inter-observer ICC=0.94, the modified WBCT HMA intra-observer ICC=0.99, the modified WBCT HMA inter-observer ICC=0.91) (Table 1).

Conclusions: The modified WBCT HMA was equivalent to the Saltzman technique in both inter and intra-observer reliabilities. The authors found that the modified technique was easier and less time consuming to perform in identifying the axis of the tibia since the modified technique uses multiple cuts to restore the full thickness of tibia, which not only reduces potential error, but also saves time during measurements. Compared with a relatively shorter tibia in one cut, the reconstructed tibia provides a longer and clearer shaft to work with, which allows both proximal and distal circles to be drawn with higher precision (Figure 1).

References:

1. Saltzman, C. L., & El-Khoury, G. Y. (1995). The hindfoot alignment view. *Foot & Ankle International*, *16*(9), 572-576.
2. Arena, C. B., Sripanich, Y., Leake, R., Saltzman, C. L., & Barg, A. (2021). Assessment of hindfoot alignment comparing weightbearing radiography to weightbearing computed tomography. *Foot & Ankle International*, *42*(11), 1482-1490

Tables & Figures:

	ICC	SD	95% CI	
			Lower	Upper
Overall				
Interobserver	0.92	0.04	0.81	0.97
Intraobserver	0.98	0.01	0.95	0.99
Saltzman				
Interobserver	0.94	0.05	0.80	0.99
Intraobserver	0.97	0.03	0.88	0.99
Modified				
Interobserver	0.91	0.08	0.68	0.98
Intraobserver	0.99	0.01	0.96	1.00

Table 1. Inter- and intra-observer reliabilities of the two WBCT HMA measurements

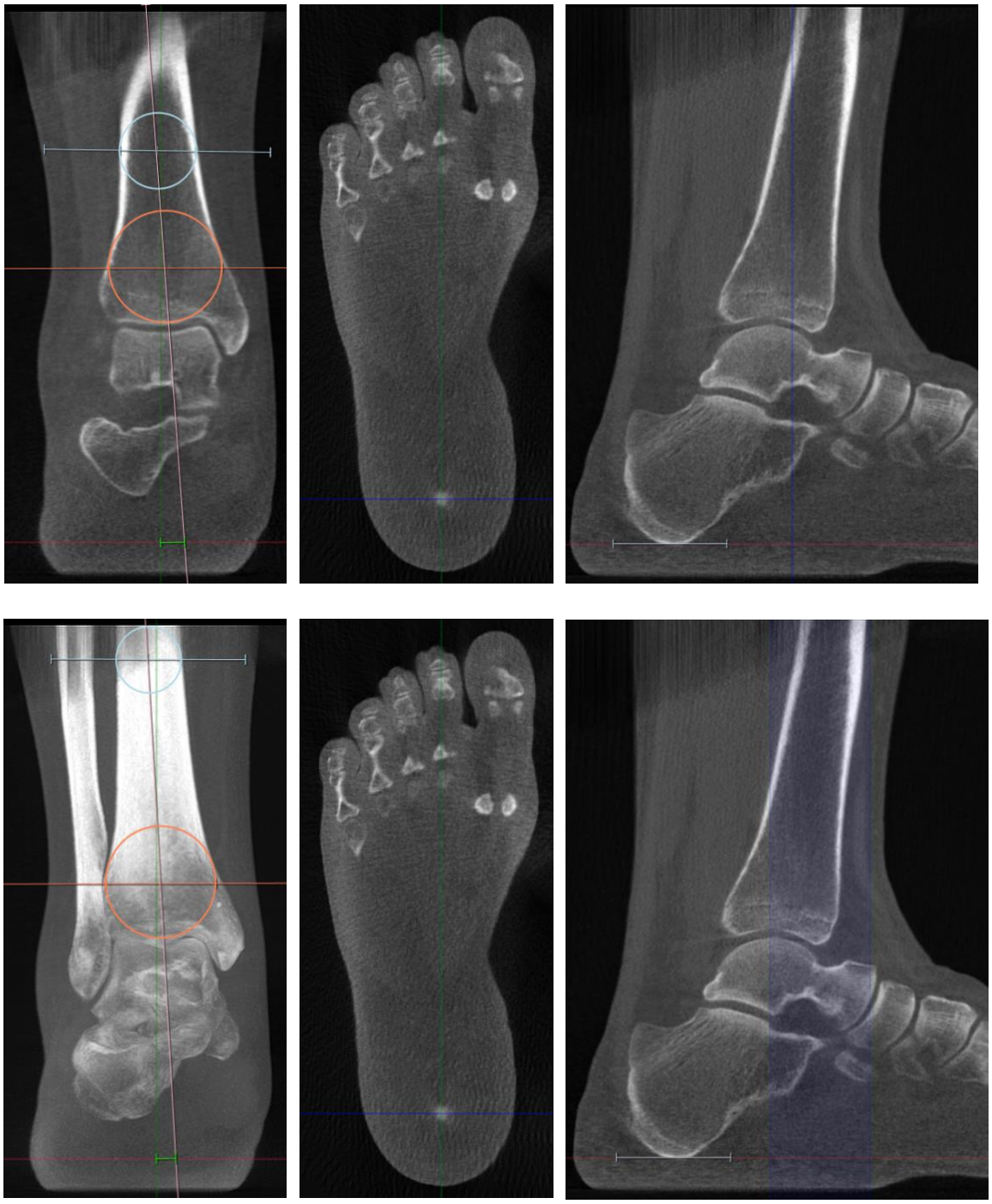

Figure 1. In the Saltzman (Above) technique, the tibia axis is determined only in one specific coronal cut, which has "the widest tibial diaphyseal distance at the most proximal edge of the image"[1], while in the modified (Below) technique, the tibia axis is drew on a reconstructed coronal view involving the full length and width of the tibia