

## THE RELIABILITY AND REPRODUCIBILITY OF FOOT MEASUREMENTS USING A MIRRORED FOOT PHOTO BOX COMPARED TO CALIPER MEASUREMENTS

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### INTRODUCTION

It is widely believed that the height of the medial longitudinal arch (MLA) is a predisposing factor to various types of lower extremity injuries. Discrepancy exists in the literature as to which foot morphologies predispose individuals to certain injury patterns, and whether MLA height plays a role in injury prevention. The controversy surrounding the importance of MLA height and foot morphology could result from inconsistencies in these measurements in the literature. The purpose of this study is to determine the reliability of intertester, intratester, and foot photo box (FPB) versus caliper measurements

### METHODS

This study was comprised of 30 subjects (15 male, 15 female) between the ages of 18 and 30 years old. Both feet were tested (n=60) in a 90% weight bearing (WB) stance. First, each foot was palpated and marked for the following bony landmarks in a 90% WB posture: navicular, calcaneus, head of the first metatarsal, and shaft of the first metatarsal. Using a caliper and goniometer, foot length (FL), truncated foot length (TFL), navicular height (NH), height of the dorsum of the foot at 50% of FL (DH), and the angle of the first ray (FRA) were measured. A digital photograph was taken of both feet individually in a 90% weight bearing stance. The mirrored FPB allowed visualization of the posterior, anterior, medial, and plantar aspects of the foot from one picture.

Once the first rater completed measuring and photographing both feet, the marks were erased and the second rater repeated the protocol. The bony landmarks were then digitized and FL, TFL, NH and FRA were measured from the digital photos using the SigmaScan Pro software (Richmond, CA).

The subjects were then asked to return for a second day of testing approximately one week later. Intertester and between measurement condition (FPB versus calipers) reliability were determined using the intraclass correlation coefficient (ICC) (2,k) model and intratester reliability was determined using the ICC (2,1) model.

### RESULTS AND DISCUSSION

Preliminary results for the mean, intratester, and intertester reliability for the foot photographs, as well as the FPB to caliper comparisons for the right foot of 15 subjects (7 male, 8 female) are shown in Table 1. While the intratester reliability was slightly higher using caliper measurements, the intertester reliability was higher using the FPB.

Comparing the FPB to the caliper measurements shows good reliability (0.993-0.858), indicating that the FPB could be used

in place of caliper measurements with similar reliability. Caliper measurements have already been shown to be valid to radiographic measurements [3], the FPB measurements should also correlate well with radiographic measurements. The FPB values reported are similar to those in the literature from radiographic measurements[1]. The highest between condition reliability was NH/FL and NH/TFL.[3]

	Mean	SD	Intratester	Intertester	Conditions
FL	250.26	21	0.9909	0.9945	0.993
TFL	186.46	14.92	0.9773	0.9774	0.9922
NH	36.8	5.31	0.8644	0.8405	0.9451
DH	60.1	5.76	0.8862	0.9203	0.8897
FRA	24.2	4.39	0.4911	0.5964	0.9197
NH/FL	0.1475	0.0235	0.8885	0.882	0.9282
NH/TFL	0.1984	0.0317	0.8941	0.9011	0.9176
DH/FL	0.2401	0.0172	0.8499	0.8366	0.8601
DH/TFL	0.3232	0.0223	0.7757	0.7448	0.8578

Table 1: Foot Photograph Measurements and ICC values.

The FPB offers several advantages over the caliper measurements; including, speed of measurement, visualization of rearfoot angle, measurement of various footprint indices, and the ability to have the pictures assessed by foot and ankle specialists for a clinical assessment of foot morphology. From the plantar view, various footprint indices[2] were measured, with intratester and intertester ICC values ranging from 0.975 to 0.923 and 0.969 to 0.928, respectively. The average photo took  $51.3 \pm 19.6$  seconds per foot while the caliper measurements took more than 4 times as long with an average of  $227.4 \pm 68.9$  seconds.

### CONCLUSIONS

The mirrored FPB is at least as reliable as caliper measurements, and offers better intertester reliability. The speed of testing is faster with the photograph, and also allows calculation of footprint indices. Previously, caliper measurements have been shown to correlate well with radiographic measurements. Our results are similar to results from previous studies which reported caliper and radiographic measurements. [1, 3] Future studies will determine the validity of the FPB to radiographic measurements.

### REFERENCES

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