

## **Foot Pressure and Radiographic Measurements in the Treated Clubfoot**

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### **Introduction**

Clubfoot is a common pediatric orthopedic deformity. Previous studies have looked at radiographic measurements as a means of assessing treatment outcome in the clubfoot population. Although, dynamic foot pressure measures are used to assess outcomes in other foot deformities, to date, no study has investigated the relationship of radiographic measurements to angles defined on dynamic footprints in the treated clubfoot deformity. This retrospective study investigated radiographic measures, foot pressure measures and the relationship between the radiographic and foot pressure measures in the *treated* clubfoot and the uninvolved contralateral foot of subjects with unilateral clubfeet.

### **Statement of Clinical Significance**

This study indicates that foot pressure measurements and radiographic measures are able to detect differences between treated clubfeet and uninvolved feet. Dynamic foot pressure measurements are related to traditional radiographic measure based on the correlations found in this study. Therefore, dynamic foot pressure measurements can be used to measure outcome of treatment without radiographs.

### **Methodology**

Data from eighteen subjects, with the diagnosis of unilateral clubfoot, that had radiographs and foot pressure assessments of both feet on the same date were retrospectively reviewed. The mean age of the subjects at evaluation was 7.5 years (range 2-15 years). Talocalcaneal angle (lateral and AP), Calcaneus-2<sup>nd</sup> metatarsal angle, Calcaneus-1<sup>st</sup> metatarsal angle radiographic measurements were taken using the methodology described by Thompson<sup>1</sup> et al. Foot pressure data were collected using the Novel EMED platform system. Three trials were collected bilaterally with the subject walking at his/her self-selected speed. Data were analyzed using the Novel Geometry and Lateral Area Indices programs. The COPI (Center of Pressure Index) and LAMI (Lateral-Medial Area Index) were calculated from the Lateral area indices program and the long plantar angle, medial plantar angle, heel angle, subarch angle, and coefficient of spreading were calculated using the Geometry program.

Paired t-tests were used to assess the differences between the treated clubfoot and the uninvolved foot. Pearson r correlations were used to assess the correlation between the radiographic measures and the foot pressure measures. Correlations were assessed independently for the uninvolved foot and the treated clubfoot. Fishers r to z transformation was used to test for statistical significance of the correlations.

### **Results**

Significant differences between the treated clubfoot and uninvolved foot in the radiographic measures of AP talocalcaneal angle (p=0.0089), lateral talocalcaneal angle (p=0.0027) and calcaneus-2<sup>nd</sup> met angle (p=0.0026) were found. For the foot pressure measures, significant

differences ( $p \leq 0.05$ ) were found for the following measures: subarch angle, foot progression angle, LAMAI (MPP & MVP), and COPI (MPP & MVP). Correlations between the radiographic and foot pressure measures that were statistically significant at  $p \leq 0.05$  are reported in Tables 1A (treated clubfoot) and 1B (uninvolved side).

| <b>TREATED CLUBFOOT</b>  | Talocalcaneal angle (lateral) | Calcaneus-2nd Met angle | Calcaneal-1st Met angle |
|--------------------------|-------------------------------|-------------------------|-------------------------|
| Long Plantar angle       |                               | 0.510                   |                         |
| Medial Plantar angle     |                               | 0.490                   |                         |
| Subarch Angle            |                               | -0.491                  | 0.627                   |
| Coefficient of Spreading | -0.858                        |                         |                         |
| LAMAI                    |                               | 0.623                   |                         |
| COPI                     |                               | 0.601                   |                         |

Table 1A-Significant Correlations for the Treated Clubfoot

| <b>UNINVOLVED SIDE</b> | Talocalcaneal angle (A-P) | Calcaneal-1st Met angle |
|------------------------|---------------------------|-------------------------|
| Medial Plantar angle   | 0.480                     |                         |
| Heel Angle             | -0.583                    | -0.647                  |
| Subarch Angle          | 0.729                     | 0.736                   |
| LAMAI                  |                           | -0.520                  |
| COPI                   |                           | -0.517                  |

Table 1B-Significant Correlations for the Uninvolved Side

### **Discussion:**

If successful clubfoot correction has been achieved, the treated clubfoot should be near “normal”. While all of the feet had good clinical outcomes, some differences in radiographic and foot pressure measurements were still noted in our population between the treated clubfoot and uninvolved side.

Based on the correlations reported, this study gives preliminary indication that foot pressure measurements correlate to radiographic measures in the treated clubfoot and uninvolved foot. If the same information can be obtained utilizing a foot pressure assessment as an x-ray, there would be a decreased need for x-rays and decreased radiation exposure for children with clubfeet. These findings could lead to a change in clinical practice.

Future work in this area hopes to establish a means to utilize the foot pressure measurements to assess treatment outcomes, degree of correction and progressive recurrence in the clubfoot.

### **References:**

1. Thompson, G.H., et al (1982). *J.Bone and Joint Surgery*, 64-A, NO. 5, 652-665