

# **PREDICTORS OF DEFORMITY IN PATIENTS WITH PROGRESSIVE COLLAPSING FOOT DEFORMITY AND VALGUS OF THE ANKLE**

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## **INTRODUCTION:**

Markers used for diagnosis and grading are well studied in patients with Progressive Collapsing Foot Deformity (PCFD). Middle facet subluxation (MFS) in weight-bearing computerized tomography (WBCT) has been established as an early indicator of peritalar subluxation (PTS). However, when the disease affects the ankle leading to a valgus talar tilt (Class E), structures distal to this topography may behave differently. The aim of this study is to assess and compare predictors of deformity in PCFD patients with and without valgus of the ankle. Our hypothesis is that PTS markers will have a different pattern in Class E patients, not presenting as precise indicators for evaluation and staging of PCFD in this scenario.

## **METHODS:**

In this IRB-approved retrospective case-control study we analyzed WBCT imaging of 21 consecutive patients with PCFD with valgus of the ankle and 64 controls (flexible PCFD without ankle involvement). MFS (defined by percentage of uncoverage), middle facet incongruence angle, middle cuneiform-to-floor distance, forefoot arch angle, talonavicular uncoverage angle, hindfoot moment arm (HMA), foot and ankle offset (FAO) and talar tilt angle (TTA) were measured and compared between groups using one-way ANOVA. A multivariate regression analysis was performed to evaluate which of the measurements influenced the alignment. A partition prediction model was constructed to assess how the variables contributed to the deformity. Statistical significance was instituted for p values under 0.05.

**RESULTS:** Higher mean HMA (20.78mm, 17.56-24.02 vs. 8.94mm, 7.09-10.79;  $p<0.0001$ ), FAO (14.89%, 12.51-17.26 vs. 6.32%, 4.96-7.68;  $p<0.00010$ ) and TTA ( $17.10^\circ$ , 14.75-19.46 vs.  $2.29^\circ$ , 0.94-3.65;  $p<0.0001$ ) were found in the ankle valgus group, as well as a lower mean MFS (38.45%, 34-42 vs 21.84% vs. 15-28;  $p<0.001$ ) when compared to the no ankle valgus group. An inverse relation between MFS and TTA was found, which was demonstrated by an increase in the talar tilt and decrease in middle facet uncoverage ( $r_s=0.40$ ;  $p<0.001$ ). FAO values were affected by MFS in the no ankle valgus group ( $R^2$ : 0.41;  $p<0.001$ ) but not in the ankle valgus group ( $R^2$ : 0.001;  $p=0.91$ ), which was influenced mainly by the TTA ( $R^2$ : 0.53;  $p<0.001$ ). Additionally, a FAO value higher than 12.14% was found to be a strong predictor (79%) of deformity at the ankle.

**DISCUSSION AND CONCLUSION:** Higher mean HMA (20.78mm, 17.56-24.02 vs. 8.94mm, 7.09-10.79;  $p<0.0001$ ), FAO (14.89%, 12.51-17.26 vs. 6.32%, 4.96-7.68;  $p<0.00010$ ) and TTA ( $17.10^\circ$ , 14.75-19.46 vs.  $2.29^\circ$ , 0.94-3.65;  $p<0.0001$ ) were found in the ankle valgus group, as well as a lower mean MFS (38.45%, 34-42 vs 21.84% vs. 15-28;  $p<0.001$ ) when compared to the no ankle valgus group. An inverse relation between MFS and TTA was found, which was demonstrated by an increase in the talar tilt and decrease in middle facet uncoverage ( $r_s=0.40$ ;  $p<0.001$ ). FAO values were affected by MFS in the no ankle valgus group ( $R^2$ : 0.41;  $p<0.001$ ) but not in the ankle valgus group ( $R^2$ : 0.001;  $p=0.91$ ), which was influenced mainly by the TTA ( $R^2$ : 0.53;  $p<0.001$ ). Additionally, a FAO value higher than 12.14% was found to be a strong predictor (79%) of deformity at the ankle.