A New Measure of Tibial Sesamoid Position in Hallux Valgus in Relation to the Coronal Rotation of the First Metatarsal in CT Scans

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Abstract

Background: We aimed to find a new radiographic measurement for evaluating first metatarsal pronation and sesamoid position in hallux valgus (HV) deformity.

Methods: Data from a clinical study of 19 control patients (19 feet) with no HV deformity were compared with preoperative data of 138 patients (166 feet) with HV deformities. Using a weightbearing plain radiograph in anteroposterior (AP) view, the intermetatarsal angles (IMAs) and the hallux valgus angles (HVAs) of the control and study groups were measured. Using a semi-weightbearing coronal computed tomography (CT) axial view, the $\alpha$ angle was measured in the control and study groups. In addition, the tibial sesamoid grades in plain radiograph tangential view and the CT axial view were measured. The tibial sesamoid position in an AP view was checked preoperatively. Based on these measurements, 4 types of HV deformities were defined.

Results: The mean values of the $\alpha$ angle in the control and HV deformity groups (control group $\mu = 13.8$ degrees, study group $\mu = 21.9$ degrees) was significantly different. Among 166 HV feet, 145 feet (87.3%) had an $\alpha$ angle of more than 15.8 degrees, which is the upper value of the 95% confidence interval of the control group, indicating the existence of abnormal first metatarsal pronation in HV deformity. Four types of HV deformities were defined based on their $\alpha$ angles and tibial sesamoid grades in CT axial view (CT 4 position). Among 25.9% (43/166) of the study group, abnormal first metatarsal pronation with an absence of sesamoid deviation from its articular facet was observed. The prominent characteristic of this group was that they had high grades in the AP 7 position ($\geq$5); however, in the CT 4 position, their grade was 0. This group was defined as the “pseudo-sesamoid subluxation” group.

Conclusions: Patients with HV deformities had a more pronated first metatarsal than the control group, with a greater $\alpha$ angle. Pseudo-subluxation of the sesamoids existed in 25.9% of our study group. From our results, we suggest that the use of the CT axial view in assessments of HV deformity may benefit surgeons when they make operative choices to correct these deformities. With regard to the pseudo-sesamoid subluxation group, the use of the distal soft tissue procedure is not surgically recommended.

Keywords: hallux valgus, first metatarsal pronation, sesamoid, CT axial view

TMC Summary

- Study Design: 3D CT study of 166 hallux valgus (bunion) and 19 control feet
- Findings:
  - 87.3% of the hallux valgus group had a frontal-plane rotational deformity
    - 25.9% with metatarsal rotation & no sesamoid subluxation
    - 61.4% with metatarsal rotation & some degree of sesamoid subluxation
  - The avg. metatarsal frontal-plane rotation was 21.9°
- Interpretation:
  - With over 87.3% of bunions demonstrating frontal-plane metatarsal rotation, this is a critical component that must be addressed for an anatomic correction of the deformity in all three anatomic planes
    - Frontal-plane rotation is a key indication for the LAPIPLASTY™ Procedure