Sesamoid Position in Hallux Valgus in Relation to the Coronal Rotation of the First Metatarsal

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KEYWORDS

• Hallux valgus • Sesamoid position • Metatarsal rotation

KEY POINTS

- Hallux valgus (HV) is not a simple two-dimensional deformity but is instead a three-dimensional deformity that is closely linked to sesamoid position and first metatarsal (MT) pronation.
- HV may or may not be accompanied by sesamoid subluxation and/or first MT head pronation.
- Each of these scenarios should be assessed using weighted computed tomography scan preoperatively, and the necessary corrections should be performed accordingly.

INTRODUCTION

The most important radiologic indices for severity of hallux valgus (HV) deformity are the HV angle (HVA) and the first-second intermetatarsal angle (IMA).[1] HV is classified as mild, moderate, or severe based on the degree of HVA and IMA, and the IMA and HVA are corrected to the normal range after determining the metatarsal (MT) osteotomy site appropriate for each classification.[2] However, these indices are two-dimensional measurements, making them useful for assessment of the correction angle and the degree of HV deformity, but they do not elucidate the actual three-dimensional causes of HV deformity. When treating HV, it is necessary to measure and understand the following three-dimensional deformities to improve the success rate and improve the long-term prognosis. Additionally, one should consider various components or associated disorders of HV in correction of HV.[3]

The first step of deformity correction in the coronal plane is assessment of the degree of sesamoid subluxation and first MT pronation. Previously, sesamoid

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subluxation has been assessed by the position of the sesamoid relative to the first MT shaft on weight-bearing anteroposterior (AP) radiograph, while pronation of the 1st MT was assessed by gross observation of the degree of slanting of the first toenail to the plantar surface.[4] Recently, the three-dimensional sesamoid position has been identified by simple radiographs and computed tomography (CT) scans, and studies have identified the positional relationship between the sesamoid and first MT during walking via weight-bearing CT imaging.

Both sesamoid position and first MT pronation influences the method of HV correction. This article presents a review of the literature addressing the positional relationship of the first MT with the sesamoid, and their clinical significance in relation to three-dimensional deformities of HV.

THREE-DIMENSIONAL DEFORMITY OF THE GREAT TOE IN HALLUX VALGUS

When determining the severity of HV, the IMA is most often used, and most surgeons primarily rely on IMA values for determination of the correction method. However, the IMA measures only a deformity in the transverse plane. Increase of IMA occurs together with axial rotation, or pronation, of the first MT at the TMT (tarsometatarsal) joint.[4–6] The pronation of the first MT causes change in the positions of the abductor hallucis tendon, extensor hallucis longus, and flexor hallucis longus relative to the first metatarsal head. .

With respect to HV deformities, although a larger IMA means a larger DMAA and more severe sesamoid subluxation,[2,7,8] it is necessary to better understand the associations between such deformities.[7] When first MT pronation occurs, the sesamoid appears to be displaced laterally; DMAA is increased, and the lateral side of the first MT head looks round (round-shaped lateral wedge sign) on the foot weight-bearing AP standing radiograph.[9] The stiff intermetatarsal ligament causes pronation of the first metatarsal by holding the lateral sesamoid in its place, as the medialization of the first metatarsal head occurs through the loose medial capsule over the fixed lateral sesamoid.[10] This is referred to as a drive belt sign (**Fig. 1**).[10] Moreover, the morphology of the first MT-cuneiform joint, the degree of hypermobility, the severity of flatfoot deformity, imbalance between the flexor hallucis longus (FHL) and extensor hallucis

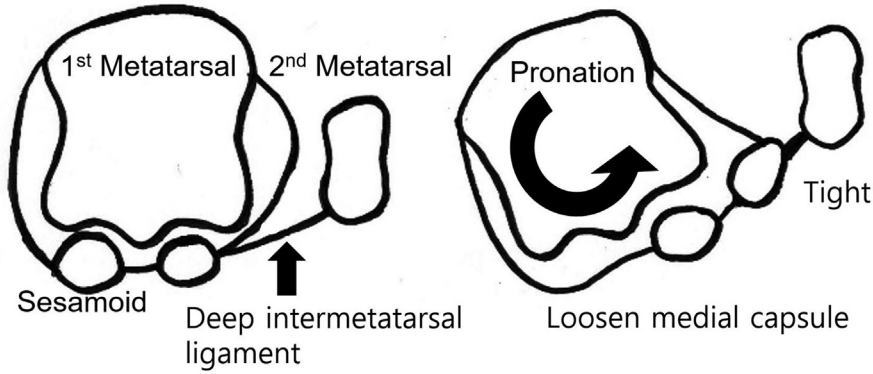

Fig. 1. When hallux valgus occurs, not only does the first metatarsal (MT) move medially on the transverse plane, but rotational deformity in the axial direction occurs as the first MT is pronated. This three-dimensional deformity occurs as the deep intermetatarsal ligament becomes tight, and the medial capsule becomes loose. This is referred to as a drive belt sign.