

# Understanding The Biomechanical Effects Of Hallux Limitus

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Given the multifaceted nature of hallux limitus, having a strong understanding of the subject is vital for anyone who treats the feet. Indeed, hallux limitus is part of the discussion for a variety of conditions including hallux rigidus, hallux valgus, first MPJ arthritis, osteochondritis and first ray hypermobility. There are countless treatment solutions for hallux limitus depending on the nature of the pathology.

Can one make any sense of the variety of topics related to hallux limitus? Is there a common ancestor to this pathology? If we know more about hallux limitus, is there a way to improve clinical outcomes? Can we at least agree on a common terminology and definition?

In order to address some of these questions, let us take a closer look at the terminology and the pathomechanical algorithm for the progression of pathology to deformity, and review related research that has an impact on the clinical treatment of hallux limitus. I will also try to explain the dysfunction or pathomechanics of the first metatarsophalangeal (MPJ) joint. This will help one better understand the deformities of hallux rigidus (HR) and hallux abducto valgus (HAV), and the related problems of sub-hallux ulcers, recurrent bunions and pinch callus.

Having a better understanding of this pathology and deformity may lead to a better interpretation of the literature and the treatment options, regardless of whether one is utilizing a surgical or a conservative approach. Direction from the literature always helps but understanding the data is essential.

## Defining Hallux Limitus

Unfortunately, clinicians commonly use the term hallux limitus to define a pathology, a deformity and a clinical sign when one should only use the term to define a pathology. In regard to hallux limitus, there are actually two different pathologies: structural hallux limitus and functional hallux limitus.

The term structural hallux limitus (SHL) refers to a pathology involving the lack of hallux dorsiflexion with non-weightbearing and weightbearing. Structural hallux limitus usually originates with trauma that disrupts the joint, consistently limits motion and usually progresses rapidly to the deformity of hallux rigidus.

The other hallux limitus pathology is functional hallux limitus (FHL). This pathology, first described in 1972, exhibits a normal range of hallux dorsiflexion during non-weightbearing but there is a dramatic decrease in hallux dorsiflexion during weightbearing.<sup>1</sup>

Contemporary literature defines these limits as greater than 50 degrees of dorsiflexion with non-weightbearing but less than 12 degrees with weightbearing.<sup>2</sup> Do we know what causes this mystery of two different ranges of motion of the same joint? No. However, we have clues that make it predictable and reversible.

## How The Pathology Progresses To Deformity

Please note that I have been careful to differentiate between pathology and deformity. We have not begun to talk about etiology. One can consider both SHL and FHL as pathologies that progress to deformities. Structural hallux limitus always progresses to the deformity of hallux rigidus and FHL progresses to either hallux rigidus or hallux valgus. The common characteristic of both pathologies is the decreased ability to dorsiflex the big toe joint when the heel comes off the ground in gait, forcing the joint to move when there is limited motion. This causes the deterioration of the joint surfaces through increased periarticular pressure and tension, leading to subsequent subchondral destruction, inflammation and osseous proliferation.

It is easy to imagine the progression of structural hallux limitus from a fractured proximal phalangeal base, sesamoid fracture or prolonged exposure to an arthropathy but how does the progression occur from functional hallux limitus to hallux valgus? To understand this, we have to keep the pathology/deformity terminology straight and follow a simple pathomechanical algorithm.

Hallux valgus and hallux rigidus are deformities that originate from the effects of the pathology of functional hallux limitus. It is important to understand this distinction because a good clinician directs his or her attention to the deformity and the pathology.

Focusing only on deformity without consideration for the original pathology often results in a recurrence of the original problem after treatment.