Biomechanical Cadaveric Evaluation of the Role of Medial Column Instability in Hallux Valgus Deformity

Emilio Wagner, Pablo Wagner[1], Florencia Pacheco Martinez, Mario López, Felipe Hernan Palma[2], Rodrigo Guzman-Venegas
[1]Alemana, [2]Universidad De Los Andes

INTRODUCTION: Medial column instability is a frequent finding in patients with flatfeet and hallux valgus, within others. The etiology of hallux valgus is multifactorial, and medial ray axial rotation has been mentioned as having an individual role. Our objective was to design a novel cadaveric foot model where we could recreate through progressive medial column ligament damage some components of a hallux valgus deformity.

METHODS: Ten fresh-frozen lower leg specimens were used, and fluorescent markers were attached in a multisegment foot model. Constant axial load and cyclic tibial rotation (to simulate foot pronation) were applied, including pull on the flexor hallucis longus tendon (FHL). We first damaged the intercuneiform (C1-C2) ligaments, second the naviculocuneiform (NC) ligaments, and third the first tarsometatarsal ligaments, leaving the plantar ligaments unharmed. Bony axial and coronal alignment was measured after each ligament damage. Statistical analysis was performed.

RESULTS: A significant increase in pronation of multiple segments was observed after sectioning the NC ligaments. Damaging the tarsometatarsal ligament generated small supination and varus changes mainly in the medial ray. No significant change was observed in axial or frontal plane alignment after damaging the C1-C2 ligaments. The FHL pull exerted a small valgus change in segments of the first ray.

DISCUSSION AND CONCLUSION: In this biomechanical cadaveric model, the naviculocuneiform joint was the most important one responsible for pronation of the medial column. Bone pronation occurs along the whole medial column, not isolated to a certain joint. Flexor hallucis longus pull appears to play some role in frontal plane alignment, but not in bone rotation. This model will be of great help to further study medial column instability as one of the factors influencing medial column pronation and its relevance in pathologies like hallux valgus.