Toward Three- dimensional pre-surgical printed models to assess anatomical and biomechanical differences between healthy and flat feet

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Abstract

The foot is a crucial element of human anatomy and acts as the interface between internal tissues and the external surface it encounters. Thus, there are many clinical implications that can arise due to disparity in the structure of individual feet. With such abnormalities, come an array of associated problems, such as arthritis, flat foot, plantar fasciitis, and shin splints [1], each of which can induce pain in the individual. Experimental data collection provides data on the locomotion patterns, however they cannot illustrate how the internal segments of the feet behave during the gait pattern. Since accessing the internal structure of the human foot in-vivo is impossible, image-based modelling technique could provide biomechanical information of the gait in any anatomical landmark of the foot complex. This study plans to accurately model both a 'healthy' foot and a flat foot, by taking three-dimensional (3D) Magnetic Resonance Images (MRI). Bio-CAD image-based modelling technique [2] will then be used, with ScanIP software, to segment each of the 28 bones into a finite element model [3] to predict and analyse their bio-realistic behaviour. Biomechanical forces such as pressure will then be applied to each of the models to understand how the distribution of force across the foot can lead to some of the clinical manifestations of having flat foot, such as knee and back pain. With the demand for patient-specific medicine at its all-time high [4], this model will provide critical information on the biophysical properties in healthy 'control' feet, and flat-footed subjects.

References

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Biography

Sabine Hoadley is studying at the University of Exeter, College of Medicine and Health. She is currently in her final year of BSc Medical Sciences. She has just completed her Professional Training Year at The University of Queensland Centre for Clinical Research, working as a research assistant in the neuroimmunology department.

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