FIRST METATARSOPHALANGEAL JOINT STRESS IN PLANUS, RECTUS, AND CAVUS FEET: PRELIMINARY EFFECTS OF PLANTAR FASCIA

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SUMMARY
Osteoarthritis (OA) is the leading cause of disability in older adults [1] and 1st metatarsophalangeal joint (MTPJ) OA, is the most common form of degenerative joint disease in the foot [2]. Many foot pathologies are of a biomechanical nature and often associated with one foot type over another [3,4]. OA is reported to be the result of elevated stresses in the joint. However, the link between stress distribution in the 1st MTPJ and different foot types is not well understood.

INTRODUCTION
Osteoarthritis (OA) is the leading cause of disability in older adults [1] and 1st metatarsophalangeal joint (MTPJ) OA, is the most common form of degenerative joint disease in the foot [2]. Many foot pathologies are of a biomechanical nature and often associated with one foot type over another [3,4] OA is reported to be the result of elevated stresses in the joint. However, the link between stress distribution in the 1st MTPJ and different foot types is not well understood. Furthermore the tension band effects of the plantar fascia upon 1st MTP joint function is also

METHODS
A high resolution 7 Tesla MRI was used to create a geometrically accurate 3D model of the first MTPJ using Mimics v14 imaging software. To simulate rectus, planus and cavus feet, 1st metatarsal declination angles of 20.2°, 10.1° and 30.7° were constructed. Material properties and boundary conditions were applied to solve for stress using ANSYS. The ligaments were simulated by linear spring elements. The base of the first metatarsal bone was mechanically grounded in this model. Plantar loading conditions were applied, based on plantar pressure data collected from different foot types.

RESULTS AND DISCUSSION
Preliminary results of our static 3D FE model during mid-stance of gait showed peak stresses in the distal 1st MTPJ cartilage of 6.0 x 10^5 Pa to 9.6 x 10^5 Pa and 8.6 x 10^5 Pa for the rectus, pes cavus and pes planus foot, respectively. Results of this study could further understanding of the pathomechanics of the 1st MTPJ and could help clinicians make informed decisions for the prevention and treatment of 1st MTPJ OA.
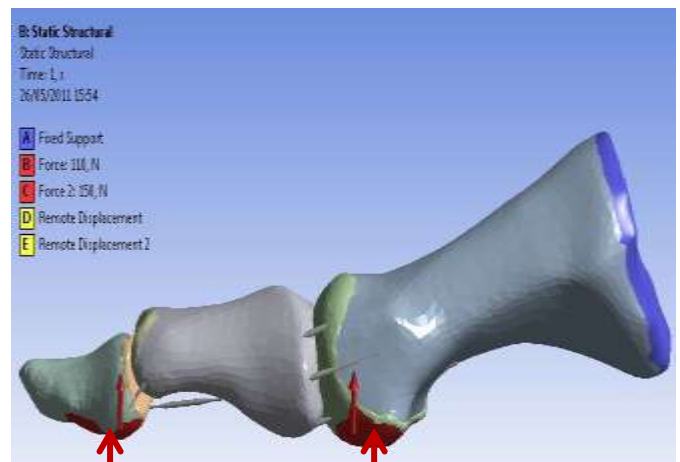

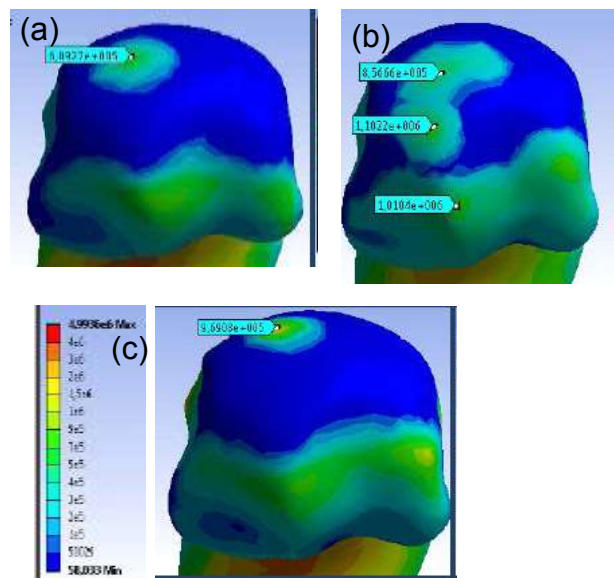**Figure 1**: 3D FEA model from 7T MRI

Figure 2 Number of expected abstracts for ISB2013 per week in January 2013.

CONCLUSIONS
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ACKNOWLEDGEMENTS

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