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SUBJECT-SPECIFIC FINITE ELEMENT MODELLING OF SUBCHONDRAL BONE: VALIDATION AND CLINICAL APPLICATION

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ABSTRACT

Osteoarthritis is a debilitating joint disease marked by pain, cartilage damage and altered subchondral bone morphology and mechanical properties. Alterations to subchondral bone are hypothesized to influence and accelerate cartilage degeneration, as well as contribute to joint pain. These hypotheses though are largely based on findings from animal or cadaveric studies. Importantly, animal studies of disease initiation and progression may not be applicable to the human process. Also, the validity of cadaveric studies is uncertain given that clinical disease stage or pain symptoms are generally unknown. Non-invasive, subject-specific finite element modelling offers potential to advance understanding of the role of subchondral bone in disease initiation, progression and pain. Finite element modelling of bone at articulating sites though is challenging due high material property heterogeneity, anisotropy and varying orientation. The first portion of this presentation will focus on methods used by our group to validate and advance finite element models of bone at articulating sites. The second portion will summarize recent findings by our group comparing mechanical metrics of individuals with and without osteoarthritis as well as with different levels of joint pain.