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Relationships among Articular Cartilage Biomechanical Properties and Biomarkers Produced by Subchondral Bone from Osteoarthritic Knees

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INTRODUCTION: Osteoarthritis (OA) is a multifactorial disease progressing from an initial injury to whole-joint inflammation and degeneration causing pain and dysfunction. While OA is a disease of the cartilage, the subchondral bone has been shown to play a role of OA. This study was designed to determine the relationship between biomechanical properties of the articular cartilage and production of biomarkers by the underlying bone. It was hypothesized that there would be significant changes in subchondral bone biomarker production associated with changes in the biomechanical properties of the overlying articular cartilage from osteoarthritic knees.

METHODS: With IRB approval (#1208392), cartilage and bone were collected from patients undergoing total knee arthroplasty, TKA (n=8). 6mm diameter tissue explants were created and cultured in for 3 days. On day 3 media were tested for biomarkers and the biomechanical properties of the cartilage were assessed. The samples were group into evenly distributed quartiles based on cartilage biomechanical properties, and a Kruskal Wallace test with post-hoc analysis and Bonferroni correction were used to determine significant differences in bone biomarker production between groups ($p < 0.05$).

RESULTS: The data indicates that as cartilage modulus increases and KSI decreases, the production of degradative and pro-inflammatory biomarkers by the bone increases significantly.

CONCLUSION: The outcome of this study helps to reveal some of the complex relationships between cartilage and bone in OA. Ongoing studies in our laboratory are steered toward further characterizing the complex interactions during development and progression of OA to better delineate disease mechanism and the development of effective interventions.