2009 OREF Resident Research Symposia
Greater Rochester Area

Optical Coherence Tomography (OCT) Grading Correlates with T2 MRI and Extracellular Matrix Content

David M. Bear, Ashley Williams, Charleen T. Chu,
Christian H. Coyle and Constance R. Chu
University of Pittsburgh Medical Center

Optical Coherence Tomography (OCT) and T2 mapping are emerging clinical imaging technologies with the potential to detect subsurface changes in cartilage retaining a macroscopically intact articular surface. This study tests the hypothesis that OCT correlates with magnetic resonance imaging (MRI) T2 values, and that OCT signal is sensitive to cartilage matrix degeneration. Forty-five osteochondral cores were harvested from five human tibial plateau explants after T2 MRI. Cores underwent OCT imaging and were graded as follows: A – obvious birefringence, B – no birefringence, C – subsurface voids and/or irregular surface. Extracellular matrix content was determined and cores underwent histologic and polarized light microscopy (PLM) evaluation. Grade B and C cores had 25% higher superficial T2 values ($p=0.047$) and 50% higher deep T2 values ($p=0.012$) than grade A cores. Grade B and C cores had 36% higher GAG content compared to grade A cores ($p=0.009$). Histology and PLM demonstrated increased surface irregularity and structural disorganization with increasing OCT grade. OCT grade and T2 value increased with increasing collagen disorganization, suggesting that T2 MRI and OCT are sensitive to changes in collagen structure. Our results demonstrate the ability of OCT and T2 MRI to detect early cartilage degeneration in clinically normal appearing cartilage.