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Monitoring tissue regeneration by magnetic resonance imaging and spectroscopy

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Magnetic Resonance Imaging (MRI) is making its way to the tissue engineering laboratories as a non-invasive characterization tool for engineered tissues [1-6]. MRI provides three-dimensional volumetric maps of the tissue based on the spin density, relaxation times, and diffusion of water protons or other high abundance Nuclear Magnetic Resonance (NMR) visible nuclei (such as sodium in cartilage tissue and phosphorous in bone tissue). These MR-visible properties reflect the physical and biological environment around the observed nuclei (for example, hydrogen protons in water), and therefore, can provide non-destructive information about changes in the local biochemical and mechanical properties of engineered tissue during the growth phase (in vitro and in vivo). We have explored different models of cartilage and bone tissue constructs such as chondrocytes suspended in alginate beads, chondrocytes cultured in scaffold-free-pellets and biomimetic scaffolds seeded with Human Marrow Stromal Cells (HMSC) for imaging and spectroscopic studies in our lab. We correlate MR properties such as T_1 and T_2 relaxation and diffusion of water in these engineered constructs with their extra-cellular matrix components: proteoglycans and collagen. In this talk, I will present current results demonstrating the quantification of tissue growth using MRI. We anticipate that in the future, MRI will augment histological and immunohistochemical techniques by providing a real time quantitative assessment of engineered tissue growth at all stages, from cell seeding to post-implantation.

Biography

Mrignayani Kotecha, currently holds the position of Research Assistant Professor in the Department of Bioengineering at the University of Illinois at Chicago. She received a Ph.D. in Physics from the Rani Durgavati University, Jabalpur, India and later worked in different research positions at the Indian Institute of Science, Bangalore, India, the Weizmann institute of Science, Israel, and the University of Duisburg-Essen, Germany before coming to the University of Illinois at Chicago, USA in 2006. Her expertise lies in the field of Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI). Currently, she is developing proton and X-nuclei MRI techniques for solving tissue engineering problems.

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