Section IV: Macromolecular Imaging of Cartilage

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Hyaline articular cartilage is composed of very few cells (chondrocytes), surrounded by a large extracellular matrix. The extracellular matrix is composed primarily of water and two macromolecules: the collagen fibers and the amorphous proteoglycan (or the associated glycosaminoglycans). Importantly, the macromolecular status of cartilage is inextricably responsible for the biomechanical properties and functional integrity of the tissue. Destruction of the collagen-proteoglycan matrix in cartilage has been shown to be the initial event during cartilage degradation in osteoarthritis. Over the past decade, considerable effort has been invested in developing imaging techniques that can detect the biochemical changes in cartilage matrix. This section provides an overview of several advanced magnetic resonance imaging techniques that can noninvasively detect macromolecular changes during cartilage degeneration or damage. Specifically, the delayed gadolinium-enhanced magnetic resonance imaging of cartilage (dGEMRIC), sodium magnetic resonance imaging, and T2 and T1rho relaxation time mapping techniques are discussed in detail. In addition to technique development, the correlations with the

changes in cartilage matrix during the course of cartilage degeneration are also discussed. These techniques have the potential to provide information beyond cartilage morphological changes with regard to early degeneration and biochemistry, which may improve our ability to understand and intervene in osteoarthritis and other diseases associated with cartilage degeneration. ■

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