MRI OF DEGENERATIVE JOINT DISEASE IN THE MUSCULOSKELETAL SYSTEM

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While MRI adequately serves the needs of assessing acute injuries to the musculoskeletal system today, MRI's full potential as tool in assessing the degree and causes of chronic, degenerative processes in the musculoskeletal system are unmet. Three-dimensional radial sequences are superior to two-dimensional sequences for high resolution MR imaging. These techniques may play an important role in the diagnostic of osteoarthritis patients specifically in evaluating the articular cartilage. Here we adapted an existing high performing imaging method for acquiring high isotropic resolution fat-suppressed knee joint images. The performance of this sequence for evaluating the articular cartilage of the knee joint at 3.0T was compared with conventional MRI three dimensional sequences. Higher SNR and CNR were achieved for cartilage and synovial fluid in comparison to the conventional counterpart. Some connective tissues in joints give low signal and are invisible with standard MR protocols. In the second part of this work, we developed a novel imaging method to robustly decompose signal into channels of ultrashort water relaxation, longer water relaxation, and fat by incorporating changes to the IDEAL chemical species separation algorithm. The method was effective in phantom and in vivo studies and has the potential to be utilized for segmenting a variety of tissue types. Finally, the effects of 3D under sampling under conditions of high isotropic resolution and fixed scan time were quantified in vivo imaging and benefits of increased coil elements investigated. Preliminary results comparing an 8-channel and 16-channel coil are included. 16-channel images showed

dramatically improved detail and better joint depiction with increased acceleration factor compared to standard 8-channel knee coil.