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Ultrashort echo time (UTE) magnetic resonance imaging and its application in osteoarthritis

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Abstract

Osteoarthritis (OA) is one of the most prevalent diseases in the world. It affects over 50 million Americans, 25% of whom are unable to perform activities of daily living and costs the United States more than $60 billion per year. It is essential to develop techniques to improve detection of OA at the early stage. Therapy is more effective at the early stage than at the late stage of OA when irreversible damage has occurred.

OA is a heterogeneous and multifactorial disease associated with progressive loss of articular cartilage. The current diagnostic approaches include arthroscopy, radiography and magnetic resonance imaging (MRI). Although arthroscopy is considered the reference standard for evaluating surface alterations of cartilage, it is invasive and of limited value in longitudinal evaluation. Plain film radiography measures cartilage thinning indirectly via “joint space narrowing”, and is severely limited by its inability to visualize cartilage directly. MRI provides excellent soft tissue contrast at high spatial resolution, and allows accurate measurement of longitudinal changes in cartilage morphology. However, conventional MRI performs poorly in detection of the early stages of OA. We have developed ultrashort echo time (UTE) sequences with nominal TEs of 8 μs that are 100-1000 times shorter than the TEs of clinical sequences. These allow us to image clinically “MR invisible” joint tissues (deep cartilage, menisci, ligaments, tendons, as well as cortical and subchondral bone), including their free water and loosely bound water components. The recent developments in qualitative and quantitative UTE imaging of the musculoskeletal system will be presented.

Biography

Dr. Jiang Du completed his Ph.D. in Medical Physics from the University of Wisconsin-Madison in 2003. He joined the University of California, San Diego as an assistant adjunct professor of Radiology in 2005, and an associate professor in residence since 2010. Dr. Du has authored more than 70 peer-reviewed articles in reputed journals with a focus on osteoporosis, osteoarthritis, and MR angiography. His awards include the Agfa HealthCare/RSNA Research Scholar (2008) and the American Heart Young Investigator Award (2008). He also received funding support from NIH, GE HealthCare, Bracco Diagnostic, UCSD Academic Senate grant and Department of Veterans Affairs.