

In vivo 3 tesla magnetic resonance T1 ρ relaxation mapping of intervertebral discs

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Early signs of disc degeneration are manifested in biochemical changes (proteoglycan loss, dehydration, and collagen degradation) that eventually lead to morphologic degradation in the vertebral bodies, endplates, and facet joints. MRI has been widely used to detect intervertebral disc degeneration (IVDD) because it is non-invasive, provides superior soft tissue contrast, and can be used to assess tissue hydration. To date, MRI has been mostly used for morphologic, qualitative assessment of IVDD. Pfirrmann et al. proposed a grading system for disc degeneration based on standard spin-echo sequences. Recent studies have proposed that T1 ρ is associated with loss of macromolecules (which is an initiating factor in IVDD). MRI T1 ρ imaging, which probes the interaction between water molecules and their macro-molecular environment, has the potential to identify early biochemical changes in the intervertebral disc. Our studies aim to quantify T1 ρ relaxation time in intervertebral discs with varying grades of degeneration using in vivo MR imaging at 3 Tesla (Figure 1). We are also investigating the relationship between T1 ρ relaxation time and the biochemical composition of the intervertebral disc, including proteoglycan content, with ex vivo experiments.

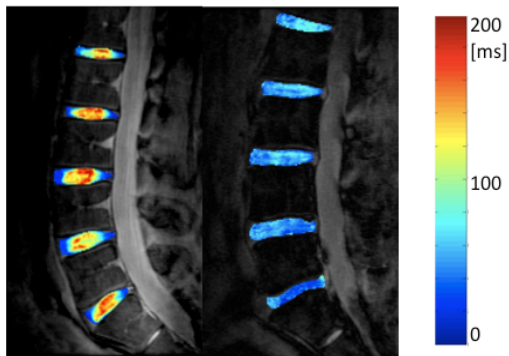


Figure 1A **Figure 1B**

A representative T1 ρ colormap of a healthy subject (1A) and a subject with disc degeneration (1B). The T1 ρ values in the healthy discs are greater than those in the degenerative discs.