Title: Contrast Optimization for Knee MRI at 7 T

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Nr. of Words: 281

Introduction:

MRI properties of knee joint tissues including cartilage, bones, fat, synovial fluid, menisci, ligaments, tendons, could act as markers for the pathologies of this anatomically complex joint in the human body.

MRI offers a variety of contrast mechanisms based on pulse sequences which are employed.

In this work, we aim at generating different and optimal contrasts to track human knee pathologies at 7 T, beneficially at high spatial resolution.

Methods:

Initially, two pulse sequences are considered for this purpose. Among spin-echo based pulse sequences, we employ 2D and 3D TSE and among gradient-echo based pulse sequences, we use 3D FLASH.

The MR signal dependency on sequence parameters and tissue properties is known. We simulated it to derive sequence parameter values to achieve any certain level of contrast between two different tissues.

The number of free parameters on which the MR signal depends is sequence specific. For TSE we feed the simulation with desired range of TE and TR and obtain their optimal values to generate any certain level of contrast between two tissues. For FLASH we have the flip angle as another free parameter.

Results:

To get an insight into reliability of the parameters derived from the simulation, they were compared with the values used by Springer et al. (2017) in their comparison study of knee MR imaging at 3 T and 7 T.

Discussion:

Simulation provides us with the ability to calculate some of the sequence parameters to generate different contrast levels between two different tissues assuming their relaxation times are known at a certain field strength which is the case for knee joint tissues at 7 T. This could also provide the possibility to establish multi-tissue contrast optimization.