DWI of the Spinal Cord with Reduced FOV Single-Shot EPI

Drew Mitchell

MD Anderson Cancer Center

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Introduction

- Spinal cord diffusion-weighted imaging (DWI) can diagnose disorders from fiber tract damage
- Several challenges:
  - Magnetic field inhomogeneities around spine create off-resonance artifacts
  - Partial volume effects from CSF and lipid
  - Spinal cord cross section very small
  - Bulk physiologic motion from heart, breathing, swallowing, CSF pulsation
- Result is low-signal, low-resolution DW images with artifacts in spinal cord

Introduction

- Single-shot echo planar imaging (ss-EPI) most frequently used technique for DWI
  - Acquires whole k-space after single excitation pulse
  - No ghosting artifacts from motion-induced phase errors
- Long readout experiences T_2^* decay

Introduction

- Spinal cord imaging benefits from reduced FOV applications
- Reduced FOV methods decrease the readout duration and reduce off-resonance artifacts
- Excited FOV in PE direction reduced by 2D spatially selective echo-planar RF excitation pulse and 180° refocusing RF pulse
- Allows multi slice imaging and suppresses fat signal

Theory

Standard DW spin-echo ss-EPI sequence, with excitation pulse replaced with 90° 2D spatially selective echo-planar RF pulse

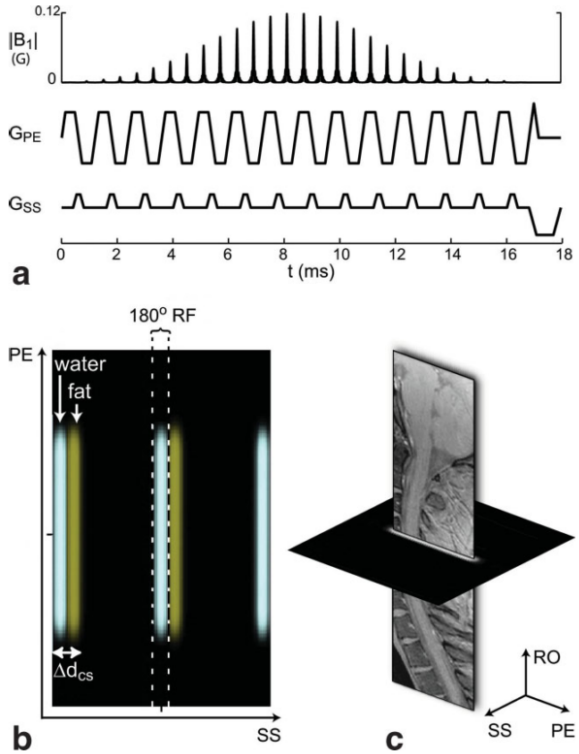

FIG. 1. (a) 2D echo-planar RF pulse and (b) simulation of the excitation profile showing how the 2D RF pulse and refocusing 180° RF pulse pair select water only in the main lobe (color coded for illustration purposes). Note that water and fat profiles are shifted by $\triangle d_{cs}$ in the SS-direction. (c) The resulting water slice and slab profile shown in 3D, along with the reduced FOV image.

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