AbstractID: 13696 Title: Effect of RF Dwell Time on Eddy-Current Compensation in Diffusion-Weighted MRI

Purpose:
Diffusion-weighted (DW) MRI can provide information to improve target delineation in radiation treatment planning. The widely used twice-refocused spin-echo (TRSE) sequence is optimized to diminish eddy current-induced geometric distortions. However, the TRSE sequence imposes a longer minimum echo time, which precludes its use in acquiring DW images in tissues with short T2s. We found that radiofrequency (RF) pulse dwell times can also affect DW image quality, and demonstrate that high-fidelity, multi-shot DW images can be obtained using the non-optimized Stejkal and Tanner (ST) sequence when short RF pulse dwell times are employed.

Method and Materials:
A pulse sequence of our own design was implemented to acquire DW images using ST and TRSE diffusion-encoding schemes with 25 usec and 2 usec RF pulse dwell times. Single- and multi-shot spiral DW images (b=0, 1000 s/mm^2) of phantom and healthy volunteer were acquired on a 3.0T Siemens Verio scanner. Images were reconstructed offline using custom software developed at our Institution.

Results:
Single- and multi-shot non-DW images did not exhibit a dependence on RF pulse dwell time. Furthermore, single-shot DW images acquired with the TRSE method did not exhibit a dependence on RF pulse dwell time. However, multi-shot DW images exhibited significant artifacts at long RF pulse dwell times, even for the optimized TRSE method. Reducing the RF pulse dwell time improved the inherent immunity of the sequences to eddy current and motion-induced artifacts, permitting acquisition of high-fidelity, multi-shot DW images even with the non-optimized ST method.

Conclusions:
Compensation of eddy current and motion-induced artifacts in multi-shot DW imaging can be affected by choice of RF pulse dwell time. High-fidelity, multi-shot DW images of short T2 tissues can be obtained using the non-optimized, traditional ST method so long as the RF pulse dwell time is kept short.

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