AbstractID: 12528 Title: Preliminary Performance of a DTI Capillary Phantom in a Quality Assurance Experiment

Purpose: The purpose of this study was to determine the measurement stability of fractional anisotropy (FA) and the apparent diffusion coefficient (ADC) using a phantom in conjunction with a diffusion tensor imaging (DTI) sequence. Given an appropriate phantom with anisotropic structures, procedures could be developed for DTI for monitoring daily quality assurance.

Methods and Materials: A doped, water-filled phantom was constructed, containing four separate arrays of glass capillaries of varying diameter. A cork phantom holder was constructed for proper and reproducible placement of the phantom within the GE Excite HDx 3.0T MRI scanner. MRI images of the phantom were acquired in fourteen separate scan sessions. To evaluate intra-session reproducibility of mechanical phantom alignment and slice prescription reproducibility, software was used to coregister images from each session and determine displacement. Temperature and signal-to-noise measurements of the phantom were made for each scan session. Data acquired from the scan sessions were used to calculate FA and ADC, which were evaluated for dependency with respect to phantom temperature and SNR.

Results: Mean absolute displacements in alignment were 3.45mm along the S-I axis, 0.74mm along the A-P axis, and 1.70mm along the R-L axis. Slice prescription was determined to vary by approximately 14.3% of DTI slice volume from session to session. FA and ADC were not significantly dependent on SNR ($p>0.45$), but were significantly dependent on temperature ($p<0.003$). After temperature corrections, FA and ADC were stable temporally to within <6% and <2%, respectively.

Conclusion: Using our anisotropic diffusion phantom, we determined that daily FA and ADC variations correlate significantly with temperature, but not on SNR. After correcting these biases, residual FA and ADC are stable to within a few percent.