AbstractID: 7165 Title: Effects of EPI slice angle, slice thickness and phase encoding direction on fMRI sensitivity in areas with susceptibility artifact

Purpose: A key problem of using EPI for BOLD fMRI is the field inhomogeneities near air/tissue interfaces, or the susceptibility artifact. Therefore, fMRI studies in brain areas such as orbitofrontal cortex (OFC) and temporal lobes (TL) may suffer from signal dropouts and spatial distortions. This study aimed to determine the optimal EPI slice angle, slice thickness and phase-encoding (PE) direction for the reduction of BOLD sensitivity (BS) losses in TL and OFC.

Methods: The study was performed on five healthy volunteers using a 1.5-T MRI scanner. A single-shot GE EPI sequence was applied with TR/TE/FA = 3000ms/60ms/90^0, FOV = 220mm and matrix = 64. The slice tilt was set from -45° to +30° (in 6 steps of 15°) relative to the AC-PC direction, 35 or 24 slices for the slice thickness of 3 or 6 mm, respectively, and the PE direction either left-right or anterior-posterior, which resulted in 24 parameter combinations. BS maps were calculated with corresponding phase maps for each combination and normalized to a brain template using SPM2 for comparison.

Results: Significant BS gain (>15%) were observed in several parameter combinations, when comparing to the baseline BS (no slice tilt, slice thickness= 6mm, PE= anterior-posterior). The optimal parameters that introduced most voxels with such BS gain were +30° slice tile, slice thickness= 3mm and PE = anterior-posterior in the OFC, and -45° slice tile, slice thickness= 6mm and PE = left-right in the TL.

Conclusion: For the purpose of reducing BS losses in OFC and TL, this study provided the optimal EPI parameters that can be easily adopted in a clinical 1.5T MR scanner. For the PE direction, however, it is better to be kept in the anterior-posterior direction to avoid peripheral nerve stimulation. Similar studies at 3T are currently under investigation.