Interleaved TMS/fMRI is a promising technique to study connectivity between brain areas. Functional connectivity can be assessed by targeting a cortical area-of-interest using TMS (Transcranial Magnetic Stimulation) and directly monitoring the effects on local and remote BOLD activity by means of fMRI. An important practical challenge is the accurate positioning of the coil inside the MRI scanner. Here, we describe a novel positioning method and report pilot results on its usage studying the motor system.

**TMS Coil Positioning:** Neuronavigation systems used in many TMS studies for the precise targeting of cortical areas (Schönfeld-Lecuona et al., Brain Topogr., 2005) cannot be utilized inside the MR cabin. To circumvent this limitation, Bohning et al. developed a mechanical holding device in combination with a simple software program which enables positioning of the TMS coil over a desired target area (Bohning et al., Clin Neurophysiol., 2003) within the MRI scanner. Critically, the target has to be manually located in a structural scan acquired directly before the start of the interleaved TMS/fMRI experiment based on the individual brain anatomy. Here, we describe an improved positioning method which allows accurate TMS coil placement (Medtronic Magpro X100 with figure-8 coil MRI-B88; see Fig. 1) inside the MR scanner using pre-planned coil positions previously determined using a neuronavigation system, thereby eliminating the need for the manual and time-consuming identification of individual brain structures. Initially, a T1-weighted high-resolution (1mm iso-voxel) structural image is acquired once for each subject for usage in our neuronavigation system (BrainView, Fraunhofer IPA, Stuttgart, Germany). In BrainView, coil positions-of-interest are saved with respect to the coordinate system defined by the high resolution image. Inside the scanner, the position of the subject’s head is determined using a fast structural image (FLASH) lasting ~1 min, which is automatically coregistered to the high resolution image using custom-written software (MATLAB, Natick, USA) and SPM5 (Wellcome Department, UCL, Great Britain) functions. The software automatically determines the parameters of the coil holding device corresponding to the pre-planned coil position, thereby preventing the need to manually identify brain structures. Accuracy of the method was assessed using agar phantoms, demonstrating that pre-planned coil positions can be reached within 3.9 ± 1.0 (SD) mm (5.5 mm maximum offset) which is in comparable range of spatial accuracy reported for neuronavigation systems used outside of the MRI scanner.

**Motor cortex stimulation:** BOLD activity induced by paired TMS pulses on the motor cortex was investigated in 5 subjects. The TMS “Hot Spot” of a particular finger muscle in the motor cortex (M1) was determined offline and its position was saved using the neuronavigation systems used outside of the MRI scanner. To identify brain structures. Accuracy of the method was assessed using agar phantoms, demonstrating that pre-planned coil positions can be reached within 3.9 ± 1.0 (SD) mm (5.5 mm maximum offset) which is in comparable range of spatial accuracy reported for neuronavigation systems used outside of the MRI scanner.

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