Frontoparietal TMS-EEG: Transcranially versus Peripherally Induced Brain Responses - DTU Orbit (13/08/2019)

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**Background:** Transcranial Magnetic Stimulation (TMS) can induce action potentials in frontal or parietal areas which may spread to connected cortical areas via fiber tracts. The local and distributed cortical response to TMS can be mapped with electroencephalography (EEG). However, TMS also results in an effective acoustical and somatosensory stimulation. The co-stimulation of peripheral neural structures may contribute to the TMSevoked EEG potentials (TEPs).

**Methods:** The aim of this study was to delineate the contribution of peripheral multi-sensory co-stimulation to the TEPs. In healthy young individuals, we recorded the TEPs evoked by real TMS over the left paramedian prefrontal or posterior parietal cortex using a figure-of-eight coil. State-of-the-art procedures were applied to attenuate somatosensory and auditory confounds during real TMS, including the placement of a foam layer underneath the coil and auditory noise masking. We also recorded the EEG responses evoked by realistic sham stimulation of the same areas. Realistic sham stimulation mimicked the auditory and somatosensory sensations evoked by real TMS. Data analyses tested for similarities between the EEG responses evoked by real and realistic sham stimulation.

**Results:** The temporal and spatial patterns of the cortical potentials evoked by real TMS at the prefrontal and parietal site closely resembled the cortical potentials evoked by realistic sham TMS. This was the case for both, early and late TEP components. EEG responses were influenced by the intensity of the TMS pulse in the real and realistic sham condition.

**Conclusion:** Peripheral TMS-induced co-activation makes a substantial contribution to the TEPs. Future TMS-EEG studies should include a peripheral multisensory control stimulation in their study design. Otherwise, it is not possible to decide whether a finding is caused by the transcranial or the non-transcranial components of TEPs.

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