Where does TMS Stimulate the Motor Cortex? Combining Electrophysiological Measurements and Realistic Field Estimates to Reveal the Affected Cortex Position - DTU Orbit (16/12/2018)

Where does TMS Stimulate the Motor Cortex? Combining Electrophysiological Measurements and Realistic Field Estimates to Reveal the Affected Cortex Position

Much of our knowledge on the physiological mechanisms of transcranial magnetic stimulation (TMS) stems from studies which targeted the human motor cortex. However, it is still unclear which part of the motor cortex is predominantly affected by TMS. Considering that the motor cortex consists of functionally and histologically distinct subareas, this also renders the hypotheses on the physiological TMS effects uncertain. We use the finite element method (FEM) and magnetic resonance image-based individual head models to get realistic estimates of the electric field induced by TMS. The field changes in different subparts of the motor cortex are compared with electrophysiological threshold changes of 2 hand muscles when systematically varying the coil orientation in measurements. We demonstrate that TMS stimulates the region around the gyral crown and that the maximal electric field strength in this region is significantly related to the electrophysiological response. Our study is one of the most extensive comparisons between FEM-based field calculations and physiological TMS effects so far, being based on data for 2 hand muscles in 9 subjects. The results help to improve our understanding of the basic mechanisms of TMS. They also pave the way for a systematic exploration of realistic field estimates for dosage control in TMS.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Max-Planck-Institute for Biological Cybernetics
Contributors: Bungert, A., Antunes, A., Espenhahn, S., Thielscher, A.
Number of pages: 12
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Cerebral Cortex
ISSN (Print): 1047-3211
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.87 SJR 3.892 SNIP 1.633
Web of Science (2017): Impact factor 6.308
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.5 SJR 4.103 SNIP 1.614
Web of Science (2016): Impact factor 6.559
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.68 SJR 4.929 SNIP 1.872
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.86 SJR 4.887 SNIP 1.994
Web of Science (2014): Impact factor 8.665
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 7.26 SJR 5.386 SNIP 1.899
Web of Science (2013): Impact factor 8.305
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 7.28 SJR 5.077 SNIP 1.916
Web of Science (2012): Impact factor 6.828
ISI indexed (2012): ISI indexed yes