Method for rapid coil placement and E-field evaluation during TMS

Unmet Need

Transcranial magnetic stimulation (TMS) is a noninvasive brain stimulation technique where a TMS coil placed on the scalp is used to induce a high intensity electric field (E-field) that directly modulates the activity of brain regions and network nodes. Computational E-field dosimetry has been identified by the National Institute of Mental Health as instrumental for determining brain regions stimulated by TMS and for developing rigorous and reproducible TMS paradigms. For efficient and focal stimulation, it is important to position and orient the coil to induce a maximal E-field in the targeted cortical region of interest (ROI). Current coil placement protocols, even with gold-standard neuro-navigation and robotic coil placement methods, have limited precision and require a large computational effort. Therefore, new computational models linking the external coil placement and current to the E-field induced in the brain and accounting for coil placement uncertainty are of critical need.

Technology

Duke researchers have developed a novel fast computational auxiliary dipole method (ADM) that improves accuracy of TMS by determining the optimum coil position and orientation. The optimum coil placement maximizes the E-field along a predetermined direction or, alternatively, the overall E-field magnitude in the targeted region. This method can find the optimum coil placement in under 15 min using a laptop computer which enables its routine use for TMS. Furthermore, it enables the fast quantification of uncertainty in the induced E-field due to limited precision of TMS coil placement protocols, enabling minimization and statistical analysis of the E-field dose

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Publication(s)

External Link(s)

• From the Brain Stimulation Engineering Lab at Duke

variability.

This software technology has been made available under a dual-license approach: (1) An open-source license under the GNU General Public License (GPL-v2.0) for non-commercial use, and (2) a custom license with Duke, for use without the GPL-v2.0 restrictions.

Advantages

- an accurate and rapid method for E-field-informed coil placement that can be used on a standard laptop.
- determines optimum coil placement for TMS targeting in under 15 minutes
- is implemented in SimNIBS 3.2 platform and can also be easily integrated with other transcranial brain stimulation software packages