SOURCES OF VARIABILITY IN STUDIES USING NON-INVASIVE BRAIN STIMULATION TO INDUCE CORTICOMOTOR PLASTICITY

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Type: Systematic Review

Where: Online & Copenhagen, Denmark

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Methods & techniques: Transcranial magnetic stimulation (TMS), Electromyography (EMG), Motor-evoked potentials (MEP), Transcranial electrical stimulation (TES)

ABOUT THE MENTOR

Armita Faghani Jadidi is a Postdoc fellow at Danish Research Centre for Magnetic Resonance (DRCMR), Funktions- og Billeddiagnostisk Enhed (FBE), Amager og Hvidovre Hospital (AHH), Capital Region of Denmark.

She has expertise in biological signal processing, noninvasive brain stimulation and neurorehabilitation. She has experience with EEG, TMS, and MRI to investigate the underlying mechanism of neurological and mental disorders (e.g., chronic pain and depression) and therapeutic non-invasive interventions (e.g., TENS and iTBS). Her current research focus is EEG-monitoring (online/offline) of accelerated personalized brain stimulation (iTBS) to investigate target engagement and alteration in cortical activity. She is interested in adaptive brain stimulation protocols to increase effectiveness of the therapeutic intervention's which motivates her to gradually extend her research to closed-loop non-invasive brain stimulation.

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Check out one of her works: Jadidi, A. F., Stevenson, A. J. T., Zarei, A. A., Jensen, W., & Lontis, R. (2022). Effect of modulated TENS on corticospinal excitability in healthy subjects. Neuroscience, 485, 53-64.

About the Topic

The field of non-invasive transcranial brain stimulation (NTBS) is rapidly growing within systems neuroscience, allowing the modulation of functional brain networks beyond the time of stimulation. Several NTBS techniques have been shown to induce neuromodulatory effects in the targeted network, including transcranial electrical and magnetic stimulation (TES and TMS, respectively). It has been shown that induced neuromodulation effects have therapeutic potential in a wide range of neuropsychiatric disorders, like depression. A key limitation of NTBS is that its lasting plasticity-inducing effects are often relatively weak and show large intra- and interindividual variability. This limits the neuroscientific use of NTBS as a network manipulation tool and constitutes a major obstacle to developing NTBS into powerful therapeutic interventions.

What will be done?

We will conduct a systematic literature review following PRISMA guidelines.

Over the last decade, growing number of factors contributing to variability in NTBS effects have been reported in various studies, amongst others, genetic factor, current medication, stimulation parameters, and the functional state of the brain network at the time of stimulation. In this review, we aim to synthesize the existing knowledge of factors that contribute to the variability of stimulation-induced corticomotor plasticity in healthy humans. We will primarily focus on TMS and low-intensity TES as stimulation modalities and the cortical motor hand area (M1-HAND) as the cortical target region. We will review all studies that have reported the inter- or intra-individual variability of TMS-induced plasticity with the MEP of intrinsic hand muscles as read out. We will try to identify and categorize the various sources of variability and summarize existing recommendations/approaches to minimize variability.
This is important because improving knowledge about sources of variability could lead to advances in proposing novel tailored NIBS protocols for the treatment of physiological and pathological conditions.

The group 5 selected early-stage researchers will be working under the supervision of Dr Faghani Jadidi in collaboration with Hartwig Siebner, Axel Thielscher and Lasse Christiansen.

The research will result in one review paper in a peer-review journal.

What will you learn?

- ✓ How to conduct a systematic review following PRISMA guidelines
- ✓ How to wite a review article for publication in a scientific journal
- ✓ What are the underlying mechanisms of NIBS effects (especially TMS)
- ✓ Which are the sources of inter-individual variability in NTBS effects.

Career benefits

- ✓ Learning about the variability of NTBS (especially TMS) in plasticity induction studies
- ✓ Networking and learning journey with experts in NTBS field at the international level
- ✓ Establishing connections with peers and enhancing your soft skills to work in an international team
- ✓ Contributing to planned publication as co-authors

What is your role?

You will work in the international team to conduct a literature review and write a manuscript for publication. You will participate in regular online meetings and have the opportunity to meet with your team members in Copenhagen.

ESRs ENGAGEMENT REQUIREMENTS

Time requirements

Each participant is expected to dedicate 10 weeks over the period of 12 to 18 months. You will have a keep-on-track monthly online meeting with the mentor and the team members. The working hours will be mostly flexible, and the dynamic will depend on work progress.

Physical location

The work will be done mainly remotely.
Depending on the team members' availability to travel, the group may organize one or two meetings in Copenhagen (3-5 days each).

Skills and knowledge

For joining the group, you should have basic knowledge about TMS and NTBS protocols to induce neuroplasticity (this can be achieved by reading the literature, no formal courses on these topics are required).
The advantage will be given to candidates with knowledge of literature search and experience in writing academic paper.