Can topical application of numbing cream improve the efficacy of sham TDCS?

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Abstract
Alzheimer's disease (AD) is a neurodegenerative condition with enormous social and economic impact at a global scale. Given the inefficacy of the pharmacological treatments developed so far in decelerating/blocking AD pathology, the study and development of so-called alternative (i.e., non-pharmacological) and non-invasive therapies has become one of the major focuses of biomedical research on AD in recent years. Indeed, several researchers have demonstrated the therapeutic potential of optical and mechanical (i.e., optomechanical) stimuli in brain lesions. Among them, photobiomodulation (PBM, the application of modulated red/NIR light for therapeutic purposes) and tailored ultrasonic waves applied to the brain through transcranial ultrasound stimulation (TUSS) are at the forefront of clinical interventions with the potential to improve associated neuropathology and symptomatology of AD (e.g., reduction of protein aggregates deposition in the brain, increased functional connectivity and synchronization of neuronal activity, cognitive improvements), both at the preclinical and clinical levels. However, the biologic mechanisms differentially activated/stimulated during optomechanical stimulation are far from being understood. There are no proven data about the bioavailability of the stimulus energy and their bioeffects on signaling pathways, inflammation and clearance mechanisms, as well as on how these alterations relate with the behavioral improvement observed. Thus, this review compiles and describes possible biological mechanisms and alterations through which optomechanical stimuli can be effective in mitigating AD neuropathology and clinical symptoms. The topics reviewed here will be crucial for further development in the field of alternative, noninvasive brain stimulation approaches against AD, also contributing to all therapeutic interventions by transcranial stimulation in the future, enabling the development of customized therapies.
Keywords: Alzheimer's disease, optomechanical stimuli, immunoregulation, neuroprotection

P2.125

THE "STIMULATION CONTEXT" ALTERS THE RELATIVE MAGNITUDE OF SHORT-LATENCY AFFERENT INHIBITION

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Abstract
Background: Short latency Afferent Inhibition (SAI) is a widely used neurophysiological read-out of fast sensorimotor integration at the cortical level. SAI is measured using a conditioning-test paradigm: A conditioning peripheral electrical stimulus of sensory afferents from the hand markedly inhibits the motor evoked potentials (MEP) evoked by transcranial magnetic stimulation (TMS) of the contralateral motor hand area (M1-HAND).
Objectives: We tested the hypothesis that the relative magnitude of SAI is modified by contextual aspects of peripheral conditioning. Specifically, we expected that the predictability of peripheral sensory stimulation may play a role.
Methods: We recorded blocks of sixty MEPs from three intrinsic hand muscles in twenty healthy participants. Each block consisted of three experimental conditions: 1) An unconditioned TMS pulse delivered to left M1-HAND alone, 2) TMS preceded by electrical stimulation of the right index finger (D2), or 3) TMS preceded by electrical stimulation of the right little finger (D5). Conditions were either randomly intermixed or delivered in blocks in which a single condition was repeated either five or ten times. MEP amplitudes and magnitude of SAI were compared using ANOVAs ($p<0.05$).
Results: Randomization of the three stimulation conditions was associated with a relative reduction in SAI magnitude signifying less afferent inhibition across all three muscles ($p<0.001$). The relative attenuation of SAI was entirely caused by a relative suppression of the unconditioned MEP amplitude ($p<0.001$). Mean amplitudes of the conditioned MEPs were comparable across conditions.
Conclusions: The relative magnitude of SAI critically depends on whether or not the occurrence of the peripheral stimulus is predictable or not. We hypothesize that corticospinal excitability is reduced, if individuals cannot predict the occurrence or absence of the peripheral electrical stimulus, resulting in a reduction of the test MEP amplitude. The neural mechanisms underlying this context-dependency warrant further investigation.
Keywords: transcranial magnetic stimulation, short latency afferent inhibition, sensorimotor control

P2.126

CAN TOPICAL APPLICATION OF NUMBING CREAM IMPROVE THE EFFICACY OF SHAM TDCS?

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Abstract
Introduction: Transcranial Direct Current Stimulation (TDCS) can modulate intrinsic cortical activity by stimulating specific brain areas. TDCS produces peripheral somatosensory co-stimulation that may contribute to the neuro-modulatory effects and hamper effective blinding.
Objective: To assess how topical administration of numbing cream modifies the subjective tingling experience during sham relative to real TDCS in focal vs. non-focal and high- versus low-intensity stimulation settings.
Methods: 30 healthy participants received bi-hemispheric TDCS targeting the hand representation of the left primary motor cortex (M1-HAND). We compared non-focal TDCS with a bi-polar montage (7x5cm electrodes) and focal TDCS with a center-surround montage (3cm diameter central electrodes, surrounded by 10cm diameter ring electrodes). TDCS was applied with randomized blocks of 2mA or 4mA (30sec ramp-up, 3min stimulation, 30sec ramp-down) and matched sham conditions (30sec ramp-up and down). Participants were tested across two days, with and without anesthetic cream applied underneath the electrodes. They rated their sensations of tingling following each stimulation block, with a 10-level VAS-score. We tested the effect of the experimental factors "numbing cream", "focality of stimulation", "intensity of stimulation", and "sham-real stimulation" on VAS scores using repeated-measures ANOVA and non-parametric permutation tests ($p<0.05$).
Results: Tingling was more intense during real TDCS relative to sham TDCS in the high-intensity but not low-intensity condition (sham-real x intensity interaction, $p = 0.011$). Topic application of numbing cream generally reduced VAS-ratings, but it did not alter the relative difference in tingling experience between real and sham TDCS, high-intensity and low-intensity TDCS, focal and non-focal stimulation.
Conclusion: While inducing an overall attenuation of tingling experience, the use of numbing cream does not improve the matching of tingling experience between corresponding sham and real TDCS conditions.
Keywords: peripheral effects, numbing cream, sham tDCS, focal high intensity

P2.127

OPTIMISING MR IMAGING DATA QUALITY FOR A NOVEL ULTRATHIN MULTICHANNEL COIL FOR SIMULTANEOUS TMS/FMRI EXPERIMENTS: A COMPARISON OF SEQUENCE PARAMETERS

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Abstract
Background: The novel ultrathin multichannel receiver coil was specifically designed for simultaneous TMS/fMRI research. While this novel TMS-MR coil has been shown to significantly improve signal-to-noise ratio