

mechanistic approach facilitates the understanding of putative meso-scale network architectures and synaptic dynamics involved in the site-specific effects of GPI-DBS, and has the potential to identify structuro-functional network montages necessary for GPI-DBS benefit.

Research Category and Technology and Methods

Basic Research: 19. Modeling and computational methods

Keywords

DBS, MER, Computational

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P1.044

EFFECT OF HD-TDCS ON AGEING WORKING MEMORY: PRACTICE-DEPENDENT INFLUENCE

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Abstract

Introduction: High-definition transcranial current stimulation (HD-tDCS) shows promise for improving ageing working memory. However, prior task activity may affect the HD-tDCS after-effect according to the activity-dependent model [1]. This preliminary study investigated the practice-dependent effects of HD-tDCS on working memory in healthy older adults.

Methods: Ten healthy older adults (7 male) with a mean age of 64.6 ± 2.1 years were recruited and received 10 minutes of either 2mA anodal or sham HD-tDCS to the left dorsolateral prefrontal cortex over 2 sessions that were one week apart. One block of two-back task was performed before and after the stimulation in every session with each block consisting of 200 trials. Participants in the less-practice group ($n=6$) received anodal stimulation with less task experience (1 task block before stimulation) whereas those in more-practice group ($n=4$) received anodal stimulation with more task experience (3 task blocks before stimulation). Two-way ANOVA was conducted on the behavioural measure (change in d-prime, or $\Delta d'$) and the amplitude change in event-related potentials (ERPs) N200 and P300.

Results: Significant interaction between stimulation (anodal vs. sham) and prior practice (less vs more) revealed that individuals with less prior practice had greater $\Delta d'$ ($F(1,8)=21.310$, $p=.002$) and greater $\Delta N200$ amplitude at left frontal area ($F(1,8)=7.642$, $p=.025$) after anodal HD-tDCS relative to more-practice group ($p=.008$), as well as compared to after sham stimulation ($p=.008$). A greater $\Delta N200$ amplitude at the left frontal region for target trials after anodal stimulation was found to be positively correlated with enhanced task performance ($r=0.627$, $p=.052$).

Discussion/Conclusion: The pilot findings suggest that less prior practice amplifies the beneficial effects of HD-tDCS, potentially due to the brain's regulatory mechanisms adjusting plasticity thresholds based on previous activities, or meta-plasticity. This has important implications for the design of tDCS/HD-tDCS research and clinical application.

Research Category and Technology and Methods

Translational Research: 9. Transcranial Direct Current Stimulation (tDCS)

Keywords

HD-tDCS, activity-dependent, working memory, ageing

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P1.045

CAUSAL CORTICAL AND THALAMIC CONNECTIONS IN THE HUMAN BRAIN

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Abstract

The brain's functional architecture is intricately shaped by causal connections between its cortical and subcortical structures. Here, we studied 27 participants with 4864 electrodes implanted across the anterior,

mediodorsal, and pulvinar thalamic regions, and the cortex. Using data from electrical stimulation procedures and a data-driven approach informed by neurophysiological standards, we dissociated three unique spectral patterns generated by the perturbation of a given brain area. Among these, a novel waveform emerged, marked by delayed-onset slow oscillations in both ipsilateral and contralateral cortices following thalamic stimulations, suggesting a mechanism by which a thalamic site can influence bilateral cortical activity. Moreover, cortical stimulations evoked earlier signals in the thalamus than in other connected cortical areas suggesting that the thalamus receives a copy of signals before they are exchanged across the cortex. Our causal connectivity data can be used to inform biologically-inspired computational models of the functional architecture of the brain.

Research Category and Technology and Methods

Basic Research: 1. Deep Brain Stimulation (DBS)

Keywords

thalamus, cortical rhythm, whole-brain causal connection, single-pulse stimulation

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P1.046

TRANSCRANIAL PULSE STIMULATION (TPS) FOR THE TREATMENT OF PATIENTS WITH ALZHEIMER'S DEMENTIA: PHYSICAL PRINCIPLES AND STATE OF THE ART

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Abstract

Transcranial Pulse Stimulation (TPS) is a non-invasive procedure for the treatment of patients with Alzheimer's dementia. In TPS, smooth low-energy shock waves, so-called TPS pulses, are generated and delivered in a non-invasive focused way to the brain regions typically affected by Alzheimer's disease. Shock waves are acoustic mechanical pulses characterized by high positive pressure amplitudes and a steep pressure increase compared to the ambient pressure. The effects of shock waves in medicine can be attributed to the physical mechanism of momentum transfer and the action of force that this causes. As a neurostimulation method, the goal of TPS is to stimulate deep brain tissue and regenerate nerve cells and cell functions as well as improve vascularization within the brain. Various studies were recently conducted on the effects and safety of this treatment method. In this overview, the physical principles of the TPS procedure and the underlying biological and physiological effects attributed to the mechanotransduction mechanisms of action induced by low-energy shock waves are described. Further, an overview on recent TPS studies published for the treatment of patients with Alzheimer's disease is presented, including applied protocols and achieved results regarding clinical effects and safety issues. The studies use various psychological and physiological measures to assess the cognitive and emotional functions of the patients before and after treatment. The results suggest that TPS is a safe and effective treatment option, particularly in improving cognitive functions and depressive symptoms of patients with Alzheimer's dementia. Finally, TPS studies related to other neurological applications as well as ongoing trials are presented and discussed as well.

Research Category and Technology and Methods

Clinical Research: 13. Other Brain Stimulation Technology

Keywords

TPS, Transcranial Pulse Stimulation, Shock Waves, Neurostimulation

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P1.047

DIFFERENTIAL WHOLE-BRAIN EEG SOURCE ACTIVATIONS ACROSS THE CORTEX DETERMINED BY CCPAS CONDITIONS

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