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neuromodulation and may serve as a pre-surgical tool or a potential treatment for depression.

Research Category and Technology and Methods

Clinical Research: 6. Pulsed Ultrasound (pUS)

Keywords

Low-Intensity Focused Ultrasound, LIFU, Depression, ALIC

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P1.006

CONTROL OF MIRROR ACTIVITY BY TRANSCRANIAL DIRECT CURRENT STIMULATION TO THE SUPPLEMENTARY MOTOR AREA

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Abstract

Introduction

We investigated how anodal and cathodal transcranial direct current stimulation (tDCS) over the region of the supplementary motor area (SMA) affected mirror activity (MA) occurred during contralateral voluntary hand task.

Methods

Twenty-two right-handed healthy subjects were enrolled in this study (mean age 23.5±1.0 years). Anodal tDCS (a-tDCS) or cathodal tDCS (c-tDCS), and sham stimuli (a-Sham and c-Sham) were applied over the SMA (3cm anterior to Cz, 10-20 EEG system), respectively. A direct current of 1mA was applied for 10 min, and the sham stimuli were conducted only for the first 30 sec.

MA was evaluated as the transcranial magnetic stimulation (TMS) over left primary cortex (M1) - induced motor evoked potential (MEP) amplitude recorded from the right first dorsal interosseous muscle while performing a pinch task with the left hand.

Statistical significance of differences between groups was inferred by a repeated measures analysis of variance with two factors (tDCS and polarity), and the significance level was set at 5 %.

Results

A significant interaction between tDCS (real, sham) and polarity (anode, cathode) for MEP amplitude was observed ($p=0.023$). A simple main effect analysis demonstrated that a-tDCS significantly increased ($p=0.049$) MEP amplitude and c-tDCS decreased ($p=0.044$) it compared with those in a-Sham and c-Sham, respectively.

Discussion

The facilitatory a-tDCS to the SMA increased right hand MA while performing left hand pinch task, whereas inhibitory c-tDCS showed less MEP amplitude. The results clearly showed that the modulation of SMA by t-DCS altered M1 excitability ipsilateral to the pinch task. These suggest that neural modulation of SMA would be a potential preventing control mechanism of mirror movement observed in stroke patients.

Research Category and Technology and Methods

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

Keywords

Mirror activity, Motor evoked potential, Transcranial direct current stimulation

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P1.007

OPTIMISING TRANSCRANIAL ELECTRICAL STIMULATION TO REDUCE MOTOR CORTEX EXCITABILITY

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Abstract

Motor cortex excitability is complex and likely mediated by a balance between excitatory-inhibitory neural circuits. Suppressing excitability may have therapeutic value as hyperexcitability is postulated to contribute to several neurological diseases such as dementia and amyotrophic lateral sclerosis. Research from the past decade has established the role of transcranial electrical stimulation (tES) in modulating neural activity. However, research on suppressing cortical excitability using tES has been underexplored relative to protocols focused on enhancing it.

Here, we compare the effect of various tES stimulation protocols such as cortico-spinal-transcranial direct current stimulation (tDCS), 140Hz-transcranial alternating current stimulation (tACS), and transcranial random noise stimulation (tRNS) in comparison to sham to reduce excitability in the motor cortex in healthy volunteers. We measured the effect of these tES protocols on excitability with state-of-the-art threshold-tracking transcranial magnetic stimulation techniques. The findings from this study could aid the identification of robust tES protocols that reduce motor cortex excitability. In turn, these may warrant therapeutic testing in conditions manifesting cortical hyperexcitability.

Research Category and Technology and Methods

Basic Research: 5. Other Transcranial Electrical Stimulation (tES)

Keywords

Excitability, Motor cortex, Transcranial electrical stimulation, threshold-tracking TMS

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P1.008

THRESHOLDS AND MECHANISMS OF HUMAN MAGNETOPHOSPHENE PERCEPTION INDUCED BY TRANSCRANIAL ALTERNATING MAGNETIC STIMULATION

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Abstract

Background: Exposure to time-varying magnetic fields (MFs) induce electric fields in the human central nervous system, potentially impacting brain functions. For instance, magnetophosphenes are flickering visual perceptions resulting from MF exposure, which serve as the basis for international MF exposure guidelines and recommendations protecting workers and the general public. However, magnetophosphene perception thresholds were established 40 years ago on small cohorts, leaving room for uncertainties, and a still unsure interaction site.

Methods: We used transcranial alternating magnetic stimulation (tAMS) to deliver sinusoidal electric fields comparable to transcranial alternating current stimulation (tACS). Magnetophosphene perception was quantified in 81 volunteers exposed to MF (entire head, ocular or occipital exposure conditions) at 4 frequencies and 11 intensities (including sham).

Results: tAMS reliably induced magnetophosphenes without scalp sensation, a major advantage over tACS in the perspective of possible clinical applications. Binary logistic regressions quantified frequency-dependent perception thresholds, suggesting an interaction between induced current density and retinal rod cells.

Conclusion: Beyond immediate implications for safety guidelines and identifying the phosphene perception site (common in tACS experiments), our findings support tAMS's potential for differential diagnosis of retinal disorders and neuromodulation therapy. This study advances our understanding of MF effects on the visual system and offers new avenues for clinical applications.

Research Category and Technology and Methods

Basic Research: 13. Other Brain Stimulation Technology

Keywords

Time varying magnetic field, Extremely low frequency, Human study, Neuromodulation

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