that the 80 Hz tACS with the phase for the right IPS leading that for the left IPS by 90° (= 2.78 ms) partialized the VWM performance towards the right visual hemifield. Our findings suggest that the phase delays of high-gamma band over bilateral parietal areas may reflect the priority of information during VWM tasks.

Research Category and Technology and Methods

Basic Research: 8. Transcranial Alternating Current Stimulation (tACS)

Keywords: Transcranial alternating current stimulation (tACS), multi-site multi-phase transcranial alternating current stimulation (msmp-tACS), visuospatial working memory (VWM), noninvasive brain stimulation (NIBS)

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Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

P1.058

HIGH-DEFINITION TRANSCRANIAL DIRECT CURRENT STIMULATION (HD-TDCS) FOR THE ENHANCEMENT OF WORKING MEMORY – A SYSTEMATIC REVIEW AND META-ANALYSIS OF HEALTHY ADULTS.

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Abstract

Background: High-definition transcranial direct current stimulation (HD-tDCS) administers weak electric current through multiple electrodes, enabling focal brain stimulation. An increasing number of studies investigate the effects of anodal HD-tDCS on the enhancement of working memory (WM). The effectiveness of the technique is, however, still unclear.

Objective/Hypothesis: This systematic review analyzed the current literature on anodal HD-tDCS for WM enhancement, investigating its effectiveness and the influence of different moderators to allow for comparison with conventional tDCS.

Methods: Following the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines, a comprehensive literature review was conducted using PubMed, Web of Science, and Scopus. Sixteen single- or double-blind, sham-controlled studies were included in the review. Eleven studies were included in the meta-analysis, focusing solely on stimulation of the left prefrontal cortex (PFC).

Results: No significant effect of anodal HD-tDCS on the left PFC for WM accuracy was found ($p = 0.08$). Further analysis revealed heterogeneity in the results. Moderator analysis indicated a significant difference between studies that repeatedly used HD-tDCS enhanced WM training and studies with one-time use of HD-tDCS ($p < 0.001$), the latter having a smaller effect size. Another moderator was the research design, with differences between within-subjects-, and between-subjects designs ($p < 0.05$).

Within-subject studies showed lower effect sizes and substantially lower heterogeneity. Qualitative analysis reinforced this finding and indicated that the motivation of the participant to engage in the task also moderates the effectiveness of HD-tDCS.

Conclusion: This review highlights the importance of inter-individual differences and the setup for the effectiveness of anodal, HD-tDCS augmented WM training. Limited evidence for increased sensitivity of HD-tDCS to these factors as compared to conventional tDCS is provided.

Research Category and Technology and Methods

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

Keywords: HD-tDCS, Working Memory, Meta-Analysis, Systematic Review

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P1.059

IN VIVO LOW-INTENSITY MAGNETIC STIMULATION DURABLY ALTERS NEOCORTICAL NEURON EXCITABILITY AND SPONTANEOUS ACTIVITY

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Abstract

Repetitive transcranial magnetic stimulation (rTMS), either used at high- (in Teslas, T) or low-intensity (in μT-mT; LI-rTMS), shows promise in treating human neurological dysfunctions. However, the processes activated by magnetic fields at the single neuron level remain largely unknown, preventing the optimization of potentially therapeutic TMS protocols in terms of efficacy or safety.

We investigated the impact of LI-rTMS on spontaneous activity and excitability of pyramidal cortical neurons by combining focal magnetic stimulation and intracellular recordings from the primary somatosensory cortex in sufentanil-sedated rats. Neuronal electrical properties were compared before and after 10 minutes of continuous LI-rTMS applied at 10 Hz.

LI-rTMS protocol reliably evoked firing at ~5 Hz during the stimulation period and induced durable attenuation of synaptic activity and spontaneous firing in cortical neurons, through membrane hyperpolarization and a reduced intrinsic excitability. However, inducing firing in individual neurons by repeated intracellular current injection did not reproduce the effects of LI-rTMS on neuronal properties.

These data provide a novel understanding of the mechanisms underlying magnetic brain stimulation showing that even weak magnetic fields can activate neurons and enduringly modulate their excitability.

Research Category and Technology and Methods

Basic Research: 10. Transcranial Magnetic Stimulation (TMS)

Keywords: LI-rTMS, neocortex, neuronal excitability, in vivo intracellular recordings

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P1.060

THE EFFICACY OF NON-INVASIVE BRAIN STIMULATION TECHNIQUES ON CHRONIC PRIMARY PAIN DISORDERS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Background: Chronic Primary Pain (CPP) is characterized by an intense pain, not explained by lesions/damage to the nervous system, lasting for more than three months. Not all CPP patients benefit from standard pharmacological therapies nor are suitable for invasive neurosurgery treatments.

Non-invasive brain stimulation (NIBS) uses cortical stimulation to reduce pain by directly altering brain activity, and its effects in treating CPP is still unclear. Objectives: We aimed at evaluating NIBS effects on CPP patients.

Methods: A PRISMA systematic review was performed in PubMed, Embase, Scopus and Web of Science in May 2021. English-written, original studies measuring the effects of NIBS on pain perception were considered. The quality of studies was assessed with the Cochrane Risk of Bias and the Robins-I. The meta-analysis was conducted only on sham-controlled double-blinded studies. The pain intensity, measured through visual or numerical rating scales, was used as outcome of interest. Results:134 studies were included, comprising 2444 patients and 5 different Primary Pain conditions. The meta-analysis was run on a preliminary cohort of 42 studies. When compared to sham effects, real NIBS induced a significant

decrease of pain intensity (SMD −0.59 [CI: −0.85, −0.34]; p < 0.001). Meta-regression analysis did not show any effect of type of NIBS (i.e., rTMS vs tDCS), target region (i.e., DLPFC, M1, S1, dACC, PFC, VC) and protocol type (i.e., excitatory vs inhibitory). Discussions: Our findings show a reduction of perceived pain after real vs sham stimulation. This result was confirmed also separately for tDCS and TMS. The target region, as well as the protocol intensity didn't influence the results. This suggests that NIBS can be used as an alternative or as a combined approach in CPP treatment, but more randomized clinical trials are needed to further explore the mechanisms underlying its effects.

Research Category and Technology and Methods
Clinical Research: 10. Transcranial Magnetic Stimulation (TMS)
Keywords: metanalysis, systematic review, chronic pain, NIBS

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P1.061

CLINICAL TRANSSPINAL DIRECT CURRENT STIMULATION FOR PAIN TREATMENT. EVALUATION INCLUDING FACTORS PREDICTING TREATMENT OUTCOME.

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Abstract
Introduction: Transspinal Direct Current Stimulation (tsDCS) has been reported to block pain signaling. To approach clinical usage, studies are needed to define which patients will benefit from this type of neuromodulation, which predictors can be used and how the stimulation paradigms should be formed, ideally individualized.
Methods: Patients (n=20) with clinically and neurophysiologically verified neuropathic pain due to polyneuropathy were recruited. The study had a randomized, double-blind, placebo-controlled crossover design. BDNF polymorphism was investigated in DNA from buccal mucosa cells. Type and amount of pharmacologic treatment was recorded. Body mass index (BMI) was calculated. Clinical signs (VAS; pain and sleep quality) were reported twice daily, one week prior to, and one week after the stimulation/sham period.
tsDCS (2,5 mA, 20 min) was given once daily at three days (Monday, Wednesday and Friday) for one week. After a washout for one week, another baseline period was recorded before the next week of stimulation.
Results: No carryover effect was seen.
The less common variant of BDNF (Val66Met) was carried by 35 % of the patients. This group had a lower general level of pain. Regarding effects on pain and sleep, at the group level, tendencies to-, but no significant effects were found. However, looking at individuals, 30- and 35 % had a clinically significant (> 30 % change) improvement of pain level and sleep quality respectively the first day after the stimulation. Both effects were reduced over the coming week and these changes were negatively correlated. Pharmacologic treatment and BMI had no influence.
Conclusions: The type of BDNF one carries, seems to influence the level of pain that polyneuropathy produces. Anodal thoracic tsDCS reduces pain and improves sleep with large inter-individual differences: Roughly 30 % will benefit in a clinically meaningful way. Individualized and intensified tsDCS may be a treatment option for neuropathic pain.

Research Category and Technology and Methods
Clinical Research: 25. Therapeutics
Keywords: tsDCS, pain, polyneuropathy, prediction

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P1.062

REMEMBER NIBS? TACS IMPROVES MEMORY PERFORMANCE IN ELDERS WITH SUBJECTIVE MEMORY COMPLAINTS

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Abstract
Subjective memory complaints (SMC), the main cognitive component of which is event memory, is a predictor of Alzheimer's disease in elderly people. The purpose of this study was to investigate the effect of transcranial alternating current stimulation (tACS) with theta frequency on the medial prefrontal cortex in the improvement of episodic memory in individuals with SMC in a double blind, randomized, and sham-controlled parallel study. Sixteen participants with SMC received theta tACS on the medial prefrontal cortex (mPFC) in two active and sham groups. EEG was recorded and Rey Auditory Verbal Learning Test (RAVLT) was administered. tACS resulted in a significant improvement in episodic memory performance as measured by RAVLT. Analysis of EEG data revealed a decrease in theta power, decrease in theta, alpha, and gamma current source density (CSD) in the postcentral, insula, and cingulate gyrus, and decrease in theta and gamma phase synchronization after as a result of active tACS, compared to the sham group. Moreover, a significant correlation between delayed recall score of RAVLT and CSD in left inferior gyrus in theta frequency band was observed. The results of the current study showed that theta tACS of the mPFC can improve event memory in individuals with SMC through modulating the activity in the frontal and temporal regions in the brain, thus can be considered a potential therapeutic intervention for this population.

Research Category and Technology and Methods
Translational Research: 8. Transcranial Alternating Current Stimulation (tACS)
Keywords: tACS, Subjective memory complaints, Episodic memory, mPFC

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P1.063

AGE ISN'T JUST A NUMBER: USING TMS TO DAMPEN BRAIN REACTIVITY TO ALCOHOL CUES IN YOUNGER INDIVIDUALS WITH ALCOHOL USE DISORDER

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Abstract
Alcohol Use Disorders (AUD) are prevalent, difficult to treat, and have increased in prevalence following the COVID-19 pandemic. Younger adults aged 25-44 have seen the largest increases in projected alcohol-related mortality since the initiation of the pandemic. Transcranial magnetic stimulation (TMS) may be a promising therapeutic approach for AUD. Most of the TMS studies investigating AUD, however, have focused on older adults. Younger adults are likely more sensitive to the rewarding aspects of alcohol cues (mediated by the medial prefrontal cortex (mPFC)) and may have a relatively underdeveloped ability to resist those cues (likely mediated by the dorsolateral prefrontal cortex (dlPFC)). The goal of this study was to evaluate the relative effect of TMS to the mPFC versus TMS to the dlPFC on decreasing alcohol cue reactivity in younger adults with AUD.