TU-105. Transcranial electric stimulation over posterior parietal cortex and short-term associative memory – Differential effects of constant vs. theta frequency oscillatory stimulation

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Introduction: Transcranial electric stimulation (tES) techniques are promising tools for neuromodulation of memory functions. However, previous findings on their effectiveness are inconsistent and there have been only a few studies directly contrasting different types of stimulation and examining their differential effects on memory performance. The study objective was the comparative assessment of the online effects of three types of tES over the left posterior parietal cortex (PPC) on the enhancement of short-term associative memory. The three tES types were, constant anodal tDCS (1.5mA), and two types of personalized theta frequency (4-8Hz) oscillatory stimulation protocols - oscillatory tDCS (otDCS, 1.5mA ± 0.5mA) and tACS (0 ± 1mA). Participants (N = 40) took part in the sham-controlled cross-over experiment where they performed parallel forms of the short-term associative memory task while receiving different stimulation types in four counterbalanced experimental sessions (tDCS, otDCS, tACS, and sham). The stimuli within the short-term associative memory task consisted of digit-color association sequences in which single-digits (0-9) were presented sequentially on the cards of different colors. Participants were instructed to try to remember the digit-color associations presented in each sequence. The length of sequences varied between three (low-demand) to five stimuli (high-demand). At the end of each sequence, the participants were presented with one of the previously seen colored cards and they needed to recall the digit that was presented on a given card. Planed contrasts within repeated-measures ANOVA showed that relative to sham constant anodal tDCS improved short-term associative memory for both low- and high-demand sequences, while two oscillatory protocols improved memory performance in high-demand sequences only. The results indicate that different stimulation protocols potentially affect different cognitive processes. Namely, the effects of constant anodal tDCS on the cognitive performance seem to be mediated by the facilitation of low-level attention processes, while the effects of both otDCS and tACS appear to affect processes that are more central to the associative binding.

doi:10.1016/j.clinph.2022.07.009

TU-106. Correct end-of-study guess does not moderate the effects of tDCS on associative and working memory

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Introduction: In recent years, non-invasive brain stimulation (NIBS) techniques have shown promising effects on cognitive enhancement. Transcranial direct current stimulation (tDCS) is one of the most widely used NIBS techniques in cognitive neuroscience. Even though neurophysiological and behavioral effects of tDCS have been demonstrated across a wide range of cognitive and motor functions, the findings were not always consistent. Hence, there is an increasing interest in factors that may moderate the effects, one of which could be the participants' beliefs of the tDCS condition (i.e., real or sham) they received. Thus, this study aimed to explore if participants' beliefs about received stimulation type (i.e., the success of blinding) impacted their task performance in tDCS experiments on associative memory (AM) and working memory (WM). We analyzed data from four within-subject, sham-controlled tDCS experiments (N = 83). Two AM experiments included 20 minutes of anodal 1.5mA tDCS over posterior-parietal cortex (PPC) – left hemisphere in Experiment 1; right hemisphere in Experiment 2. WM experiments targeted PPC and dorsolateral prefrontal cortex – left side in Experiment 3; right side in Experiment 4, with 20 minutes of 1.8mA anodal tDCS. The participants completed memory tasks after the stimulation. The order of the sessions was counterbalanced across participants. At the end of the last session, they were asked to try to guess the session in which they received sham stimulation. We found no evidence that sham guessing moderated post-tDCS memory performance in experiments in which tDCS effects were observed as well as in those that showed null effects of tDCS. Specifically, we found no evidence for the interaction between actual stimulation condition and correct sham-guessing across all experiments and outcome measures (p-values range 0.12 – 0.99). Also, correct sham-guessing had no effect on the AM or WM improvement following active stimulation in the joint analysis performed on a single dataset combined from all experiments ($F_{(1,248)}$ = 1.61, p = 0.21, η_p^2 = 0.01, BF_{10} = 0.31). The results suggest that the placebo-like effect stemming from participants' beliefs about the stimulation type they received is unlikely to influence the results in tDCS memory experiments. We discuss the results in light of the growing debate about the relevance and effectiveness of blinding in brain stimulation research.

doi:10.1016/j.clinph.2022.07.010

TU-107. TMS is effective in localizing language cortices in a cohort of children and individuals with neurological conditions and intellectual disability

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Introduction: Language mapping is a crucial part of the pre-surgical evaluation for patients with epilepsy or brain tumor. However, access to some techniques for functional mapping such as magnetoencephalography (MEG) and functional MRI (fMRI), without sedation, is limited in the pediatric population, in addition to individuals with neurodevelopmental disorders. Information from MEG and fMRI carried out under sedation are non-informative in about 30% of cases. Transcranial magnetic stimulation (TMS) has recently emerged as a robust and practical non-invasive language mapping tool that is safe and well-tolerated by children and adolescents. In this study, we sought to further analyze the efficacy of TMS in identifying language dominance in a predominantly pediatric cohort with neurological conditions and in persons with neurodevelopmental disorders inclusive of autism spectrum disorder (ASD), ADHD, and ID.
Methods: We performed a retrospective chart review and identified 233 patients (17.2 ± 6.9 y, 75% 18 y, 123 f) with epilepsy or brain tumor who underwent presurgical TMS language mapping and neuropsychological testing at our institution.
Results: Patients were sorted into 7 groups based on standardized intelligence measures: moderately impaired (n = 20, 46.4 mean IQ), mildly impaired (n = 33, 62.7 IQ), borderline impaired (n = 51, 75.2 IQ), low average (n = 50, 84.8 IQ), average (n = 64, 98.1 IQ), high