Abstract #45

INCREASING PAIN INHIBITION BY WORKING MEMORY WITH ANODAL TRANSCRANIAL DIRECT CURRENT STIMULATION OF THE LEFT DORSOLATERAL PREFRONTAL CORTEX

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Abstract

Pain perception is affected by interactions between top-down and bottom-up processes. Neuroimaging studies have shown that these interactions are regulated by the dorsolateral prefrontal cortex (DLPFC). Besides, working memory (WM) performance can be improved by transcranial Direct Current Stimulation (tDCS) of the left DLPFC. Thus, the aim of the present study was to test whether tDCS of the left DLPFC can increase pain inhibition through improvement of WM performance. Forty healthy volunteers were recruited to participate in two tDCS sessions (anodal and sham) during which pain sensation was evoked by electrical stimulation over the right sural nerve. WM performance was measured using a 2-back task and pain inhibition by WM was assessed by changes in pain intensity in 2-back task compared with control (no task). Painful stimuli evoked the nociceptive flexion reflex (NFR), which was used as an index of spinal nociceptive transmission. Results indicate that in baseline conditions, WM inhibited pain intensity ($p<0.001$) but not the NFR ($p=0.19$). After anodal tDCS, pain intensity was unchanged in control condition ($p=0.84$) but WM performance and pain inhibition by WM were improved compared with baseline ($p<0.001$) and ($p=0.048$), respectively. In contrast, no effect was observed with sham tDCS ($p=0.13$). These results indicate that tDCS of the DLPFC does not modulate pain perception itself, but improves pain inhibition by WM, possibly by enhancing WM performance. This furthers our understanding of interaction between pain and cognition and has important implications for clinical conditions in which interventions aim at improving WM or cognitive pain inhibition.

Abstract #46

THE EFFECTS OF TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) ON A DISCRETE NAMING TASK IN HEALTHY ADULTS

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Abstract

Background

Anodal (e.g., excitatory) transcranial direct current stimulation (tDCS) over FC5 has been shown to enhance performance on overt speaking tasks and positively impact intermuscular coherence (IMC). The extent to which these effects are modulated as a function of producing familiar vs. unfamiliar words has not yet been evaluated.

Methods

Thirty adults (ages 18-45 yrs) read aloud two matched sets of letter strings before and after 13 minutes of tDCS (1mA) over Broca's area. The task consisted of familiar words (e.g., regular words, hint, exception words, pint) and unfamiliar words (e.g., nonwords, bint, pseudohomophones, pynt). Participants were blinded to their assignment of receiving either anodal, cathodal or sham stimulation. Effects of stimulation condition on accuracy (ACC), RT and IMC were evaluated.

Results

In the anodal condition, ACC decreased in pseudohomophones. In the cathodal condition, ACC decreased in familiar words, and increased in unfamiliar words. Preliminary analyses showed that changes in IMC were sensitive to stimulation condition. Further analyses will address the prediction that anodal stimulation will decrease RT on familiar words and increase RT on unfamiliar words. Cathodal stimulation will have the opposite effects.

Impact

The current project expands our knowledge of the effects of tDCS over Broca's area on speech motor control. Such information is important to understanding the underlying mechanisms associated with disruptions or delays to these systems and have the potential to inform new approaches for remediation of reading impairments for individuals with dyslexia and older adults.

Abstract #47

PHYSIOLOGIC ARTIFACTS WHEN COMBINING EEG AND TDCS

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Abstract

The field of non invasive brain stimulation (NIBS) has benefited from integration with imaging including magnetic resonance imaging (MRI) and electroencephalography (EEG). Several studies have reported on concurrent tDCS and EEG, and used signal processing of varying complexity (e.g. high-pass filtering to ICA) to remove "non-physiologic stimulation artifacts" - namely artifacts arising from non-ideal stimulation and recording amplifier performance. None has addressed "physiologic artifacts" which are defined here as non-stationary changes in artifacts resulting from interactions between the stimulation induced voltage and body. We identified and systematically characterized a series of tDCS induced physiologic and non-physiologic artifacts during concurrent EEG and High Definition (HD) -tDCS, and adapted subject-specific computational modeling to corroborate physiological EEG findings. Physiologic artifacts include 1) cardiac distortion; 2) ocular motor distortion; 3) movement (myogenic) distortion. In each case, the artifact was montage, intensity, and polarity specific; as such contamination from these physiologic artifacts cannot be accounted for by typical control experiments (e.g. EEG changes that are dose specific). High resolution finite element models explained artifact based on specific impedance changes. Importantly a) physiologic artifacts are universal, they are nominally independent of device and so exist regardless of devices; b) the broad-band nature of contamination may confound a broad range of experiments (e.g. oscillations, ERP); c) removal of artifacts requires recognition of their peculiar dynamic and individualized nature.

Abstract #48

PHYSICIAN-MONITORED HOME TDCS FOR POST-BRAIN INJURY FATIGUE, DEPRESSION AND HEADACHE: A CASE REPORT

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