

#### 453 REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION OF THE DORSAL ANTERIOR CINGULATE CORTEX IN THE TREATMENT OF OBSESSIVE COMPULSIVE DISORDER: A DOUBLE BLIND RANDOMIZED CLINICAL TRIAL

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**Background:** Obsessive compulsive disorder (OCD) is a debilitating disorder, and many patients do not respond favorably to current treatments. In a previous open label pilot study, we found that low frequency (LF) repetitive transcranial magnetic stimulation (rTMS) of the dorsal anterior cingulate cortex (dACC) produced a reduction of OCD symptoms.

**Objective:** To evaluate the efficacy of LF-rTMS over the dACC for the treatment of OCD symptoms in a randomized, double-blind, sham-controlled clinical trial.

**Methods:** 18 patients with OCD were randomly assigned to receive either active or sham stimulation. Treatment location was identified using Brodmann mapping of high resolution MRI scans for each participant inBrainsight neuro-navigation software. 20 sessions of 1200 pulses at 1-Hz frequency were applied over the dACC using either an active or sham double-cone coil at 120% of motor threshold with 2 minute intervals between trains. Participants received two treatments per day, separated by a 15-minute break, over two weeks. Symptoms were assessed using the Yale-Brown Obsessive Compulsive Scale (YBOCS) at sessions 0, 10, and 20 of treatment, as well as monthly for 3 months post-rTMS.

**Results:** Repeated measures ANOVA indicated an overall change in Y-BOCS scores over time ( $F_{16,5} = 3.205$ ,  $p < .05$ ). Post-hoc analysis revealed a significant change in scores from baseline to mid-treatment ( $F_{16,5} = 3.205$ ,  $p < .001$ ; pairwise comparisons with Bonferroni correction). There was no significant difference in symptom improvement between active and sham treatment groups ( $F_{16,5} = 0.592$ ,  $p > .05$ ). Two-sample t-tests demonstrated no significant percent reduction in YBOCS scores between treatment groups acutely ( $t(13) = -1.46$ ,  $p > .05$ ) nor chronically ( $t(12.6) = -0.153$ ,  $p > .05$ ).

**Conclusion:** 20 sessions of active low frequency rTMS stimulation over the dACC was no more effective than sham stimulation in reducing OCD symptoms.

**Keywords:** rTMS, OCD, clinical trial, neuropsychiatry

#### 454 BEHAVIORAL AND HEMODYNAMIC EFFECTS OF PREFRONTAL ANODAL STIMULATION IN HEALTHY OLDER ADULTS: A SIMULTANEOUS TDCS-fNIRS STUDY

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Several studies have evaluated the effect of anodal transcranial direct current stimulation (tDCS) over the prefrontal cortex (PFC) for the enhancement of working memory (WM) performance. However, results are mixed, and the functional consequences of prefrontal tDCS during WM tasks are still unknown, especially regarding potential benefits for cognitive aging. The present study addresses this question by testing healthy older adults with a multimodal approach. Twenty-one participants (mean age = 69.7 years; SD = 5.05) took part in the study attending three sessions. In the first two, participants performed a WM task both before, during and after the delivery of 1.5 mA anodal tDCS/sham over the left PFC. The anode was placed between F3 and F7 (International 10-20 system), with the cathode over the contralateral shoulder. Anodal tDCS lasted 26 minutes, while the sham only 30 seconds, both with a fade-in and fade-out of 30 seconds. The order of the two sessions was counterbalanced across participants. During the stimulation, participants also received performance contingent feedback (high or low monetary incentives) for fast and correct responses at the WM task. In both sessions, hemodynamic activity of the bilateral frontal, motor and parietal areas was recorded with functional near-infrared spectroscopy (fNIRS). The third session consisted with a standard neuropsychological assessment. Results show a significant impact of tDCS on both WM performance and hemodynamic activity.

Specifically, faster responses at the WM task were observed both during and after anodal tDCS, while no differences were found during and after the sham. This effect was however significant only taking into account individual visuo-spatial WM capacity, with greater benefit found for low WM capacity participants. Moreover, increased hemodynamic activity was found in the bilateral PFC during and after the anodal tDCS, when compared with the sham stimulation, while no effects were detected in both motor and parietal areas.

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**Keywords:** tDCS; fNIRS; working memory; aging

#### 455 TARGETING CORTICAL OSCILLATIONS WITH EEG-INFORMED TMS: POTENTIAL AND CHALLENGES

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**Background:** EEG-triggered transcranial magnetic stimulation (TMS) allows to target specific oscillatory brain states. This method can be used in real time to test whether or how the functional brain response to TMS is modulated by the phase and power of pericentral alpha oscillations (mu-activity).

**Methods:** In 14 young adult volunteers (5 females, average age: 23 years), we triggered single TMS pulses at a specific phase of the intrinsically expressed pericentral mu-rhythm. Corticomotor excitability was assessed with single-pulse TMS using the mean amplitude of the motor evoked potential (MEP) as a primary outcome measure. We defined no exclusion criterion based on the individual expression of mu-power. A linear mixed effects model with the fixed effects "mu-phase", "mu-power" and "inter-stimulation interval" (ISI) and the random effect "participant" was used to test for state-dependent changes in MEP amplitude.

**Results:** Phase-triggered TMS reliably targeted four distinct phases of the ongoing mu-oscillations (0, 90, 180 and 270 degrees). Linear mixed effects analyses revealed no significant main effect of phase, but significant main effects for power and ISI as well as a significant interaction between power and ISI.

**Conclusion:** Phase-triggered TMS is technically feasible in the alpha frequency range. Phase-triggering can be used to study the neurophysiology of cortical oscillations. The ISI between two consecutive TMS pulses and the power (but not phase) of pericentral mu-alpha oscillations at the time of stimulation contribute to fluctuations in corticomotor excitability. These findings have implications for future attempts to personalize TMS protocols based on individual oscillatory brain activity patterns.

**Keywords:** EEG, TMS, State dependence, cortical oscillation

#### 456 EFFECT OF CATHODAL TRANSCRANIAL DIRECT CURRENT STIMULATION TO THE LEFT VENTROLATERAL PREFRONTAL CORTEX ON RESTING STATE DEFAULT MODE CONNECTIVITY

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**Background:** Transcranial direct current stimulation is a non-invasive method of modulating brain function by passing a small electric current across the scalp. The method may have therapeutic potential, but its effect on *in vivo* neural activity remains poorly understood. Here, we examined resting fMRI activity in individuals with bipolar disorder and healthy controls following 1mA cathodal stimulation to the left ventrolateral prefrontal cortex (LVL PFC).

**Method:** Resting state fMRI data (6mins) was obtained in 25 euthymic individuals with bipolar disorder and 25 matched healthy controls following 17.5mins of cathodal 1mA stimulation to the LVL PFC (LVL PFC condition) or to the left somatosensory cortex (LSS condition) during separate, counterbalanced sessions. An extracephalic anode was used in both cases. Data were analyzed using standard seed-based resting state analysis methods, with a posterior cingulate cortex (PCC) seed region. Functional connectivity Z statistics were extracted from a rostral anterior cingulate cortex (rACC) region of interest.