depression. Future work should assess whether PAS-EEG to the DLPFC can help predict therapeutic outcome with iTBS.
Keywords: Treatment-Resistant Depression,TMS, DLPFC, neuroplasticity

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OPTIMIZATION OF VAGUS NERVE THERAPY : A STUDY OF THE BEHAVIORAL AND ELECTROPHYSIOLOGICAL EFFECTS OF TRANSCUTANEOUS VNS

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With only 1/3 of refractory epileptic patients responding to vagus nerve stimulation (VNS) therapy, this intervention still needs further research. Transcutaneous-VNS (T-VNS) is a non-invasive device stimulating the auricular branch of the vagus nerve, which was suggested to affect pain perception. Thus, T-VNS effects on behavioral and brain responses to nociceptive and non-nociceptive somatosensory stimuli could account for potential biomarkers of VNS effectiveness.
5 healthy volunteers participated to the study. During a 2-day protocol, T-VNS was delivered on the left ear for 3 hours with randomized active stimulation (cymbae conchae) or active control (earlobe). Before and after T-VNS, nociceptive (CO_2 laser recruiting either A-δ or C fibers; 128 mN pinprick) and non-nociceptive (vibrotactile; cool) stimuli were applied on the contralateral hand dorsum. Perception thresholds, intensity, and quality were retrieved as behavioral responses. Using scalp electroencephalography (EEG; sampling rate: 512 Hz), we recorded event-related potentials (ERPs) elicited by thermonociceptive, cool, and vibrotactile stimuli, delivered in separate blocks (40 stimuli per block), randomized across participants.
Both active T-VNS and sham stimulation showed antinociceptive effects, reflected in a decrease of the amplitude of the ERPs elicited by thermonociceptive stimuli in 4 et 3 participants respectively. In contrast, no clear effect was found for behavioral responses, indicating a dissociation between ERPs and perception.
These preliminary results suggest that the overall antinociceptive effect of t-VNS is rather unspecific, most probably resulting from the global stimulation of the auricular nerves rather than that of the sole vagal branch. Additional comparison with trigeminal stimulation and more participants are needed to increase statistical power and significance.
Keywords: VNS, T-VNS, nociception

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EXPLORATORY STUDY OF OPTIMAL CONDITIONS OF REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION OF THE PRIMARY MOTOR CORTEX FOR CHRONIC PAIN

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Background: Recent meta-analyses reported that high-frequency repetitive transcranial magnetic stimulation (rTMS) of the primary motor cortex (M1) was safe and had a transient pain-relieving effect in patients with neuropathic pain. However, the efficacy rate was not high in our pilot randomized controlled trial, in which we adopted a 5-Hz rTMS with 500 pulses per session. Therefore, exploration of an optimal stimulus condition is required. In this study, we investigated multiple stimulus conditions to explore an optimal stimulus condition of M1-rTMS.
Methods: We conducted a randomized, blinded, crossover exploratory trial of M1-rTMS in patients with chronic pain. Patients were randomly received four single-session of intervention at least two weeks apart. The tested stimulus conditions were 5 Hz with 500 pulses per session; 10 Hz with 500 pulses; 10 Hz with 2,000 pulses; and sham stimulation. The outcome measures were a visual analogue scale (VAS), the Short-form McGill Pain Questionnaire 2 (SF-MPQ2), and the Patient Global Impression of Change (PGIC). Statistical analyses were performed by a mixed-effect model (fixed effect: intervention, order, interaction between intervention and order; random effect: subject) and multiple comparisons.
Results: 19 patients (13 central post-stroke pain, 3 peripheral neuropathic pain, 3 others) were enrolled in the study. There was a significant effect of intervention (i.e. stimulus condition) on PGIC ($p=0.03$). Multiple comparisons with correction revealed that 10-Hz rTMS with 2,000 pulses provided better pain relief on SF-MPQ2 compared to sham ($p=0.04$). Multiple comparisons without correction revealed that 10-Hz rTMS with 2,000 pulses provided better pain relief on VAS, SF-MPQ2, and PGIC compared to sham; on SF-MPQ2 and PGIC compared to 10-Hz rTMS with 500 pulses. No serious adverse events were observed.
Conclusion: Among tested stimulus conditions, 10-Hz rTMS with 2,000 pulses per session could be most effective in patients with chronic pain.
Keywords: Repetitive transcranial magnetic stimulation, Chronic pain, Motor cortex stimulation

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EXPLORING THE TARGETED APPLICATION OF TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) FOR COGNITIVE MODULATION AFTER BRAIN INJURY

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Traumatic brain injury (TBI) causes impaired cognitive control, for which effective treatments are lacking. Response inhibition, which can be assessed by the Stop Signal Task (SST), is a key component of cognitive control and can be assessed by the Stop Signal Task (SST). Previous work has found that post-traumatic structural damage to the Salience Network (SN) is associated with abnormal Default Mode Network (DNM) activation, SN-DMN connectivity and poor SST performance.
We investigated whether tDCS applied to the right inferior frontal node of the SN can improve cognitive deficits after TBI, using a simultaneous fMRI-tDCS protocol to measure brain network responses to stimulation. TBI patients ($n=34$) and healthy controls ($n=26$) underwent 3 sessions of fMRI-tDCS (2mA peak; sham, anodal, cathodal; active electrode F8, extracranial return) whilst performing the SST. TBI participants were then randomly allocated to have 4 days of either anodal or sham tDCS. After this, TBI participants repeated the single-session experiment. Diffusion Tensor Imaging (DTI) was used to assess structural connectivity.
Anodal tDCS improved response inhibition in healthy participants, an effect which was dependent on high SN structural connectivity. In TBI participants, behavioural improvement with anodal tDCS was also positively correlated with SN tract structural connectivity, as well as DMN structural connectivity and time since injury. Cognitively impaired TBI participants had abnormal DMN activation, which anodal tDCS partially normalised. Both anodal and cathodal tDCS modulated DMN connectivity. In TBI participants, the extent of functional connectivity changes with anodal tDCS also correlated with task performance under anodal tDCS. Daily anodal tDCS did not have additional benefit on SST performance, but did on other cognitive tests.
Our study supports the Salience Network being a potential target for modulating cognition and also cognitive network function. We also highlight that network structural connectivity is an important modulator of response to tDCS.
Keywords: traumatic brain injury, cognitive control, fMRI, salience network

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THE ROLE OF MOVEMENT KINEMATICS IN NEURAL CHAIN SELECTION DURING ACTION OBSERVATION

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The ability to understand intentions based on another's movements is crucial for human interaction. This ability has been ascribed to the so-called *motor chaining* mechanism: any time a motor chain is activated (e.g., grasp-to-drink), the observer attributes the corresponding intention to the