Abstract
Background
Mindfulness-based relapse prevention (MBRP) has been shown to reduce symptoms of alcohol use disorder (AUD), such as craving and impulsivity, both of which are associated with decreased heart rate variability (HRV) and altered electrodermal activity (EDA)—key indicators of autonomic nervous system regulation. However, the underlying brain mechanisms driving MBRP's effects remain unclear. Specifically, it is unknown whether the reduction in symptom severity stems from improved autonomic regulation or enhanced cognitive control. In this study, we aim to address this question using a novel approach that selectively enhances frontal midline theta (FMT) oscillations, which are closely linked to cognitive control.
Hypotheses
Enhancement of FMT oscillations using closed-loop amplitude-modulated transcranial alternating current stimulation (CLAM-tACS) during MBRP will improve cue reactivity, behavioral inhibition and drinking behavior compared to baseline or open-loop stimulation. Enhancement of FMT will result in higher HRV and lower EDA during cognitive tasks.
Methods
Detoxified AUD patients will undergo 6 weeks of MBRP, including weekly group sessions, daily mindfulness practice, and weekly audio-guided meditation with either CLAM-tACS or open-loop tACS. Cognitive control will be assessed through a Go/No-Go task, while cue reactivity will be measured with a passive viewing task, along with EDA and HRV metrics pre- and post-treatment. Clinical measures of craving and impulsivity will also be evaluated, with a 3-month follow-up for assessing abstinence. A mixed-model ANOVA will compare outcomes between groups over time.
Results
We anticipate CLAM-tACS to enhance FMT oscillations, leading to improved cognitive control, reduced cue reactivity, higher HRV, and lower EDA, along with reduced craving and higher abstinence rates compared to open-loop tACS.
Conclusions
Our study will provide causal evidence of FMT's role in cognitive control and addictive behavior in AUD, with potential implications for neuromodulatory treatments targeting cognitive control in AUD and related conditions.
Research Category and Technology and Methods
Clinical Research: 7. Responsive (Closed-Loop) Stimulation
Keywords
Alcohol Use Disorder, closed-loop tACS, Cognitive control, Mindfulness-based relapse prevention

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P2.028

COMBINED TRANSCRANIAL ALTERNATING CURRENT STIMULATION AND PERCEPTUAL LEARNING FOR VISION IMPROVEMENT IN A SINGLE-CASE STUDY OF CONE DYSTROPHY

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Abstract
Cone dystrophy is a rare genetic disorder characterized by the progressive degeneration of cone photoreceptors, resulting in significant visual impairment. This multiple baseline single-case study explored the effects of combining peri-orbital transcranial alternating current stimulation (tACS) with perceptual learning to enhance visual function in a patient with cone dystrophy. We assessed visual acuity, Vernier acuity, and contrast sensitivity, and conducted a Tau-U analysis to evaluate the results. While the Study revealed promising improvements in several visual functions, particularly in the early stages of testing, the specific impact of tACS was not evident. Our findings suggest that perceptual learning may have the potential to improve visual perception in individuals with cone dystrophy. However, further Research with larger and more diverse populations is necessary to determine the true efficacy of peri-orbital tACS and to better understand the mechanisms underlying the observed improvements.
Research Category and Technology and Methods
Clinical Research: 8. Transcranial Alternating Current Stimulation (tACS)
Keywords
Cone dystrophy, Perceptual learning, tACS, Single-case study

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P2.029

EVOKED SLOW OSCILLATIONS AND DYNAMIC NETWORK REORGANIZATION AFTER STROKE

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Abstract
A focal ischemic lesion is thought to alter neuronal activity beyond the area of structural damage, thereby interfere with the whole network architecture.
Here, we used a combination of transcranial magnetic stimulation and electroencephalography (TMS-EEG) in conjunction with dynamic connectivity analyses and graph theory to study alterations and reorganization of cortical connectivity in a cohort of 42 patients longitudinally after stroke. We found a link between an increase of low-frequency coupling in the delta band and alterations in neural information processing in the first weeks after stroke and their relevance for motor outcome more than three months later. We demonstrate that stroke enhances slow activity and delta coupling between frontocentral and parietal regions. In addition, we observed a loss of the physiological network architecture with a decrease of small-worldness and modularity in the delta frequency, implying that a focal ischemic lesion interferes with both cortical information integration and functional segregation within the first weeks after stroke. While we found a link between bifrontal coupling in the alpha spectrum and the degree of the motor deficit in the early post-acute phase, the amount of small-worldness disruption early after stroke indicated the motor outcome in the follow-up session. In contrast, recovery of motor function and cortical reorganization after more than three months post-stroke were paralleled by the normalization of increased low-frequency coupling and a reinstatement of the complex network structure featuring a modular and small-world topology.
Research Category and Technology and Methods
Translational Research: 21. Neurorehabilitation
Keywords
TMS-EEG, Stroke, Neuroplasticity, Lesion

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P2.030

COMBINED TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) AND COGNITIVE TRAINING IMPROVES INHIBITORY CONTROL IN CLINICALLY IMPULSIVE PATIENTS WITH TRAUMATIC BRAIN INJURY

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Abstract
Background. Impulsive behaviors arising following a traumatic brain injury (TBI) are a common challenge facing patients and their caregivers. This study tested the effectiveness of a neuroplasticity-based intervention