Consistent with prior studies, we find that attention away from the hand (i.e. to the head) results in higher pre-TMS hSI beta power, and a correspondingly higher probability of beta events. Additionally, attention to the head vs. hand drives separation of late TEP components (>100 msec post-TMS). Pre-TMS beta activity similarly affects TEPs - trials with vs. without at least one beta event within 300 msec prior to spTMS show separation of late TEP components consistent with attentional modulation, suggesting a causal influence of beta events on the TEP waveform shape.
Ongoing work with the Human Neocortical Neurosolver modeling software (hnn.brown.edu) suggests the neural origin of these effects may be interpreted as beta events recruiting GABA-B inhibition in the supragranular cortical layers (Law et al. 2022).
Research Category and Technology and Methods
Basic Research: 15. Electroencephalography (EEG)
Keywords: TMS-EEG, attention, beta, modeling

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P2.126

MODULATION-BASED TMS: PLASTICITY EFFECTS OF THETA-BURST STIMULATION

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Abstract
Background: Theta-burst stimulation (TBS) is a widely-used plasticity induction protocol. Most TMS devices can only achieve TBS using biphasic pulses, due to the energy recovery required to sustain the repetition rate. However, monophasic pulses are hypothesised to more selectively recruit cortical neurons, which could increase the effectiveness of TBS. Pulse width modulation (PWM)-based devices recover more energy from each pulse, enabling monophasic TBS. Here, we use PWM-TMS and intermittent TBS to test the hypothesis that monophasic iTBS induces a stronger plasticity effect than biphasic iTBS.
Methods: For this single-blinded within-subject study, monophasic and biphasic iTBS were applied to the primary motor cortex of 26 healthy right-handed volunteers (target N=30) using a custom-made PWM-based TMS device. Plasticity was quantified as % increase in the amplitude of motor evoked potentials (MEPs) post-TBS. Both protocols were applied at least one week apart in counter-balanced order. Two baseline blocks (30 pulses each) were applied at 120% of the resting motor threshold (RMT), followed by iTBS (600 pulses, mono-/biphasic) applied at 70% RMT. The predicted plasticity effect (increased MEPs) was assessed over a 1-hour follow-up period in 30-pulse blocks every 5-10 minutes.
Results: In an interim analysis of n=26, rmANOVA revealed a significant effect of Time ($F(8,200)=3.75$; $p<.01$), reflecting the expected increase in MEP amplitudes after iTBS. There was a trend effect of Pulse Type ($F(1,25)=3.67$; $p=.07$), consistent with the hypothesis of a larger MEP increase after monophasic versus biphasic iTBS (mean difference: 7.2%). There was no interaction (Time*Pulse Type: $F(8,200)=0.75$; $p=.65$).
Conclusions: Our study shows that using a PWM-based TMS device, monophasic and biphasic iTBS protocols can induce similar increases in plasticity. The interim analysis suggests a trend in the predicted direction of a larger plasticity induction effect with monophasic versus biphasic iTBS.
Research Category and Technology and Methods
Translational Research: 10. Transcranial Magnetic Stimulation (TMS)
Keywords: transcranial magnetic stimulation, theta-burst stimulation, plasticity, TMS pulse generator

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P2.127

AGREEING TO DISAGREE: INTER-SUBJECT VARIABILITY OF MOOD RATING SCALES DURING RTMS TREATMENT OF DEPRESSION

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Abstract
Background: Outcomes of repetitive Transcranial Magnetic Stimulation (rTMS) for treatment-resistant depression vary widely across published studies. Several different mood rating scales have been used to assess response and remission.
Objective: To compare the performance of three self-report scales (Inventory of Depressive Symptomatology 30-item [IDS], Patient Health Questionnaire 9-item [PHQ], and Profile of Mood States 30-item [POMS]) and the observer-rated Hamilton Depression Rating Scale 17-item (HDRS) in detecting symptom change during rTMS treatment.
Results: 805 subjects with nonpsychotic MDD completed a six-week course of rTMS treatment with weekly self-report and observer ratings. All scales detected significant improvement during treatment, with correlations of Kendall's $\tau=0.71$-0.80 among self-report instruments and $\tau=0.52$-0.56 between self-report and observer-rated instruments ($p<0.001$). Response/remission rates varied widely across instruments: highest was PHQ (54%/34%), followed by POMS (49%/27%), IDS (41%/30%), and HDRS (36%/20%). Higher baseline severity was associated with lower likelihood of remission across all scales (Hazard Ratio 0.86-0.98) and response across self-rated scales except PHQ (HR 0.98-0.99) ($p<0.05$). Greater improvement by session 10 predicted remission across all scales (HR 1.51-3.24, $p<0.001$). Defining outcome based on the minimum number of scales meeting response/remission criteria yielded rates of 56%/37% for at least one scale, 42%/27% for two scales, and 22%/18% for three scales. Using any single scale conferred 5.2-27% risk for not detecting response/remission detected by another scale (lowest with PHQ).
Conclusion: All instruments detected improvement (including early improvement) with rTMS treatment, but degree of improvement varied notably. Use of any single scale conferred a significant risk of not detecting response/remission detected on another. Early improvement appeared more strongly predictive of eventual response/remission on self-rated scales. These findings suggest caution in comparing degree of improvement across studies using different scales, and that accurate assessment of symptom burden over treatment may require multiple instruments.
Research Category and Technology and Methods
Clinical Research: 10. Transcranial Magnetic Stimulation (TMS)
Keywords: rTMS, measurement-based care, depression

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P2.128

ADAPTIVE NETWORK INTERACTIONS IN COGNITION AFTER STIMULATION-INDUCED INFERIOR PARIETAL LOBE INHIBITION

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Abstract
The inferior parietal lobe (IPL) is an important hub of neural network function across multiple cognitive states, contributing to “task-negative” networks (default mode network; DMN) and “task-active” networks. To investigate flexible network behavior in cognition, we combined spaced double continuous theta burst stimulation (cTBS) with functional magnetic resonance imaging (fMRI) in both task and rest states. Thirty healthy, young volunteers participated in three measurements, in which posterior IPL was targeted using either right, left, or sham cTBS, prior to a three-task fMRI experiment encompassing the key cognitive domains attention, semantics, and social cognition. Additionally, all participants completed three pre-post stimulation resting-state fMRI sessions.
Independent component analysis was applied to pre-stimulation resting-state data to identify intrinsic connectivity networks. The detected networks guided back-projection to post-stimulation task data for each subject and session. Using correlational psychophysiological interaction analysis, network interactions were characterized across cognitive domains and stimulation conditions. ANOVAs and post-hoc t-tests within each domain showed that cTBS most effectively influenced network interaction in order of decreasing task complexity, starting from social cognition, followed by semantics and attention. During social cognition, compared to sham, right-hemisphere stimulation increased right fronto-parietal control (rFPCN) and somatomotor network interaction ($p=0.0139$), as well as ventral and dorsal attention network interaction ($p=0.045$). Left-side stimulation increased ventral attention-to-somatomotor network connectivity ($p=0.017$) and decreased dorsal attention and DMN subnetwork connectivity ($p = 0.016$). Right-side stimulation increased interaction between posterior DMN and rFPCN during the semantic task ($p=0.012$), and between the somatomotor network and a DMN subnetwork during the attention task ($p=0.059$). Collectively, our results demonstrate that, rather than inducing local changes, cTBS influences large-scale network interactions in a task-specific manner. The observed patterns suggest that more complex cognitive tasks show increased responsiveness to stimulation, with more distributed changes across networks and distinct, hemisphere-specific patterns between task-positive and task-negative network interactions.
Research Category and Technology and Methods
Basic Research: 18. Functional Brain Imaging
Keywords: network connectivity, cTBS, plasticity, default mode network

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DOES INTERMITTENT THETA BURST STIMULATION CHANGE OSCILLATORY ACTIVITY IN THE TARGETED LEFT DORSOLATERAL PREFRONTAL CORTEX? - A RESTING-STATE EEG STUDY

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Abstract
Background: The repeated delivery of intermittent theta burst stimulation (iTBS) to left dorsolateral prefrontal cortex (DLPFC) has been shown to improve depressive symptoms in patients with treatment-resistant depression. While alteration in brain oscillatory activity, measured by electroencephalography (EEG), has been suggested as potential mechanism of action, it is unclear whether a single session of prefrontal iTBS alters oscillatory activity in left DLPFC.
Methods: We continuously recorded three minutes of resting-state EEG (rsEEG) three times before (pre) and five times after (post) a 10-min iTBS intervention (2s on - 8s off) in 13 healthy subjects. Stimulation targeted the left DLPFC under stereotactic guidance based on the subjects' structural MRI. For each recording epoch, we estimated the spectral power of the EEG signal from the scalp electrode that was closest to the stimulation within the theta, alpha, and beta band. We calculated the average power of each pre-defined frequency band pooling all pre-iTBS and all post-iTBS measurements of the participants. Pre-iTBS and post-iTBS data were separately compared for each frequency band using a Wilcoxon test ($p<0.0167$).
Results: In our data, we did not observe statistical difference between expression of power in different bands before and after intervention ($p > 0.0167$). Moreover, the baseline expression of theta, alpha and beta activity as well as the relative change after iTBS showed large inter-individual variability.
Conclusion: Our preliminary results suggest that iTBS of left DLPFC has no consistent neuromodulatory effect on the expression of resting-state oscillatory activity in the theta, alpha, and beta band. Results will be consolidated by increasing the sample size.
Funding: This study is funded by the Innovation Fund Denmark (IFD) for the Grand Solution project “PRECISION-BCT” (Grant number: 9068-00025A).
Research Category and Technology and Methods
Basic Research: 10. Transcranial Magnetic Stimulation (TMS)
Keywords: iTBS, EEG, DLPFC, Cortical oscillations

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P2.130

THE REGULATION OF EMOTIONS ASSOCIATED WITH SOCIAL EXCLUSION: MODULATING EFFECTS OF TDCS ON PATIENTS WITH BORDERLINE PERSONALITY DISORDER

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Abstract
Background. Patients with Borderline Personality Disorder (BPD) show negative emotional reactions following both social exclusion and normally including scenarios; only experimental conditions of extreme inclusion decrease BPD patients’ rejection-related emotions to levels comparable to healthy individuals. At the brain level, emotional reactions to social exclusion are mediated by the right Ventrolateral Prefrontal Cortex (rVLPFC). Among healthy subjects, the neuromodulation of this region by means of transcranial direct current stimulation (tDCS) decreases negative emotional responses and pain following social exclusion. However, no study yet evaluated whether, among BPD patients, tDCS on rVLPFC reduces the intense negative emotions elicited by both social exclusion and social inclusion.
Methods: Forty BPD patients (36 females) were randomly assigned to receive either real or sham tDCS on rVLPFC while, in a one session experiment, they were socially included, then excluded, and finally over-included by using the Cyberball paradigm. Participants self-reported their level of rejection-related emotions after each Cyberball condition.
Results. Overall, BPD patients reported high levels of rejection-related emotions in the ostracism condition, intermediate in the inclusion condition, and low in the overinclusion condition. tDCS, compared to sham stimulation, reduced the overall levels of rejection-related emotions following both the exclusion and inclusion conditions. tDCS stimulation on rVLPFC did not influence patients’ negative emotions in the overinclusion condition.
Conclusion: Our results showed that tDCS applied to rVLPFC helped to downregulate negative emotions of BPD patients in both excluding and including interactions. Conversely, the sham group manifested higher