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**Deep transcranial magnetic stimulation of the anterior cingulate cortex in obsessive compulsive disorder patients**

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**Objective:** Evaluate whether dTMS targeting the medial prefrontal and the anterior cingulate cortices influences symptom severity in obsessive compulsive disorder (OCD).

**Background:** Converging evidence points toward the involvement of a dysfunctional cortico-striato-thalamo-cortical (CSTC) circuit in OCD. Transcranial magnetic stimulation (TMS) has been applied to treat and investigate OCD. However, conventional TMS coils lack the ability to target the CSTC circuits directly and treatment protocols for OCD showed diversified results. The use of dTMS coils allows direct stimulation of deeper neuronal pathways relative to those affected by conventional TMS coils. We evaluated whether dTMS targeting the medial prefrontal and the anterior cingulate cortices may influence symptom severity.

**Methods:** Forty OCD patients were treated with either dTMS H7/HAC high (20 Hz) or low (1 Hz) stimulation frequencies or sham coil daily for five weeks in a double blind controlled study. OCD symptoms were provoked in each patient in order to activate the OCD circuitry before treatment. EEG measurements were taken at baseline and at the end of treatment.

**Results:** The active 20 Hz dTMS group improved significantly in YBOCS score compared to the 1 Hz and sham groups (26 vs. 6% reduction),  $t(93) = -2.29$  ( $p = 0.0243$ ) with three month durability. EEG evoked responses over the anterior cingulate cortex correlated with clinical response, providing an objective measure, or biomarker of dTMS efficacy.

**Conclusions:** High frequency dTMS treatment with the H7 coil, targeting the medial prefrontal and anterior cingulate cortices, is a promising therapeutic intervention in OCD.

**Disclosure:** Drs. Zangen, Alyagon and Tendler have a financial interest in Brainsway.

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**Right prefrontal transcranial magnetic stimulation for adults with ADHD: electrophysiological correlates and prognostic biomarkers**

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**Objective:** Determine if TMS can become a treatment alternative for ADHD patients who cannot tolerate pharmacotherapy.

**Background:** Reduced excitability of the right prefrontal cortex (rPFC) is implicated in attention deficit/hyperactivity disorder (ADHD).

**Methods:** Drug-free adult with ADHD ( $N = 40$ ) received 15 daily sessions of high-frequency repetitive TMS directed to the rPFC, using deep (H-1R), standard (Figure-8), or sham coils. ADHD questionnaires were administered, and EEG recordings were taken before, during and after the first and last days of treatment. EEG was recorded during a stop signal task (SST), following single TMS pulse over the rPFC and during the treatment session itself. Healthy controls ( $N = 41$ ) were recorded once under the same conditions without rTMS treatment.

**Results:** At baseline, significantly lower amplitudes of both the TMS evoked potential (TEP), and the SST's N200 and P300 components,

were evident in the ADHD group. TEP and SST amplitudes correlated with ADHD symptoms and behavioral inhibition measures. Improvement in ADHD total symptoms was only evident in the dTMS group. TEP was enhanced following the first deep and figure-8 treatment sessions, but only dTMS caused long lasting cumulative changes. Specific EEG bands recorded during the first treatment session highly correlated with dTMS effect, yielding a prognostic marker that explained 90% of variance in therapeutic outcome.

**Discussion:** High frequency dTMS treatment is a novel treatment for adult ADHD, possibly by attenuating excitability of the rPFC. Furthermore, electrophysiological activity elicited during the first treatment session can serve as a prognostic marker, increasing treatment response rates through patient selection.

Drs. Zangen, Alyagon and Tendler have a financial interest in Brainsway.

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**Transcranial magnetic stimulation treatment of depression using a 20 hertz theta burst pulse pattern: a consecutive case series**

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**Objective:** To report the outcome of a consecutive transcranial magnetic stimulation (TMS) case series of twenty treatment-refractory, depressed patients following theta burst stimulation 20 Hz (TBS 20 Hz).

**Background:** Similar to pharmacotherapy, two thirds of patients treated with standard TMS fail to remit. TBS is a type of TMS pulse pattern modeled after neural firing in the hippocampus which may have improved efficacy, durability, and safety.

**Methods:** Twenty treatment-refractory outpatients with major depressive disorder (MDD) or bipolar disorder (BD) who failed multiple medication trials and/or electroconvulsive therapy (ECT) were treated in a private practice setting with TBS 20 Hz. Individual brain MRI scans were used to probabilistically target Brodmann area 46 in the right and left dorsolateral prefrontal cortex (RDLPC and LDLPC, respectively). Bilateral TMS was administered five times per week using a MagPro X-100 with a liquid cooled B-65 figure eight coil. Each TMS session consisted of 3600 continuous pulses administered over RDLPC, immediately followed by 4950 intermittent pulses administered over LDLPC. Weekly Beck Depression Inventory II (BDI-II) scale scores assessed outcomes.

**Results:** Fifteen of twenty (75%) treatment refractory MDD or BD patients treated with TBS 20 Hz remitted ( $BDI-II < 13$ ). Mean BDI-II scale scores for remitters dropped by 69% from 33 to 10, while the average decrease for non remitters was 23% from 37 to 29. Mean time to remission was  $5.9 \pm 3.7$  weeks.

**Conclusion:** The robust remission rate seen after TBS 20 Hz compares favorably against standard TMS or pharmacotherapeutic treatment regimens. Controlled trials are warranted to confirm these results.

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**Changes in resting-state quantitative electroencephalography (qEEG) and symptom severity during repetitive transcranial magnetic stimulation (rTMS) treatment in major depressive disorder (MDD): Case-studies**

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**Objective:** To examine relationships between changes in resting-state quantitative electroencephalography (qEEG) measures and improvement in depressive symptoms early in the course of repetitive transcranial magnetic stimulation (rTMS) treatment for major depressive disorder (MDD).