Most children and adolescents with ADHD are impaired in the suppression of task irrelevant, competing stimuli (interference control) and in the inhibition of prepotent responses. The brain region most prominently associated with these aspects of inhibition control is the right inferior frontal gyrus (rIFG) which shows structural and functional alterations in ADHD. In our talk, we will give an overview over different approaches using transcranial direct current stimulation (tDCS) of the rIFG in healthy adults and will present findings from two of our own studies with ADHD youth targeting the rIFG.

Keywords: ADHD, executive functions, children and adolescents

[0782]
PILOT STUDY OF SUPPLEMENTARY MOTOR AREA RTMS FOR TOURETTE'S SYNDROME IN CHILDREN

C. Kahl*[1], A. Kirton[1], T. Pringsheim[1], P. Croarkin[2], Q. McLellan[1], R. Swansburg[1], E. Zewdie[1], F.P. MacMaster[1]. [1] *University of Calgary, Canada;* [2] *Mayo Clinic, USA*

Introduction: Treatment options for Tourette's Syndrome (TS) are limited and can carry significant risk of side effects. New interventions are needed. The goal of this study is to determine the effect of fMRI-guided, low frequency repetitive transcranial magnetic stimulation (rTMS) on the severity of tics and underlying neurobiology in children with TS. Using low frequency rTMS, we inhibit activity in the supplementary motor area (SMA). We hypothesize that (1) the severity of tics will decrease with treatment and (2) SMA GABA will increase while SMA glutamate will decrease in association with rTMS and clinical response.

Methods: Children are recruited from a pediatric TS clinic. Inclusion criteria include age 7-12 years and moderate to severe tics. Motor task fMRI generates personalized maps of the SMA that are uploaded to a TMS neuronavigation system (Brainsight2). The participants, MRI, and TMS robotic system (Axilum) are co-registered for precise targeting of SMA, allowing for motion correction. Treatment consists of 1800 low frequency (1 Hz) rTMS stimulations to the SMA at 100% resting motor threshold; 900 per hemisphere. Response is defined as 30% reduction in Yale Global Tic Severity Scale (YGTSS) scores. Additional outcomes include mental health and symptom scales, SMA spectroscopy, safety and tolerability, and robotic TMS motor mapping. All measures are completed at baseline and post-treatment.

Results: The first two eleven-year-old male participants are presented. Both participants show a significant decrease in tic severity (A:30%; B:23%) and impairment (A:25%; B:50%) after treatment. Multidimensional Anxiety Scale for Children (MASC2) scores decreased as well (A:4%; B:42%). SMA glutamate levels also decreased (A:16.9%; B:2.2%). Procedures were well-tolerated with no serious adverse events.

Discussion: Robot-driven, personalized, neuronavigated rTMS interventions appear feasible and well-tolerated in children with severe TS. Treatment combined with TMS and neuroimaging may inform mechanisms of action and predictors of responsiveness. This study is ongoing.

Keywords: TMS, Tourette's, Pediatrics, Neuroimaging

[0783]
CORTICAL EXCITABILITY CHANGES PARALLEL MOTOR FLUCTUATIONS IN SUBJECTS WITH PARKINSON'S DISEASE AND LEVODOPA-INDUCED DYSKINESIA

F. Turco*[1], A. Canessa[1,2], C. Olivieri[1], G. Pezzoli[3], I.U. Isaias[3,4]. [1] *Fondazione Europea di Ricerca Biomedica (FERB Onlus), Italy;* [2] *University of Genoa, Italy;* [3] *Centro Parkinson ASST G. Pini-CTO Milan, Italy;* [4] *University Hospital and Julius-Maximillian-University Wuerzburg, Germany*

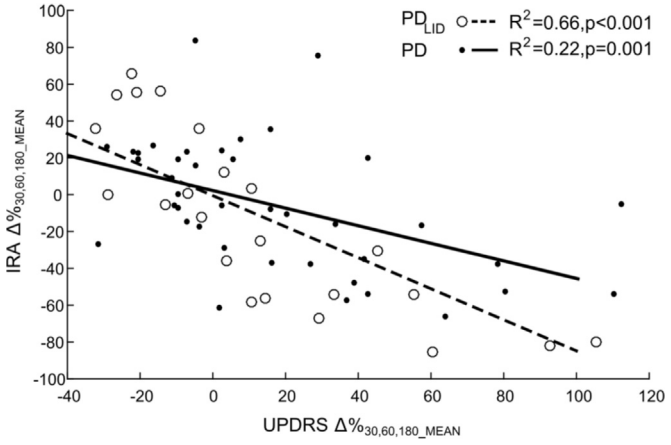
Introduction: The effect of levodopa on cortical excitability in Parkinson's disease (PD) with levodopa-induced dyskinesia (LID) is still poorly understood.

Methods: We combined transcranial magnetic stimulation (TMS) and high-density electroencephalography (64 channels) to directly investigate levodopa-related cortical excitability changes in 17 subjects with PD (7 with LID) after overnight withdrawal of all dopaminergic drugs and at 30, 60 and 180min after oral administration of 200/50mg fast-released soluble levodopa/benserazide (meds-on). We stimulated the supplementary motor area (SMA) contralateral to the clinically most affected hemibody (the right side in 12 patients) and recorded TMS evoked potentials (TEPs). We computed the area (immediate response area, IRA) of the first artifact-free component of the TEPs of the channels over a Region Of Interest (ROI) showing the highest activity (z-score >2). Patients were evaluated with the Unified Parkinson's Disease Rating Scale motor section (UPDRS) and the Abnormal Involuntary Movement Scale (AIMS). IRA and UPDRS values were calculated as percentage change from the grand mean of all measurements in meds-on state (e.g. $IRA\Delta\%_{30\_MEAN}$) or as maximum change from meds-off state ($IRA\Delta\%_{MAX\_OFF}$).

Results: PD_{LID} had longer disease duration (PD:7.0±2.1, PD_{LID}:10.7±3.0, $p<0.05$), but matched for age (PD:64.5±8.5, PD_{LID}:61.4±6.2), motor impairment ($UPDRS_{OFF}$ PD:21.1±11.2, PD_{LID}:29.3±8.5), benefit from levodopa ($UPDRS_{30}$ PD:13.4±8.7, PD_{LID}:16.4±5.8; $UPDRS_{60}$ PD:11.6±7.2, PD_{LID}:14.1±6.3; $UPDRS_{180}$ PD:15.2±7.7, PD_{LID}:18.0±6.0) and levodopa-equivalent daily dose (PD:597.3±210.6, PD_{LID}:768.6±360.1mg). At 30 and 60min after levodopa intake, PD_{LID} showed mild to moderate LID (AIMS score:7.4±4.5). Clinical improvement was paralleled by increased cortical excitability in both groups (Figure). In comparison to non-dyskinetic patients, PD_{LID} showed a higher $IRA\Delta\%_{MAX\_OFF}$ (PD:223.5±132.7; PD_{LID}:671.3±328.9, $p<0.01$), which led to a steeper reduction of cortical excitability to baseline level (meds-off) at 180min evaluation.

Discussion: We showed that levodopa directly modulates cortical excitability changes, which correlate with motor performance. PD patients with LID displayed an immediate hypersensitivity of SMA, possibly sustaining dyskinetic movements.

Keywords: TMS, EEG, Parkinson's disease, Dyskinesia



[0784]
THE ROLE OF PARIETAL CORTEX DURING MONITORING OF INVOLUNTARY MOVEMENT: A COMBINED TMS AND TDCS STUDY

F. Garbarini*[1], V. Bruno[1], C. Fossataro[1], L. Zigiotto[2,3], N. Bolognini[2,3]. [1] *Dipartimento di Psicologia, Università di Torino, Italy;* [2] *Department of Psychology, University of Milano Bicocca, Italy;* [3] *University of Turin, Italy*

Recent studies, involving both brain-damaged patients affected by anosognosia for hemiplegia and non-invasive brain stimulation in normal subjects, show that the right premotor cortex (PMC) is involved in the motor monitoring of voluntary movements. In the present study, we asked whether the PMC is involved in the motor monitoring of involuntary movements, externally triggered. We take advantage from the transcranial Direct Current Stimulation (tDCS), in order to investigate if cortical excitability shifts in this area interferes with the motor monitoring of an involuntary hand twitch

induced by a single pulse of Transcranial Magnetic Stimulation (sTMS) over the hand area of the primary motor cortex (M1). If PMC has a role in motor monitoring irrespective of the voluntary component of the movement, a modulation of the subjects' motor monitoring capacities after tDCS over PMC should emerge. Twelve right-handed healthy subjects participated in the study. The experimental design comprised three conditions: a) cathodal tDCS over the right PMC; b) cathodal tDCS over the right posterior parietal cortex (PPC); c) sham tDCS over PMC or PPC. At the end of the tDCS, participants performed the motor monitoring task: while being blindfolded, they had to detect and verbally report hand twitches induced by sTMS. The results showed that stimulation of the right PMC does not affect the monitoring of involuntary movements. Rather, it was the cathodal tDCS of the right PPC to affect motor monitoring abilities. In particular, after PPC stimulation, we found a significant increase of the false alarms rate (the subjects reported a muscle twitch, although no movement was triggered by the sTMS of M1), as compared to both PMC or sham tDCS. This finding is supports by previous evidence that intracranial stimulation of the parietal cortex during awake brain surgery generates a non-veridical feeling of movement.

Keywords: Motor monitoring, Involuntary actions, tDCS, TMS

[0786]

EFFECT OF REPETITIVE HIGH FREQUENCY TRANSCRANIAL MAGNETIC STIMULATION ON TRIGEMINAL NEURALGIA

J. Lopez-Trigo Mateu*[1], J. Lopez-Trigo Picho[2], J. Escudero[2], P. Ortiz[2]. [1] *Univerisdad Cardenal Herrera CEU, Spain;* [2] *Hospital General Universitario de Valencia, Spain*

Introduction: The aim of this study is to analyze the efficacy and safety of repetitive TMS in patients with refractory trigeminal neuralgia, and also to evaluate the maintenance of the effect.

Methods: We studied 20 patients with a placebo-active rTMS trial. A total of 1000 stimulus in 10 minutes per session with an intensity of 80% hand motor threshold, stimulating in M1 point (facial area, contralateral pain site).

We applied, at first, 5 consecutive days sessions of placebo stimulation, followed by a resting week to 24 patients, 4 were discarded by placebo effect (decrease of three points or more in VAS scale).

The remaining 20 patients had a 5 days session of active stimulation applied with a subsequent resting week. We applied a third week of active stimulation in order to evaluate the maintenance of the effect.

All patients filled a visual pain scale (VAS), a verbal pain scale (VPS) and an anxiety and depression scale (HADS). We registered pain scales before stimulation period (P0), at final placebo week (P1), final resting placebo week (P2), final first active week (P3), final active resting week (P4) and finally after the second active week (P5). The HADS was registered only in P0 and P5.

We applied Friedman test and Wilcoxon signed-rank test for the statistical analysis.

Results: The TMS showed significant reduction of pain (VAS and VPS) in comparison to the placebo, between P1 and P3 ($p<0.05$ in Friedman Test). Although the reduction of pain decreased at the end of the first active stimulation period (P3), kept stable and smaller than the placebo resting period (P2). We obtained again a positive effect after second active stimulation week (P5 with P4). Only one patient quitted the trial because suffered moderate headache.

Discussion: Like others studies we observe that repetitive TMS is effective in reduction of pain intensity on refractory trigeminal neuralgia. The maintenance of TMS effect was prolonged by a second active week stimulation period, lasting around one week more. Further studies with a larger duration and sample are needed to confirm these results.

Keywords: Trigeminal neuralgia, Transcranial magnetic stimulation, Placebo, Motor cortex

[0787]

NIRS OBSERVATION OF CHANGES IN BRAIN ACTIVITY FOLLOWING LOW FIELD MAGNETIC STIMULATION

M.L. Rohan*, R.T. Yamamoto, K. Ohashi, Y. Tong, L.M. Hocke, B.B. Frederick, B.M. Cohan. *McLean Hospital, USA*

Introduction: Low Field Magnetic Stimulation (LFMS) is a novel electromagnetic treatment for depression. We propose that LFMS acts on an immediate depressed state rather than on deficits specific to particular diagnoses, and that physiologic effects from the fields of LFMS may be present for all subjects but will only be associated with change in mood in subjects that have active mood dysregulation.

Methods: Nine healthy controls were recruited to participate in this randomized, sham controlled, single blinded study. Subjects received either active or sham LFMS on two separate occasions within two weeks. Subjects were fitted with a 12 optode cap providing 9 channels of data in bilateral pre-frontal regions. An additional infrared plethysmograph was places on the left forefinger to record the pulse for use in the removal of physiologic confounds. Data was then acquired in the resting state for 5 minutes, during LFMS (active or sham) for 20 minutes, and in the resting state for 5 additional minutes in a continuous experiment.

Standard artefact detection and timeseries analysis was performed to detect post-pre change in absolute deoxy- and oxy-hemoglobin levels for all channels as a global measure of change. Repeated measures ANOVA was used, within the FSL software package, to provide a group result.

Results: We observed a significant decrease in global deoxy-hemoglobin concentration (-0.44 +/- 0.25 μM, $p<0.04$) and a corresponding, trending, increase in oxy-hemoglobin concentration (+1.08 +/- 0.75 μM, $p<0.8$) associated with LFMS.

Figure 9 Change in deoxy-hemoglpbin (blue negative, red positive).

Discussion: The electric fields that LFMS induces have a global cortical distribution. Our hypothesis is that this global stimulation results in regional responses that are translated into change in mood. These observations are consistent with this.

Keywords: NIRS, LFMS, Electrical, Depression