Abstract
Direct cortical stimulation holds the potential to treat a range of neuropsychiatric disorders in which the connectivity of distributed networks functions abnormally. Mapping cortico-cortical evoked potentials (CCEPs) in response to direct electrical brain stimulation provides powerful insight into the organization of cortical networks. Despite many advances in quantifying cortical networks with CCEPs, the timing, direction, and magnitude of the responses are not fully understood. To better elucidate the relationship between CCEPs and cortical networks, we collected human electrocorticographic recordings from neurosurgical epilepsy patients while delivering single pulses of stimulation. We then created a directed adjacency matrix based on which electrodes responded. Next, we built directed functional adjacency matrices from at-rest data collected at least 12 hours separated from the stimulation session. We demonstrate that the estimated functional connections significantly overlap with the CCEPs and vice versa. Notably, one technique used to generate the functional adjacency matrices was able to capture the directionality of the connections while another technique predicted the onset and magnitude of the CCEPs. Using different metrics to predict the direction, timing, and magnitude of CCEPs is impactful as it provides new insights and tools for analyzing cortical networks. These results will enable more precise predictions of the responses to electrical brain stimulation furthering the development of targeted stimulation therapies.
Research Category and Technology and Methods
Clinical Research: 13. Other Brain Stimulation Technology
Keywords: Cortical stimulation, Cortico-cortical evoked potentials, Functional connectivity, Cortical networks

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Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

P3.106

BRAIN DERIVED NEUROTROPHIC FACTOR NEGATIVELY RESPONDED TO TRANSCRANIAL DIRECT CURRENT STIMULATION IN ISCHEMIC STROKE PATIENTS: RANDOMIZED CONTROLLED TRIAL

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Abstract
Introduction: Brain-derived neurotrophic factor (BDNF) levels could indicate synaptic plasticity, modulation of BDNF might be a part of transcranial direct current stimulation (tDCS) mechanisms on synaptic connectivity [1]. BDNF associated with changes to chronic pain and stress [2]. The study aims to investigate BDNF level change in response to tDCS in subacute ischemic stroke patients. Clinical trial registration ID NCT04770363.
Methods: 36 stroke survivors participated, randomly assigned to bihemispheric (Anodal over affected M1, and cathodal over healthy M1), or unihemispheric (Anodal over affected M1, and cathodal over supraorbital bone), or sham (No current). ActivaDose tDCS (USA), consisted of 20 minutes of 2 mA intensity; in each session for 12 sessions three per week. A 3ml blood was withdrawn in first and last sessions. BDNF determined using ELISA kits.
Results: Statistically significant difference (Negative) within groups for bihemispheric (P = .011), unihemispheric stimulation (P = .003), but not for sham group (P = .492). Significant difference between groups (P = .005). Post-hoc test by pairwise revealed both bihemispheric & unihemisphericstimulation significantly decreased BDNF levels more than sham (P = .001), (P = .021), respectively and no significant difference between both experimental groups (P = .217).
Discussion: Negative decrease in BDNF levels associated with positive improving of motor measures, and upper extremity pain relieving.
Process evaluation: Long-term effect of tDCS, electrode placements, and polarity change of electrodes should considered for future studies. Applying the same current intensity/dose for all participants was a critical limitation.
Research Category and Technology and Methods
Clinical Research: 9. Transcranial Direct Current Stimulation (tDCS)
Keywords: Stroke, Pain, BDNF

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Abstract key: PL- Plenary talks; S- Regular symposia oral; FS- Fast-Track symposia oral; OS- On-demand symposia oral; P- Posters

P3.107

AUTOMATED DEEP BRAIN STIMULATION PROGRAMMING BASED ON ELECTRODE LOCATION – A RANDOMIZED, CROSS-OVER TRIAL USING A DATA-DRIVEN ALGORITHM

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Abstract
Background: The correct selection of stimulation parameters is pivotal to treatment success of Deep Brain Stimulation (DBS) therapy. However, this currently follows a time-consuming and demanding trial-and-error process. We recently developed and retrospectively validated a data-driven algorithm (StimFit) which can suggest optimal stimulation parameters based on electrode location in PD patients treated with subthalamic nucleus (STN) DBS. We now prospectively evalutated the treatment effects of stimulation settings suggested by StimFit in a double-blind, randomized, cross-over, non-inferiority trial.
Methods: 35 PD patients who underwent STN-DBS surgery at Charité - Universitätsmedizin Berlin participated in this study. Motor performance was assessed after overnight dopaminergic withdrawal according to the MDS-UPDRS-III in OFF-stimulation state and under two stimulation conditions: 1) Patients' standard of care (SoC) setting, which was clinically derived according to our centers postoperative routine and 2) the settings suggested by our StimFit algorithm based on neuroimaging data. Treatment conditions were applied in a double-blind randomized manner. The primary endpoint of this study was the absolute mean difference between motor scores under StimFit and SoC stimulation, with a non-inferiority margin of five points.
Findings: MDS-UPDRS-III scores improved by 48 % under SoC and 43 % under StimFit stimulation conditions from an OFF-stimulation baseline of 47·3 ± 17·1 points. The mean absolute difference of motor scores under both conditions was -1·6 ± 7·1 (95% CI: [-4·0, 0·9]) in favor of SoC, which was statistically non-significant (Superiority test: $p_{sup} = 0·20$). Non-inferiority of StimFit stimulation was established at a margin of -5 points (Non-inferiority test $p_{noninf} = 0·0038$).
Interpretation: Predictive models embedded in mathematical optimization procedures can identify beneficial DBS parameters. This could drastically reduce programming time and ressources and pave the way for novel electrode designs. Long-term data including effects on quality of life and ON-medication assessments require further investigation.
Research Category and Technology and Methods
Translational Research: 1. Deep Brain Stimulation (DBS)