or "sweet spots" of three commonly used DBS targets, derived from 342 patients, were all preferentially connected to the SCAN (all $p < 0.001$). This functional specificity with the SCAN was causally validated through STN-DBS-evoked ECoG responses ($n = 17$ PD patients, 300 ECoG electrodes). Additionally, selective cortical-subcortical SCAN connectivity demonstrated abnormal hyperconnectivity in PD patients ($n = 65$) compared with healthy controls ($n = 60$, $p < 0.001$). This SCAN hyperconnectivity was normalized by STN-DBS ($n = 14$ PD patients, $n = 25$ healthy controls, $p < 0.05$) and SCAN-repetitive transcranial magnetic stimulation (rTMS, $n = 36$ PD patients, $p < 0.05$). Importantly, targeting the personalized SCAN region with rTMS resulted in a two-fold increase in clinical efficacy compared to targeting effector-specific regions. In conclusion, our results indicate that the SCAN is a core pathophysiological circuit in PD and that its precise localization may offer an effective, personalized target for neuromodulation therapy.

Research Category and Technology and Methods

Basic Research: 1. Deep Brain Stimulation (DBS)

Keywords

Parkinson's disease, Hyperconnectivity, Neuromodulation, Personalized functional mapping

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P2.227

TRANSCRANIAL TEMPORAL INTERFERENCE STIMULATION OF THE HUMAN FRONTOSTRIATAL NETWORK DISRUPTS REWARD LEARNING

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Abstract

Reward learning is critical for adaptive behaviors, mediated by interaction between the orbitofrontal (OFC) and nucleus accumbens (NAc) circuit. However, the causal and interactive mechanisms within this circuit remain underexplored. To address this question, we targeted either the OFC or NAc with 20 Hz transcranial temporal interference stimulation (tTIS), a recently developed non-invasive deep brain stimulation technique, combined with a reward-guided learning task undergoing the functional magnetic resonance imaging scanning in a randomized and sham-controlled study. We observed that tTIS applied on either the OFC or NAc disrupted reward-but no punishment-guided behavior compared to the sham stimulation, driven by reduced weight to positive feedback in the setting of an actor-critic architecture. Next, we provided evidence that NAc regulated OFC during rewarding learning. tTIS on NAc modulated activity both in the NAc and OFC and functional connection between these areas. Conversely, tTIS on OFC only affected activity in OFC but not in NAc. These results provide causal evidence that disrupted OFC-NAc circuit can negatively impact reward-guided behavior and support the hypothesis that reward-relevant signals are first managed by the NAc, the output of which regulates gradual learning mechanisms in the OFC.

Research Category and Technology and Methods

Basic Research: 5. Other Transcranial Electrical Stimulation (tES)

Keywords

TI, NAc, OFC, reforcement learning

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P2.228

CAN PERSONALIZED TRANSCRANIAL ALTERNATING CURRENT STIMULATION (TACS) MODULATE PAIN PERCEPTION AND PAIN-RELATED OSCILLATIONS?

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Abstract

Ongoing neural oscillatory activity was suggested to play a crucial role in the experience of pain. This study aims to determine whether there is a causal link between neural oscillations and pain perception, and whether transcranial alternating current stimulation (tACS) can modulate it.

We employed tACS to modulate ongoing oscillatory activities measured using scalp electroencephalography (EEG), and investigated how this affects pain perception. To induce pain, we used sustained periodic 0.2 Hz thermonociceptive stimuli. tACS targeted M1, contralateral to the side of the thermonociceptive stimulation. The frequency of stimulation was set to the individual peak alpha frequency (PAF). A sham stimulation was used as a control condition.

Data was acquired from 38 healthy volunteers. Statistical tests were performed using linear mixed models using "time" (pre vs post) and "condition" (active vs sham) as factors. In the "post" phase, we observed a significant reduction in heat pain thresholds (HPTs) and an increase in both intensity and pain perception compared to the "pre" phase, regardless of condition ($p<0.01$). The HPT reduction was greater for the sham condition compared to the active condition, although not significantly. Furthermore, both local and global average PAF values decreased significantly ($p<0.01$) in the two conditions, with a slightly greater reduction in the sham condition.

The reduction of HPTs, along with the increases in the intensity of perception and pain over time, suggest that participants may have become sensitized to the thermonociceptive stimulation. Although the current study does not show a significant effect of tACS on perception, the small but consistent trend of lower pain perception and smaller PAF changes in the active condition compared to sham may be interpreted as a reduced sensitization following tACS, highlighting the potential for further exploration of tACS effects on pain with enhanced designs and strategies.

Research Category and Technology and Methods

Basic Research: 8. Transcranial Alternating Current Stimulation (tACS)

Keywords

Peak Alpha Frequency, tACS, Pain, neuromodulation

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P2.229

INTRACORTICAL AND TRANSCALLOSAL INHIBITION OF THE LOWER EXTREMITY MOTOR CORTEX

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Abstract

Transcranial magnetic stimulation (TMS) has been widely used to measure corticomotor excitability and inhibition in the primary motor cortex (M1) to understand brain physiology in health and disease. The function of the inhibitory circuits is critical in motor control, experience-dependent plasticity, and pathophysiology. Most literature using TMS to measure cortical inhibition, including intracortical and transcallosal inhibition (ICI and TCI), has focused on the upper extremity. Studies of cortical inhibition of the lower extremities (LE) are limited possibly due to anatomical characteristics and technical difficulties. This study reports the ICI and TCI measured in the LE M1 among non-disabled individuals and discusses methodological considerations.

Nineteen adults (age: 29.3±9.9, 12 females) performed single-leg standing with heel-rise. Single-pulse TMS was administered by a 110-mm double-cone coil. The hotspot and resting motor threshold (RMT) were determined over the representational areas of the tibialis anterior (TA) of each hemisphere. Suprathreshold intensity (130% RMT) was applied to induce a temporary reduction in the contracting TA measured by electromyography (EMG). The reduced muscle activity *contralateral* to the stimulation was measured as the cortical silent period (cSP) to represent ICI, quantified by the duration of EMG silence following a stimulus. TCI was measured by the ipsilateral silent period (iSP) *ipsilateral* to the stimulation and quantified as the amount of EMG reduction normalized to pre-stimulation muscle