P1.017

THE EFFECTS OF DEEP BRAIN STIMULATION ON THE NEUROVASCULAR UNIT IN HUMAN INTRACRANIAL RECORDINGS

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Abstract

Background: Deep brain stimulation (DBS) is an effective therapy for a range of neurological and psychiatric disorders. However, the precise mechanism of action of DBS is not fully understood. The impact of DBS on neurovascular coupling, particularly at the microcirculation level, remains unstudied.

Methods: Microelectrode recordings (MER) from two electrodes (~600 μm apart) were analyzed to assess the effects of high- (HFS) and low-frequency (LFS) microstimulation on cardioballistic waveforms during DBS implantation surgery (n=108 patients, 193 recordings). HFS recordings included gray matter structures (STN: n=32, 52 recordings; GPi: n=27, 49 recordings; SNr: n=20, 23 recordings; Vim: n=14, 21 recordings) and white matter tracts (n=10, 13 recordings). LFS data included the STN (n=12, 13 recordings), SNr (n=13, 17 recordings), and GPi (n=4, 5 recordings). Linear mixed models (LMM) compared waveform amplitude changes pre- and post-stimulation, and a computational model was used to link amplitude changes to arteriole diameter variations.

Results: Cardioballistic waveform amplitudes were significantly increased post-HFS at the stimulating electrode (LMM; $p < .0001$), while LFS did not lead to a significant change (LMM; $p = .1723$). No significant changes in cardioballistic waveform amplitudes were detected at the distal electrode (LMM; $p = .0981$). Region-specific analysis revealed significant increases in vascular response within the Vim (LMM; $p = .0135$; 107%), STN (LMM; $p = .0229$; 79%), and GPi (LMM; $p = .0002$; 78%), while no changes were observed in white matter (LMM; $p = .1299$; 50%). Non-significant trends were observed in the SNr (LMM; $p = .0742$; 45%). Modeling of the dynamics of vessel walls in response to stimulation substantiated the hypothesis that vessel dilation can lead to an increased transmission of pulsatile forces to the microelectrode.

Conclusion: Our findings reveal that HFS effectively increases local neurovascular responses in gray matter but not in white matter regions or with LFS. These results highlight the potential therapeutic implications of DBS for neurodegenerative as well as neurovascular diseases. Further research is warranted to investigate the underlying mechanisms, optimize stimulation parameters, and explore novel applications in treating brain disorders involving impaired neurovascular function.

Research Category and Technology and Methods

Clinical Research: 1. Deep Brain Stimulation (DBS)

Keywords

DBS, microrecordings, neurovascular coupling, vasospasm

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P1.018

DIFFERENTIAL EFFECTS OF KINESTHETIC AND VISUAL MOTOR IMAGERY PERSPECTIVES ON CORTICOSPINAL EXCITABILITY IN HEALTHY ADULTS

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Abstract

Background: Motor imagery (MI), the mental simulation of movement without execution, engages neural pathways similar to actual movement. Understanding how different MI types affect corticospinal excitability can enhance rehabilitation and motor learning strategies.

Objective: To investigate how kinesthetic (KI) and visual motor imagery from first-person (V1) and third-person (V3) perspectives influence corticospinal excitability in healthy adults.

Methods: Thirteen participants (7 males, mean age 23) underwent single-pulse transcranial magnetic stimulation (TMS) of the left motor cortex while electromyography (EMG) recorded activity from five right arm muscles: biceps brachii (mBB), triceps brachii, first dorsal interosseous, abductor pollicis brevis, and abductor digiti minimi. The experiment included two baselines (before and after tasks) and four tasks: a metronome-paced baseline and three MI tasks (KI, V1, V3), randomized for each participant. During MI tasks, participants performed biceps flexion with a dumbbell synchronized to a metronome, then imagined the movement according to the specific imagery type.

Results: Significant differences in muscle activation were observed across MI tasks. In the mBB, KI imagery increased activity compared to the pre-task baseline. V1 and V3 perspectives differently influenced mBB activation, with V3 showing increased activity compared to baseline, indicating that visual perspective affects corticospinal excitability. No significant difference was found between KI and V3 in mBB activation. The metronome-paced baseline also modulated mBB activity compared to both baselines.

Conclusion: Different types of MI distinctly modulate corticospinal excitability, with both KI and V3 increasing activation in the biceps brachii. These findings highlight the crucial role of visual imagery perspective in motor system activation and provide insights for developing targeted MI-based interventions in rehabilitation and skill acquisition.

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Research Category and Technology and Methods

Basic Research: 10. Transcranial Magnetic Stimulation (TMS)

Keywords

TMS, motor imagery, kinesthetic imagery , visual imagery

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DISPLACEMENT OF THE CENTER OF PRESSURE AND SOMATOSENSORY FUNCTION IN INDIVIDUALS WITH ESSENTIAL TREMOR FOLLOWING STEREOTACTIC SURGERY TARGETED AT THE VENTRAL INTERMEDIATE NUCLEUS

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Abstract

Background: Essential tremor (ET) is an involuntary movement disorder (IMD). Stereotactic surgery targeting the ventral intermediate nucleus of the thalamus (Vim) is the preferred treatment for improving tremors when medication is no longer effective. However, some postoperative complications caused by thermal coagulation or edema in the Vim have been reported. Our recent study revealed that individuals with ET who underwent stereotactic surgery showed displacements of the center of pressure (COP) to the treated side, which was associated with balance disturbance. However, the factors causing it in the immediate post-operative period have not yet been determined.

Aims and **Methods:** To investigate the effect of postoperative changes in somatosensory on COP therapeutic lateral deviation immediately after surgery, the study compared COP and Romberg rates as somatosensory indices before and after surgery in two groups: one with ET treated with Vim nucleus radiofrequency ablation and another with IMD treated at a different target. The correlation between COP deviation and Romberg rate in the ET group was also analyzed. All participants provided informed consent.

Results: The results show that the Romberg rate, which measures sensory function, remained consistent before and after surgery for both groups. However, in the ET group, the COP displacement to the treated side was significantly greater one week after surgery compared to before.