Format: Abstract

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Transcranial direct current stimulation targeting primary motor versus dorsolateral prefrontal cortices: proof-of-concept study investigating functional connectivity of thalamo-cortical networks specific to sensory-affective information processing.

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Abstract

Pain matrix is subtended by an extensive cortical network spanning across sensory and affective domains. **Transcranial** direct current **stimulation** (tDCS) targeting primary motor (M1) or dorsolateral prefrontal cortices (DLPFC) represent popular methods to modulate such networks. However, differences between their mechanisms remain unknown. Here, in a proof-of-concept study, resting-state functional MRI was used to investigate the effects of stimulating M1 versus DLPFC on functional connectivity (FC) of networks within a healthy pain matrix. FC changes were compared to further investigate its relation with individual's baseline experience of pain. Ten right-handed healthy individuals received anodal tDCS (1mA, 20min) to right M1 and DLPFC in a single blind, sham-controlled, crossover study. FC changes were studied with venteroposterolateral, the sensory nucleus of thalamus, and with medial dorsal, the affective nucleus. Individual's perception to pain at baseline was assessed using cutaneous heat pain stimuli. The main findings were increased FC across sensorimotor networks following tDCS to M1 and DLPFC, though tDCS to M1 had a greater effect on sensory networks. Similarly, increased FC across motor cortices was observed following tDCS to M1 and DLPFC, but only tDCS to DLPFC modulated affective cortices, like DLPFC. These findings suggest that stimulating M1 mainly modulates FC of sensory networks, whereas stimulating DLPFC modulates FC of both sensory and affective networks. While a small sample size limits generalizability of findings, knowledge of such mechanisms may help differentiate between effects of M1 and DLPFC on pain experience in large clinical trials. Notably, the finding that individuals with high baseline pain thresholds experience greater FC changes with tDCS to DLPFC, implies that these individuals could respond more to **stimulation** of affective cortices.

KEYWORDS: Functional connectivity; Motor cortex; Pain; Resting-state functional connectivity **magnetic** resonance imaging (R-fMRI); Thalamus

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