MODULATION OF TDCS-INDUCED NEUROPLASTICITY

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Abstract

Background: Dopamine is a key neuromodulator of neuroplasticity, and an important neuronal substrate of learning, and memory formation, which critically involves glutamatergic N-Methyl-D-aspartate (NMDA) receptors. Dopamine modulates NMDA receptor activity via dopamine D1 and D2 receptor subtypes. It is hypothesized that dopamine focuses long term potentiation (LTP)-like plasticity, i.e. reduces diffuse widespread but enhances locally restricted plasticity via a D2 receptor-dependent NMDA receptor activity reduction. Here, we explored NMDA receptor-dependent mechanisms underlying DAergic modulation of LTP-like plasticity induced by transcranial direct current stimulation (tDCS).

Methods: Eleven healthy, right-handed volunteers received anodal tDCS (1 mA, 13 min) over the left motor cortex combined with DAergic agents (the D2 receptor agonist bromocriptine, levodopa (L-Dopa) for general dopamine enhancement, or placebo), and the partial NMDA receptor agonist D-cycloserine (CYC; dosages of 50, 100 and 200 mg, or placebo). Cortical excitability was monitored by transcranial magnetic stimulation-induced motor-evoked potentials.

Results: Low-dose CYC alone did not relevantly change anodal tDCS-generated LTP-like plasticity, while medium dosage prolonged and high dosage CYC diminished after-effects of stimulation. L-Dopa or bromocriptine alone reversed or abolished anodal tDCS-induced excitatory plasticity respectively, which was re-established by medium-dose CYC. Adding low dosage CYC did not alter the effects of bromocriptine and L-Dopa, while high-dose CYC abolished the after-effects.

Conclusions: Our results suggest that the focusing effect of dopamine on LTP-like plasticity is caused by D2 receptor-generated reduction of NMDA receptor activity. Medium-dose CYC, as compared to low and high dosages, restored anodal tDCS-induced after-effects possibly due to optimizing calcium influx via enhancement of NMDA receptor activity.

Research Category and Technology and Methods

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SEX DIFFERENCES IN THE ASSOCIATIONS BETWEEN TRANSDIAGNOSTIC TRAUMA DISTRESS AND ALCOHOL CUE-REACTIVITY IN AUD: IMPLICATIONS FOR TMS TARGET SELECTION

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Abstract

Introduction: TMS has shown great promise for the treatment of depression, OCD, and other psychiatric conditions, with some evidence for sex differences in efficacy. However, the precise targeting of TMS for alcohol use disorder (AUD) and associated traumatic experiences remains unclear. According to neurobiological literature, brain function during alcohol cue-reactivity may play a key role in TMS target selection, however activation patterns can also vary by sex.

Objective: Taken together, we aimed to 1) examine the relationship between a transdiagnostic trauma metric and alcohol cue-reactivity in males and females separately, and 2) compare the transdiagnostic trauma approach to traditional PTSD diagnosis.

Methods: In 72 Veterans (16F) with AUD, trauma distress transdiagnostic factor was previously identified through principal components analysis of self-reported symptoms. Bivariate correlations assessed how trauma distress relates to activation and functional connectivity in a-priori defined, core incentive salience nodes during an fMRI cue-reactivity task.

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