Dose response of high-intensity transcranial electric stimulation on cortical excitability and motor learning

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Introduction

Transcranial direct current stimulation (tDCS) shows promising effects on motor behavior and corticospinal excitability, but results are mixed. Typical in vivo stimulation intensities (up to 2 mA) are much lower than those used in vitro to demonstrate modulation of synaptic plasticity. We hypothesize a monotonic effect of increasing tDCS intensity above 4 mA on cortical excitability and motor learning.

Methods

Transcranial direct current stimulation (tDCS) shows promising effects on motor behavior and corticospinal excitability, but results are mixed. Typical in vivo stimulation intensities (up to 2 mA) are much lower than those used in vitro to demonstrate modulation of synaptic plasticity. We hypothesize a monotonic effect of increasing tDCS intensity above 4 mA on cortical excitability and motor learning.

Experiment 1

High-definition 4+4 tDCS was used to optimize targeting and minimize skin sensation effects. Electrode layout determined using MRI-based current flow modeling.

Experiment 2

A baseline typing task will be used to counterbalance group assignments against variability in learning ability. Similar to Experiment 1, subjects will receive 0, +4, or +6 mA tDCS (n=40 each). Sample size is powered at 80%.

Results (Experiment 1)

+4 mA group outperformed all other groups. Boosting effect lasted after 1 hour and carried over to the other hand and sequence. 4 mA and 6 mA tDCS were well tolerated.

Summary + Expected Outcomes

We have demonstrated the feasibility of applying high-intensity tDCS at 4 mA and above. This work will inform us whether more current is better, and help determine the utility of corticospinal and cortical excitability as correlates of motor learning.

Disclosure of Conflict of Interest

I have no COI with regard to the presentation.