Poster: C36

Conditions of Control: Investigating the effect of ADHD symptoms on efficacy of tDCS for improving inhibitory control

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INTRODUCTION

Cognitive control: Ability to disregard irrelevant information while attending to relevant information, supported by **prefrontal cortex** (Miller & Cohen, 2001).

Attention Deficit Hyperactivity Disorder (ADHD): Neurodevelopmental disorder impacting executive function, including cognitive control.
In ADHD, prefrontal cortex activation is decreased during cognitive control tasks (Passarotti, Sweeney, & Pavuluri, 2009).

Can cognitive control be enhanced in people with ADHD symptoms?

Transcranial direct current stimulation (tDCS): Weak electrical current applied to scalp, modulating likelihood of neuronal firing.

Meta-analysis suggests anodal tDCS over prefrontal cortex may enhance cognitive control, with some setups (small anodes, extra-cranial cathodes; Imburgio & Orr, 2018).

• Even with these setups, results vary…Why?

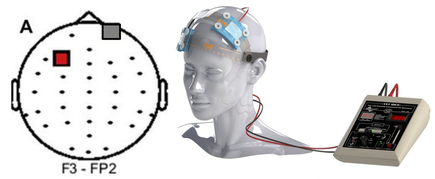
- Baseline individual differences in cognitive control may be a factor, e.g., many studies have fewer than 20 N/group and do not examine tDCS modulation from pre-test to post-test.
- ADHD symptoms may contribute to variability, e.g., anodal tDCS over prefrontal cortex may more reliably enhance cognitive control in people with ADHD (Nejati et al., 2020, Breitling et al., 2016).

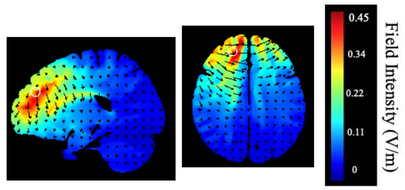
When baseline differences in cognitive control are accounted for: ***Does anodal tDCS over prefrontal cortex (using a common montage: F3-RSO) enhance cognitive control? Could it be more effective in people with more ADHD symptoms?***

METHODS

Anodal tDCS:

- Montage: F3-RSO
- 5x7cm saline-soaked sponges
- 1.5 mA stimulation begins 3 min before tasks, and continues throughout tasks for 20 mins total





Flanker Task

Respond to central arrow

> > > > > Congruent

< < > < < Incongruent

Stroop Task

- 5 Colors: **Blue**, **Red**, **Green**, **Yellow**, **Black**
- 50% incongruent
- Respond to ink color – not text

N = 91

Alternating assignment

Subset of 31 participants with info about ADHD symptoms (from ASRS-5)

Sham Participants (N = 44; no stimulation)

30s Ramp Up, 30s Ramp Down

Flanker 6 min → Stroop 5 min → Nature Video 3 min → Flanker 6 min → Stroop 5 min → Animal Judgement 10 min

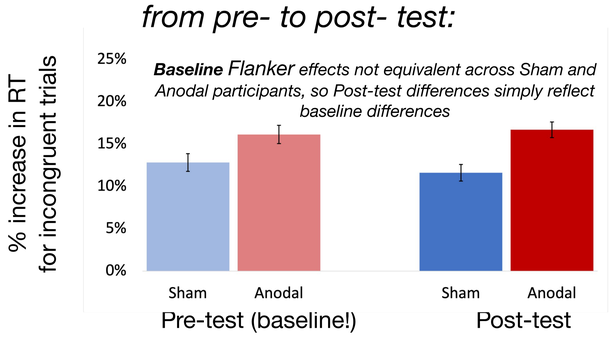
Anodal Participants (N = 47)

30s Ramp Up — 30s Ramp Down

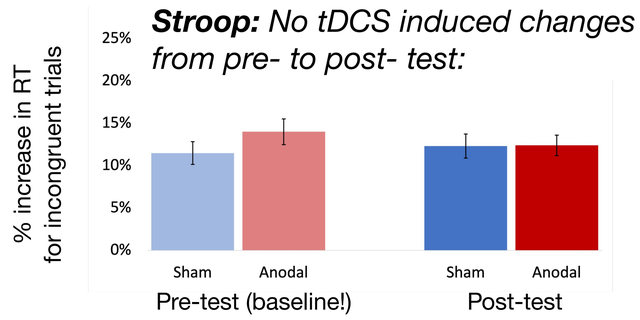
Flanker 6 min → Stroop 5 min → Nature Video 3 min → Flanker 6 min → Stroop 5 min → Animal Judgement 10 min

RESULTS (all 91 participants)

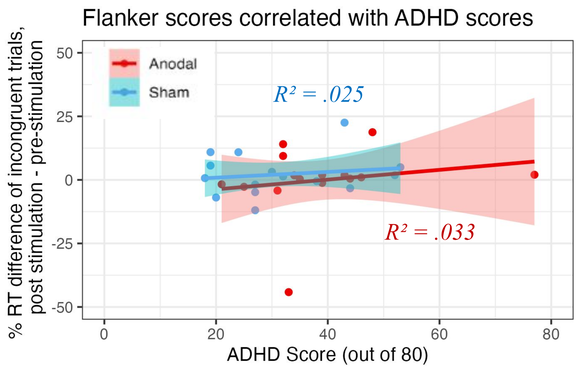
Flanker: *No tDCS induced changes from pre- to post- test:*



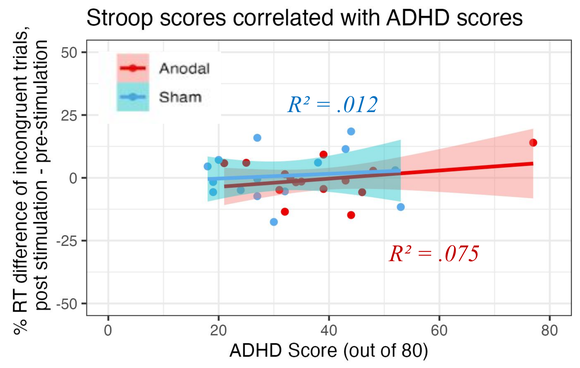
Stroop: *No tDCS induced changes from pre- to post- test:*



RESULTS (subset of 31 ppl with info on ADHD symptoms)



Flanker: *Anodal tDCS does not make incongruent trials easier for anyone, including participants with more ADHD symptoms*



Stroop: *Anodal tDCS does not make incongruent trials easier for anyone, including participants with more ADHD symptoms*

DISCUSSION

Data collection ongoing (target is 60/condition)

Currently:

- No effect of anodal tDCS over left prefrontal cortex on performance in Flanker or Stroop tasks (with *N = 91*)

  With these parameters and tasks, tDCS may not be effective in enhancing cognitive control

- No relationship between ADHD symptoms and tDCS modulation of performance in Flanker or Stroop

  BUT sample with data on ADHD symptoms *(N = 31)* is small

  If trend persists, **with these parameters and tasks, tDCS may not be more effective at enhancing cognitive control in people with more ADHD symptoms**

Reminders:

- When using tasks with large individual differences, test large sample and/or use pre- vs. post-test design

Future:

- Screening measures for subjects should **specifically screen for people with more ADHD symptoms**
- **Explore other tDCS parameters and/or components of cognitive control (e.g., working memory or set-shifting)**

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