Effect of extended duration of cortical stimulation in adults who stutter (AWS)- A preliminary study

Chanchal Chaudhary[1], Gopee Krishnan[2]
[1,2] Department of Speech and Hearing, Manipal College of Health Professions, Manipal Academy of Higher Education Manipal, India

Introduction

- Stuttering is a neurodevelopmental disorder
- Characterized by dysfluencies that disrupt the flow of speech[1]
- Affects over 1% of general population; Causing communication, occupational, and psychological difficulties[2]

Brains in AWS

- Abnormalities in brain region involved in speech and language
- Neural signature of stuttering: Left inferior frontal cortex (IFC)[2]
- Left IFC: under activation during speech; disrupted white matter tracts underlying this area

Management:

- Novel: Transcranial direct current stimulation (tDCS)
- Non-invasive brain stimulation; alters neuronal activity
- Studies on fluency enhancing effects of tDCS+ behavioral intervention show positive outcomes
- However these results are reported from short-term intervention (lasting up to 6 sessions)[3,4,5]

AIM

To examine the effect of extended duration of tDCS on dysfluencies in adults who stutter (AWS)

Materials and Method

- Soterix 1x1 tDCS stimulator
- Elastic straps, sponge pads, measuring tape, marker, saline

tDCS

- Audio recorded samples for choral speech task

Behavioral Intervention

Figure 1: Materials

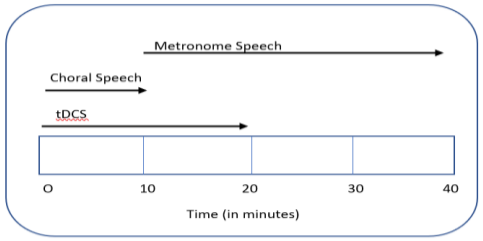


Figure 2: Intervention delivery

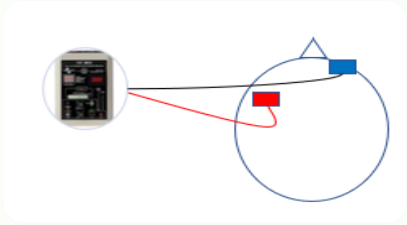


Figure 3: Stimulation site

Participants diagnosed with developmental stuttering; 18-35 years; Males

↓

Recruited from hospital OPD (tertiary care hospital); PIS and written consent forms

↓

Behavioral therapy+ tDCS stimulation (Total 40 minutes); 15 days (Fig. 2)

↓

tDCS : Anodal stim: Left IFC (FC5); Cathodal Stim: R Supraorbital ridge; 20 minutes; 1mA (Fig.3)

↓

Behavioral therapy: Choral speech; metronome speech; Preferred language of treatment (English or Kannada)

↓

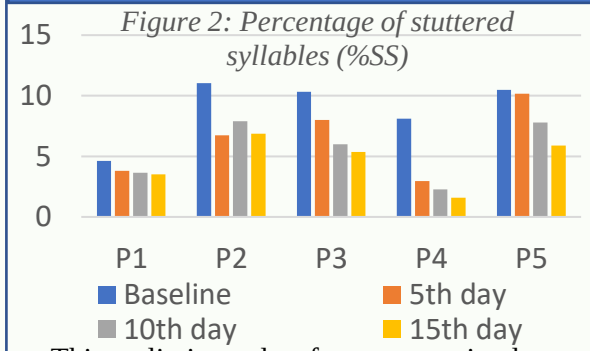
Speech samples for conversation task were audio and video recorded at baseline; 5th day, 10th day, and 15th day

↓

Outcome measures: Percentage of stuttered syllables (%SS)

Results & Conclusion

Figure 2: Percentage of stuttered syllables (%SS)



- This preliminary data from an ongoing larger trial shows the beneficial effect of extended duration of cortical stimulation in AWS
- Extended sessions of brain stimulation and speech therapy, as opposed to the currently used 5-6 sessions, showed further reduction in dysfluencies
- P2, P3, P4, and P5 showed clinically significant reduction in dysfluencies post 15 days of intervention
- These findings support our assumption that extending the tDCS with concurrent speech therapy could help optimize the treatment outcome in adults who stutter

References

1. Chesters J, Watkins KE, Möttönen R. Investigating the feasibility of using transcranial direct current stimulation to enhance fluency in people who stutter. Brain and language. 2017 Jan 1; 164:68-76.
2. Budde KS, Barron DS, Fox PT. Stuttering, induced fluency, and natural fluency: a hierarchical series of activation likelihood estimation meta-analyses. Brain and Language. 2014 Dec 1;139:99-107.
3. Chesters J, Möttönen R, Watkins KE. Transcranial direct current stimulation over left inferior frontal cortex improves speech fluency in adults who stutter. Brain. 2018 Apr 1;141(4):1161-71.
4. Garnett EO, Chow HM, Choo AL, Chang SE. Stuttering severity modulates effects of non-invasive brain stimulation in adults who stutter. Frontiers in human neuroscience. 2019 Nov 21; 13:411.
5. Yada Y, Tomisato S, Hashimoto RI. Online cathodal transcranial direct current stimulation to the right homologue of Broca's area improves speech fluency in people who stutter. Psychiatry and clinical neurosciences. 2019 Feb;73(2):63-9.