Feasibility of remote transcranial direct current stimulation for pediatric cerebral palsy during the COVID-19 pandemic

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BACKGROUND

- CP is caused by a congenital brain lesion with associated motor deficits which may result in lifelong disability
- 3.6 per 1,000 children in US are affected by Cerebral Palsy (CP)
- Physical and occupational therapy interventions can be costly and time intensive, with varying rates of success
- Transcranial direct current stimulation (tDCS) is a form of non-invasive brain stimulation (NIBS) that enhances therapy and pediatric rehabilitation interventions through neuroplasticity
- COVID-19 stresses the importance for at home, remote neuromodulation interventions to optimize outcomes
- tDCS is ideal for remote neuromodulation: low cost, tolerable, portable, compatible with rehabilitation
- Remote tDCS has been studied in adults with neurological disorders

OBJECTIVE

Can remote tDCS be successfully performed by a “parent-child” team without compromising the efficiency, quality and comfort of administration?

PARTICIPANT DEMOGRAPHICS

- 7 children (3 males, 4 females) with diagnosis of CP and motor disability. Ages 11-16 (13.86 years ± 1.8)
- Gross Motor Function Classification System
  - I (6/7) and II (1/7)
- All parents had high school/GED education level or higher

METHODS

- Recruitment from Gillick Lab Database
  (Inclusion criteria: children with history of CP/brain bleed)
- Virtual Meeting via Zoom
  • Discussed study procedures
  • Reviewed and obtained consent/assent via REDCap
- Sent supplies to family via USPS
  • Soterix Medical SNAAPstrap, mini-CT stimulator, sponge pads, alcohol wipes, measuring tape, pen

RESULTS

- Study duration: 10 days
- Participants performed tDCS setup following video instructions
- Data collected via surveys and tracking videos

Figure 1. Quality of tDCS setup tasks. All images were rated on a scale of 0-2 to evaluate the quality of task completion (2: performed successfully; 1: performed incorrectly; 0: incomplete). Step A required alignment of Soterix tDCS head strap with nasion of child. Step B required attachment of two electrode sponge pads to tDCS montage. Step C involved connection of the red and black electrodes to the mini-CT device. After the 10 minute sessions, the headgear moved on 1/7 participants on day one, and 4/7 participants on day 2. The average displacement for the sessions with movement was 0.73 cm ± 0.46.

EFFICIENCY

Figure 2. A. Average tDCS Setup Times. The time (in seconds ± SD) to complete the tDCS set-up steps was 10 min 25 sec ± 344 (sec) on day 1, 6 min 33 sec ± 142 (sec) on day 2, and 5 min 31 sec ± 56 (sec) on day 3. A one-way ANOVA revealed a strong trend between day and time of completion (F(2,18)=3.541, p=0.051). B. tDCS Setup Times per participant

CONFORT

Figure 3. Comfort of tDCS headgear. Participants are ordered by survey completion date.

CONCLUSIONS

- Parent-child pairs have the ability to follow remote tDCS setup procedures with the guidance of instructional videos
- Efficiency increased by almost 50% after two days
- Parent-child pairs correctly positioned the device, although error of alignment occurred in one participant
- Future studies with tDCS remote stimulation delivery will lead to increased accessibility and participation in research
- Enables inclusion of families with limited access, mobility, and finances to access non-invasive brain stimulation (NIBS), particularly during COVID-19 pandemic

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REFERENCES