The Feasibility of Transcranial Direct Current Stimulation as an Adjunct to Inpatient Physiotherapy in Pediatric Acquired Brain Injury: Challenges with Eligibility and Retention

Jennifer Ryan, Deryk Beal, Darcy Fehlings, Danielle Levac, Virginia Wright

Background

Intensive physiotherapy (PT) in the subacute stage of acquired brain injury (ABI) promotes motor recovery, but plateaus in recovery have a lasting impact on mobility and participation. Transcranial direct current stimulation (tDCS) combined with motor skill practice has enhanced motor outcomes in children with cerebral palsy but has not been studied in pediatric ABI. tDCS during the subacute stage of recovery might be ideal due to the high potential for neuroplasticity.

Research Question:
Is a ‘PT+tDCS’ protocol feasible in an existing inpatient pediatric ABI program?

Methods

Study Design: Randomized sham control feasibility trial

Participants:
- Target sample size = 30
- 5-18 years old
- Moderate to severe ABI
- Inpatients on the Brain Injury Rehabilitation Team (BIRT) at Holland Bloorview Kids Rehabilitation Hospital
- JR screened admissions weekly in collaboration with BIRT PT and physician

Treatment:
- Anodal active/sham tDCS to bilateral primary motor cortices followed immediately by PT intervention
- 16 sessions over 4 weeks

Feasibility Indicators:
- Eligibility and recruitment rates
- Tolerance to tDCS
- Retention and adherence rates
- Change in gross motor function (core set of validated outcome measures)

Results

Table 1. Screening from Jan 1, 2020 to Sep 30, 2021.

| Admissions | 233 |
| Mean Age (years) | 8.9 |
| Admissions 5-18 years | 166 |
| Met Eligibility Criteria | 6 |
| Enrolled | 4 |
| Completed Study Protocol | 1 |

Table 2. Most frequent reasons for STUDY EXCLUSION in age eligible children

<table>
<thead>
<tr>
<th>Total</th>
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<tbody>
<tr>
<td>Brain tumour*</td>
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<tr>
<td>Seizures</td>
</tr>
<tr>
<td>Communication and/or Behaviour Challenges</td>
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<tr>
<td>Short length of stay</td>
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<tr>
<td>No ABI PT goals</td>
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<tr>
<td>Bone flap removed, scalp incisions, etc.*, Decreased tolerance</td>
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Program admissions who met eligibility criteria ➔ 2.6%
Eligible children who enrolled in the study ➔ 67%
Enrolled children who completed study protocol ➔ 25%

Conclusions

- Study enrollment was far lower than expected
- The number of children admitted for rehabilitation after surgery for brain tumours or epilepsy contributed to low study eligibility rates
- Study retention was affected by changes in medical stability during admission
- Eligibility and retention may improve after discharge from inpatient rehab (i.e., once bone flap replaced, fatigue/tolerance improves, etc.)
- Next step: Evaluate the feasibility of a PT+tDCS protocol in outpatient children with ABI

References

Figure 1. 1x1 tDCS unit (https://soterixmedical.com)