Parietal-Insular-Vestibular tDCS for Treatment of Lateropulsion following Stroke

Michael Reding,1,4 Suzanne Babyar,1,2 Taiza Santos-Pontelli,3 Tennyson Lemos,3 Dylan Edwards1,4
1Burke Medical Research Institute & Burke Rehabilitation Hospital, White Plains, NY; 2Hunter College, NY, NY;
3Ribeirao Preto Medical School, University of Sao Paulo, Brazil; 4Weill Medical College of Cornell University, NY, NY.

ABSTRACT

OBJECTIVE

To determine if tDCS to the PIVC affects lateropulsion in seated position after stroke.

BACKGROUND

Lateropulsion following stroke (Pusher Syndrome) is defined as a lateral displacement of subjective postural vertical manifested by the patient's tendency to push their center of gravity toward the weak side.1 It is thought due to lesions affecting the Ventral Lateral Thalamus or its projections to the Parietal-Insular-Vestibular Cortex (PIVC).2 Lateropulsion is a significant impediment to stroke recovery and might be ameliorated by either anodal tDCS stimulation of the affected PIVC, or cathodal tDCS inhibition of the unaffected PIVC.3

METHODS

Subjects
Nine subjects with Burke Lateropulsion Scale scores >2 within 30 days of an ischemic stroke. Burke Rehabilitation Hospital IRB approved the protocol. (74.8 y ± 9.5; 7 female; 6 right brain lesion; BLS 6.2 ± Z.9.

Instrumentation (Figure 1):
• Specialized chair centered upon an AMTI (ORS-6) forceplate transferred force data to AcqKnowledge software (Biopac™ Systems).
• Simultaneously, a Biopac™ accelerometer (centered on mid-sternum of the seated subject) converted trunk lean data via a accelerometer-to-inclinometer subroutine in AcqKnowledge.
• Starstim (model 1.3) delivered 2mA tDCS (via 25cm² saline-soaked sponge electrodes).

Procedure: Each subject experienced tDCS with the following montages on different days:
• Montage 1: Test Condition. Anode over the ipsilesional PIVC* and cathode over the contralesional PIVC
• Montage 2: Control Condition. Anode over the ipsilesional PIVC and cathode over the contralesional supra-orbital region.

RESULTS

Repeated Measures ANOVA showed:
• Mean mediolateral COP-X deviated significantly towards the paretic side, away from anodal stimulation over time for both montages. There was no significant effect of montage Test versus Active Control on COP-X displacement (Figure 2).
• Mean Velocity of COP-X increased significantly for both montages over time, but was not significantly different for montage Test vs. Active Control (Figure 3)
• Mean Inclinometer readings (degrees) also showed a significant deviation with time towards the paretic side away from anodal stimulation for both montages. This deviation was significantly less for montage Test versus Active Control

DISCUSSION

Both montages showed worsened COP-X displacement and inclinometer tilt towards the paretic side over time. This may indicate subject fatigue, or a true detrimental effect of anodal stimulation over the affected PIVC. Both montages showed an increase in COP-X mean velocity.

SUMMARY & FUTURE DIRECTIONS

Our results may indicate a weak but beneficial disruption of tonic postural bias toward the paretic side. A non-stimulation sham control will be added to the protocol. A Galvanic Vestibular Stimulation montage (anode over the affected mastoid, cathode opposite) will be added searching for a more robust treatment effect

REFERENCES

8. There are no conflicts of interest associated with this project.
9. Tennyson Lemos, MD, Stroke Research, Burke Rehabilitation Hospital
10. Suzanne Babyar, MD, Stroke Research, Burke Rehabilitation Hospital

Figure 1: Mean (SE) Mediolateral Displacement of Center of Pressure for Two Montages

Figure 2: Mean (SE) Trunk Tilt Measured by Inclinometer

Figure 3: Mean Velocity of Mediolateral COP-X Displacement

Figure 4: Mean (SE) Trunk Tilt Measured by Inclinometer