

**Methods:** 36 sub-acute ischemic stroke survivors participated in the study, randomly assigned to one of three groups receiving (tDCS), bihemispheric (Anodal over affected M1, and cathodal over healthy M1) or unihemispheric (Anodal over affected M1, and cathodal stimulation over the supraorbital bone of the healthy side) or sham (No current). ActivaDose tDCS (USA) used, consisted of 20 minutes of 2 mA intensity; in each session for 12 sessions three sessions per week. A 3ml blood sample was withdrawn from one of the arm veins. The first sample was withdrawn in the first session and the second sample after the end of the tDCS sessions after four weeks of the treatment. Serum levels of BDNF were determined using commercially available ELISA kits (SunRed Biotechnology Company).

**Results:** There was a statistically significant difference (Negative change) within the groups for bihemispheric (P-value = 0.011), and unihemispheric stimulation (P-value = 0.003). For the sham group, no significant difference (P-value = 0.492) as presented in figure 1. There was significant difference between groups (P-value = 0.005). Running post-hoc test by pairwise revealed both bihemispheric and unihemispheric stimulation significantly decreased BDNF levels more than sham (P=0.001), (P=0.021), respectively and with no significant difference between both experimental groups (P=0.217).

**Conclusion:** BDNF has showed significant decrease after tDCS application in ischemic stroke patients, even the motor measures have been positively improved.

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## LONG-TERM HOME-BASED FRONTO-CEREBELLAR TRANSCRANIAL DIRECT CURRENT STIMULATION FOR AUTISM SPECTRUM DISORDER: A CASE SERIES

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**Introduction:** In a previous study, we reported that right cerebellar/left frontal transcranial direct current stimulation (tDCS) is feasible, safe and potentially effective for improving Autism Spectrum Disorder (ASD) symptoms among children (D'Urso 2021).

Considering the cumulative neurophysiological effect of repeated sessions of tDCS and the potential decay of the obtained clinical improvements after discontinuation, longer-term treatments show great promise to increase the clinical outcomes. Home-based tDCS is a suitable option for ensuring a long-lasting compliance to the treatment, especially in ASD patients, who are very susceptible to routine changes and environmental stressors.

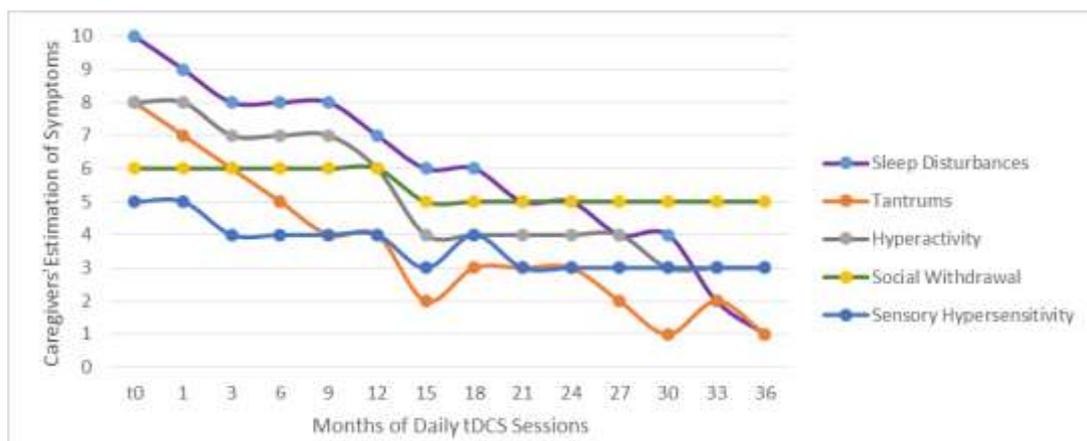


Figure 1. Treatment for three years

### Methods:

- 6 patients (4M, 2F) with ASD, aged 7 to 37 years (mean 15.2);
- Continuous daily 20-minute tDCS sessions with current intensity ranging from 1 to 2 mA;
- The anode was placed over the dorsolateral prefrontal cortex (DLPFC) and the cathode over the right cerebellum;

- Treatment was carried out at home by caregivers, after training;
- During the treatment no changes were made to the ongoing therapies;
- A 10 point VAS was administered to the caregivers to assess the most disturbing and disabling behavioral problems at baseline, after 1 month of treatment and every three months afterwards.

**Results:**

- One patient has been treated uninterruptedly for three years (Figure 1), two patients for one year, and one for three months.
- One patient stopped the treatment after 43 sessions due to lack of clinical improvement.
- The five patients who are continuing the treatment showed a significant improvement during the first few months, which has been maintained over time.
- The only patient who did not show any improvement suffers from a comorbid rare genetic syndrome.
- No adverse effects were reported, besides mild skin irritation.

**Conclusion:** Our findings suggest that fronto-cerebellar tDCS is feasible, safe and easy to administer to ASD patients even at home and for long periods of time, provided that the patients' caregivers are appropriately trained. Long-term therapy ensures the persistence of the previously obtained clinical improvement without additional side effects.

**References:**

1. D'Urso G: *Cerebellar Transcranial Direct Current Stimulation in Children with Autism Spectrum Disorder: A Pilot Study on Efficacy, Feasibility, Safety, and Unexpected Outcomes in Tic Disorder and Epilepsy. J Clin Med 2021; 11:143*

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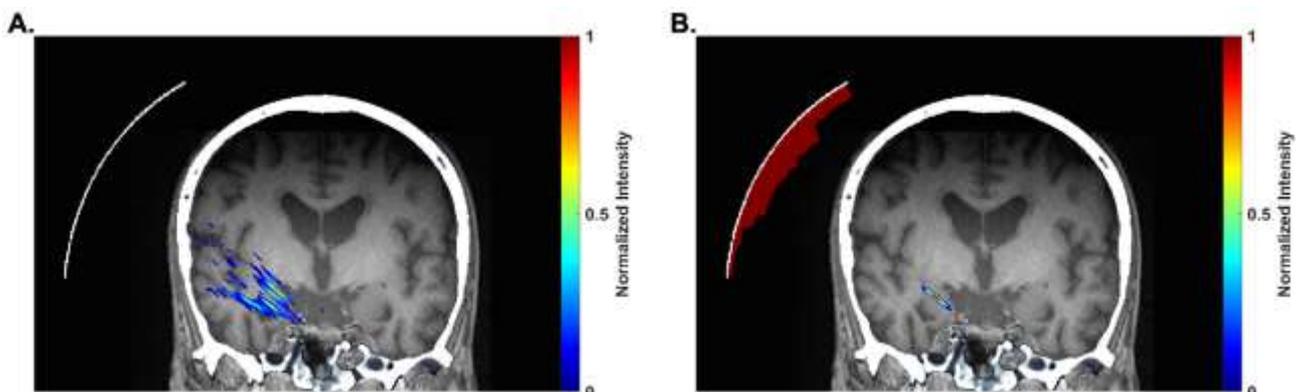
## A 20-YEAR JOURNEY IN TRANSCRANIAL ULTRASOUND STIMULATION - LESSONS LEARNED

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**Introduction:** Transcranial Ultrasound Stimulation (TUS) is an innovative technique allowing for the first time non-invasive deep brain neuromodulation with a millimetric precision. But since the proof of concept of ultrasonic neuromodulation with the skull bone removed, in 1958, many challenges remained to be overcome: (i) the development of technologies enabling to focus ultrasound beams through the human skull, (ii) the identification of stimulation parameters allowing sustained neuromodulation effects and (iii) the definition of safety limits for clinical application. Over the last 20 years our laboratory has gained an internationally recognized track record in addressing each of these three key issues. In this presentation, we review 20 years of research in our laboratory that paved the way to the translation of TUS in medicine.



**Figure 1.** Acoustic intensity map when targeting the right amygdala without (A.) and with (B.) the use of a 3D printed acoustic lens (in dark red) covering a single-element ultrasonic transducer (in white). Sagittal planes are represented. The thickness of the lens was calculated based on a CT scan of the skull