Cortical activation following chronic transcranial direct current stimulation in patients with minimally conscious state: A NIRS-based assessment associated to behavioral and plastic response

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Background

Near infrared spectroscopy (NIRS), a non-invasive technique measuring changes in brain tissue oxygenation, is potentially useful in the study of traumatic brain injury.[1,2] In a longitudinal pilot study in patients with minimally conscious state (MCS) (NCT:02288533) we assessed by NIRS the changes of cortical activation (CANIRS) following chronic transcranial direct current stimulation (tDCS) and their association with behavioral changes and biomarkers of plasticity.[3]

Methods

Six male patients aged 35±10 with post-traumatic chronic (≥1 year) MCS were enrolled to receive ten 40-minute daily sessions of 2 mA bilateral M1 anodal tDCS (Brainstim, EMS, Italy).

Before the first and last session, twenty-minute NIRS monitoring was performed, with optodes placed at M1 bilaterally. Oxygenated hemoglobin was recorded, with area-under-curve calculated to determine CANIRS. Consciousness was assessed by the coma recovery scale-revised (CRS-R) total score. Two neuro-vascular biomarkers of plasticity (brain-derived neurotrophic factor and vascular endothelial growth-factor) were quantified in sera samples by proper methods.

Results

CANIRS increased following treatment in the whole population (+13%; P=0.60) as well the CRS-R total score (from 11±3 to 12±2).

CANIRS, stable in four patients (mean fold-change 0.5), was selectively increased in two subjects (mean fold-change 2.2). Interestingly, only CANIRS responders showed an increase of CRS score (≥2 points) and variations of plastic biomarkers (Figure 1).

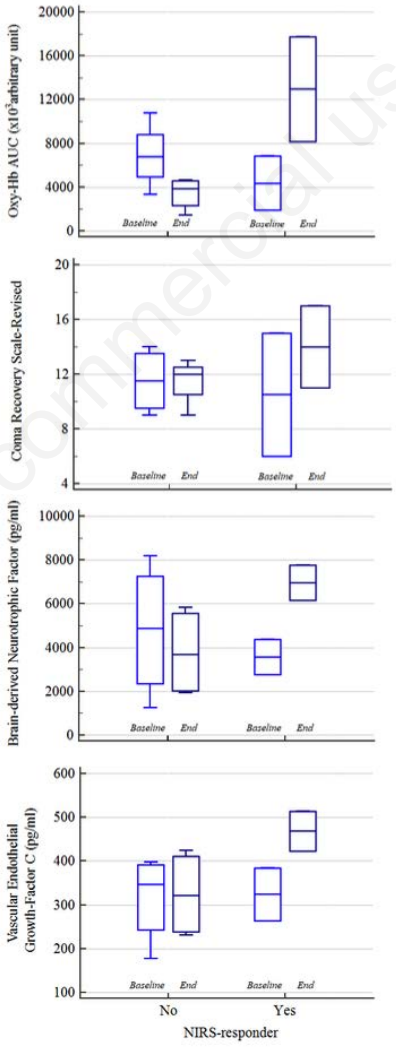

Figure 1. Values of CA_{NIRS}, CRS-R, BDNF and VEGF-C at baseline and at the end of the 10 sessions of tDCS.

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Conclusions

The study, limited by the small sample size, supports the feasibility of NIRS monitoring in MCS patients. CANIRS, with variations congruent with behavioral and plasticity changes, may represent an objective technical biomarker of response to tDCS treatment.

References

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