Effects of Direct Current Stimulation (tDCS) in Pharmacoresistent Focal Epilepsy

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Introduction

Aim of present study is to evaluate the efficacy of Cathodal Transcranial Direct Current Stimulation (tDCS) to modulate the excitability and the clinical findings in patients with Pharmacoresistent Focal Epilepsy. We hypothized that cathodal stimulation, reducing cortical excitability, could be effective in suppressing epileptiform discharges.

Methods

Twelve subjects (6 female, 6 male, mean age: 41 years +/- 1) suffering from drug-resistant focal epilepsy were evaluated. All subjects were diagnosed according to 2010 ILAE criteria. The focus has been assessed by means of EEG and by Magnetic Resonance Imaging (MRI). Subjects were divided in two groups in a randomized order, one receiving real cathodal stimulation (6 patients) and one receiving sham (placebo) stimulation (6 patients). tDCS was administered in five consecutive daily session of 20 minutes each one, at 1 mA intensity. All patients underwent three standard EEG (T0: baseline, T1: at the end of the last session and T2: after 30 days). The active electrode (cathode) was placed over the epileptogenic focus, while the reference electrode over the controlateral mastoid.

Results

EEGLAB software (version 13) on Matlab R2013a was used for the Quantitative EEG analysis. For each subject, spectra of the EEG channel closer to stimulation point were considered. The analysis of variance (ANOVA) showed a reduction of slow activity (delta frequency) in the regions stimulated by tDCS in the active group (p=0.0001), instead the sham stimulation didn't modified the spectral power. In particular, in a post hoc analysis, there was a trend to significance in the interaction between the type of stimulation (real vs sham) and the type of frequency (F(6,60)=1,9057; p=0,09456) and significant effect interaction between type of stimulation and time of observation (F (2,38)= 235,19; p=0,0001). The frequency of critical events were not significantly modified by the type of employed stimulation.

Conclusion

In our study, spectra of patients receiving active treatment were modified with reduction in power of the slow EEG activity as shown by the quantitative analysis of the frequency bands. This effect didn't last one month after the end of the stimulation. A possible explanation of this effect could be the relative few number of stimulation sessions or the poor focality of stimulation tDCS electrodes or the magnitude of active current. Our results suggest a possible role of non-pharmacological approach in the treatment of Pharmacoresistent Focal Epilepsy.

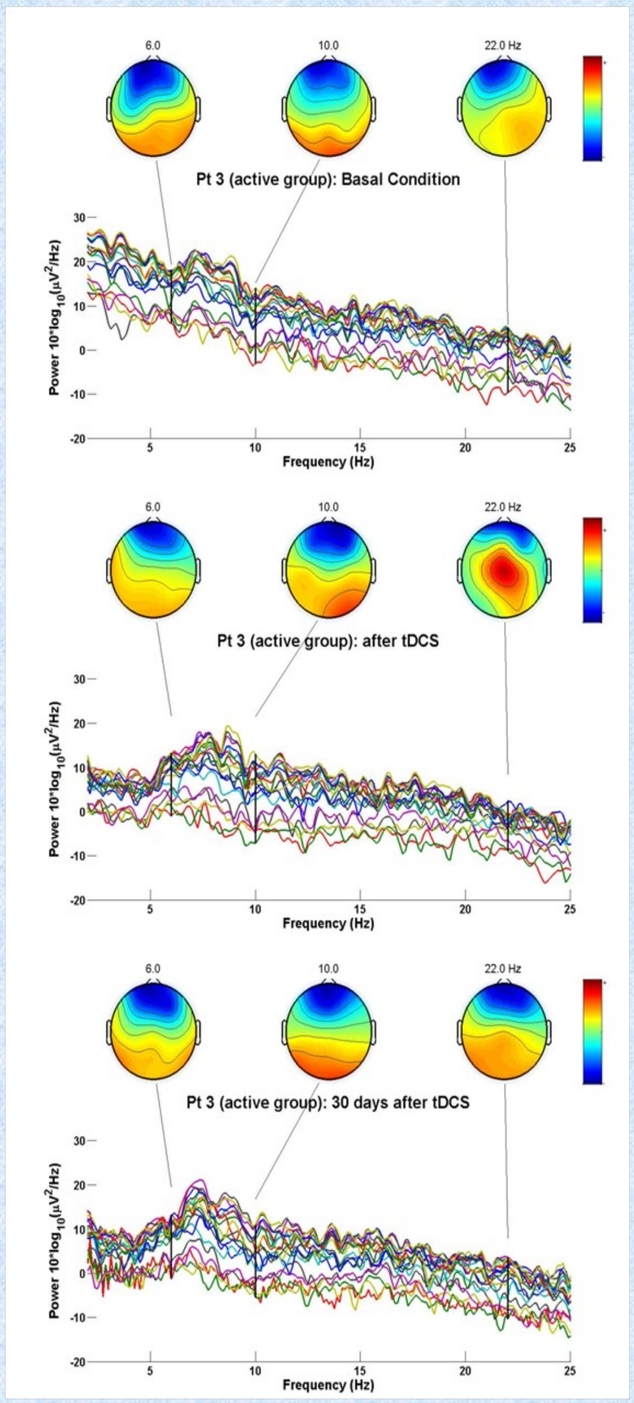

Figura 1. *Power Spectrum of the 19 unipolar derivations and topographic mapping on patients' scalp* ***(active stimulation)*** *for the three reference frequencies (6 Hz: theta band; 10 Hz: alpha band; 22 Hz: beta band)*

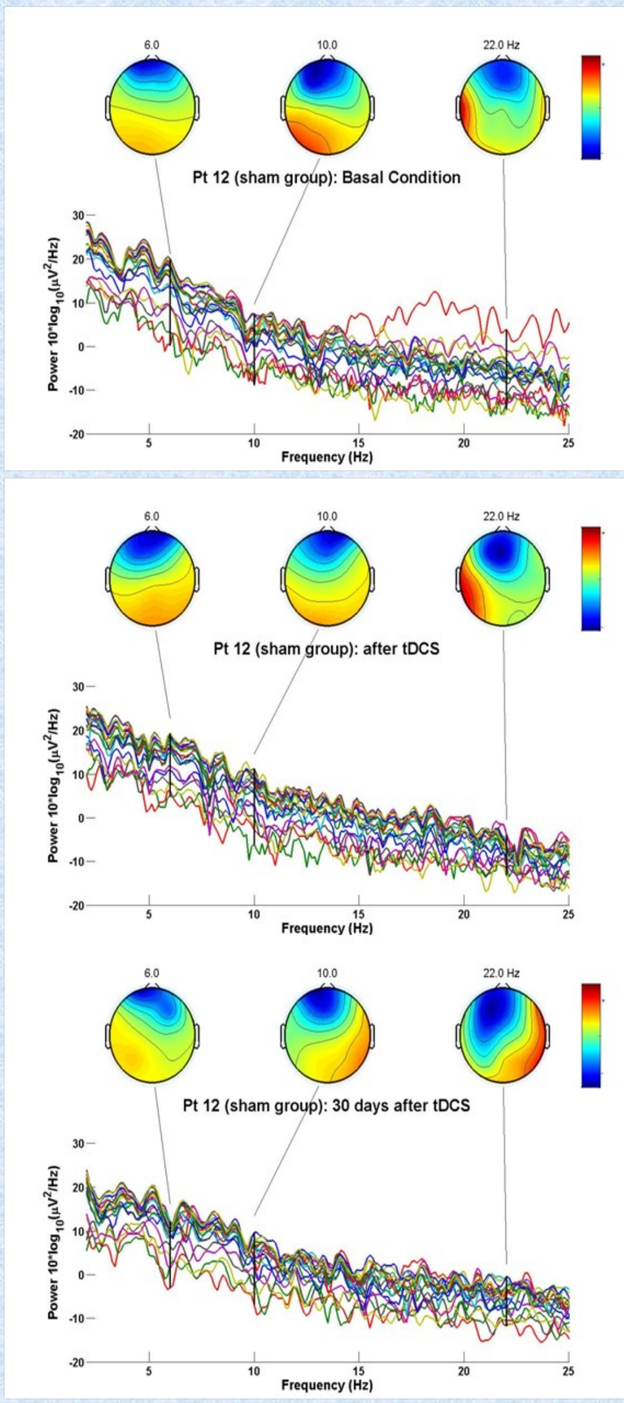

Figura 2. *Power Spectrum of the 19 unipolar derivations and topographic mapping on patients' scalp* ***(sham stimulation)*** *for the three reference frequencies (6 Hz: theta band; 10 Hz: alpha band; 22 Hz: beta band)*

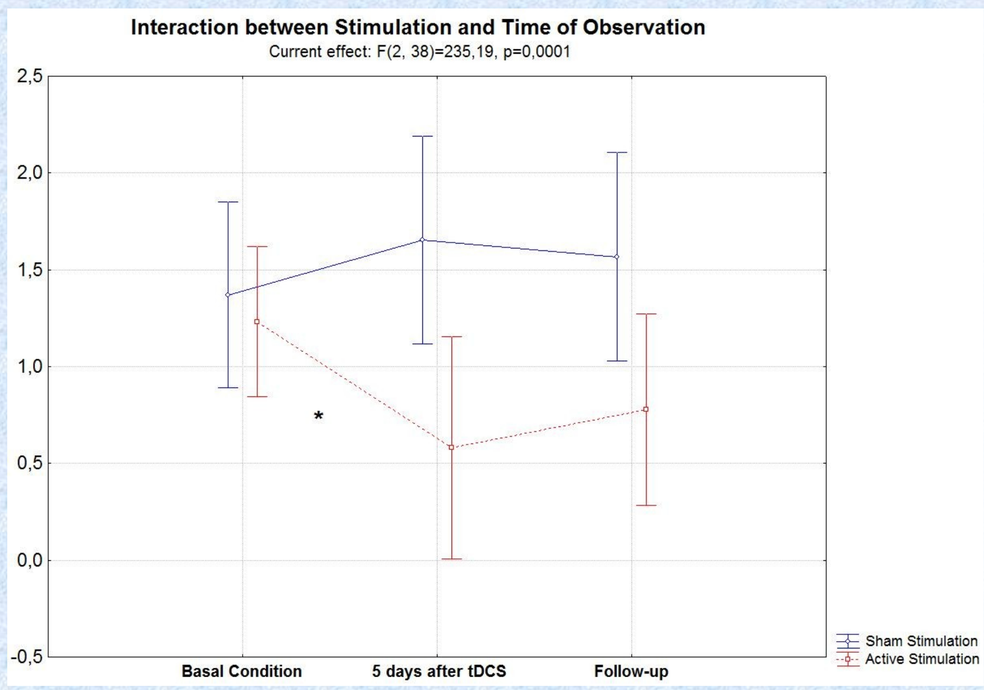

Figura 3 *Analysis of Variance (ANOVA) 2x3 (Interaction between Stimulation and Time of Observation): note the significant difference between basal condition and 5 days after tDCS condition when active stimulation was delivered.*

References

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