Modulatory effects of anodal transcranial direct current stimulation (tDCS) on somatosensory gating in patients with Fibromyalgia Syndrome.

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Introduction

Several studies have demonstrated a reduced habituation to redundant somatosensory stimuli, reflecting an impaired sensory gating in Fibromyalgia Syndrome (FMS) patients (Montoya et al., 2006). In this sense, anodal transcranial direct current stimulation (tDCS) has been shown to modulate the early and late stages of somatosensory processing, generating functional and structural changes (Hilgenstock et al., 2016; Hirtz et al., 2018). However, no study has explored the effects of tDCS on sensory gating in FMS.

The aim of the present study was to examine the modulatory effects of anodal tDCS applied over the left primary somatosensory cortex (SI) on somatosensory gating in FMS patients.

Materials and Methods

Participants. 39 female FMS patients (43 – 71 years, mean 55.56 ± 7.85) participated in the study and were randomly assigned to the active tDCS (n = 17) or non-electrical stimulation (SHAM; n = 22).

Experimental design. tDCS group received a single anodal tDCS session (20 minutes of duration, 1.5 mA of intensity) over the left SI. Before and after tDCS or SHAM stimulation, somatosensory evoked potentials (SEPs) were recorded during a paired-pulse paradigm, consisted in two identical somatosensory stimuli (S1 and S2) applied in the right forefinger in rapid succession.

Statistical analysis. P50, N100 and Late Positive Complex (LPC) components were measured (Figure 1). Amplitude differences elicited by S1 minus S2 as sensory gating indicator were analyzed through a multivariate analysis of variance with repeated measures, using *Group* (tDCS vs. SHAM) as between-subject factor and *Time* (pre vs. post), *Hemisphere* (left vs. right) and *Electrode* (30 electrodes) as within-subject factors.

Fig. 1. SEPs elicited by S1 and S2 of tDCS and SHAM groups before (PRE) and after (POST) the brain stimulation at each hemisphere.

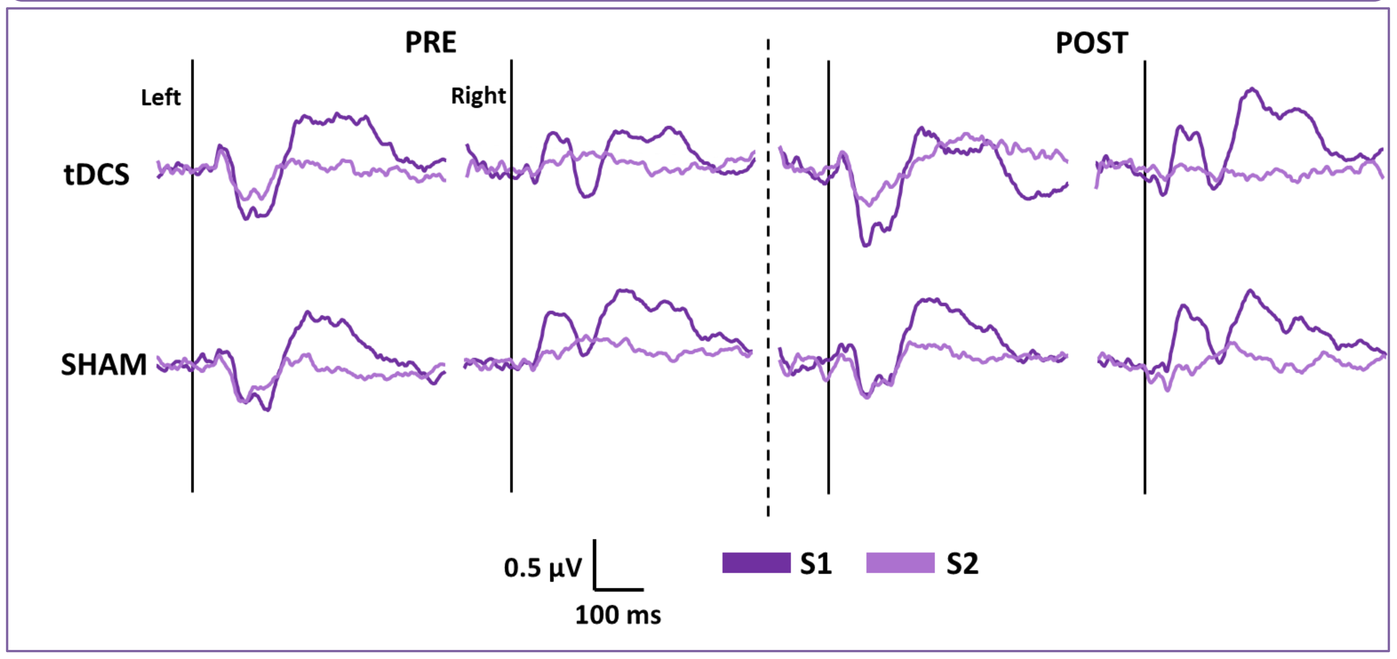
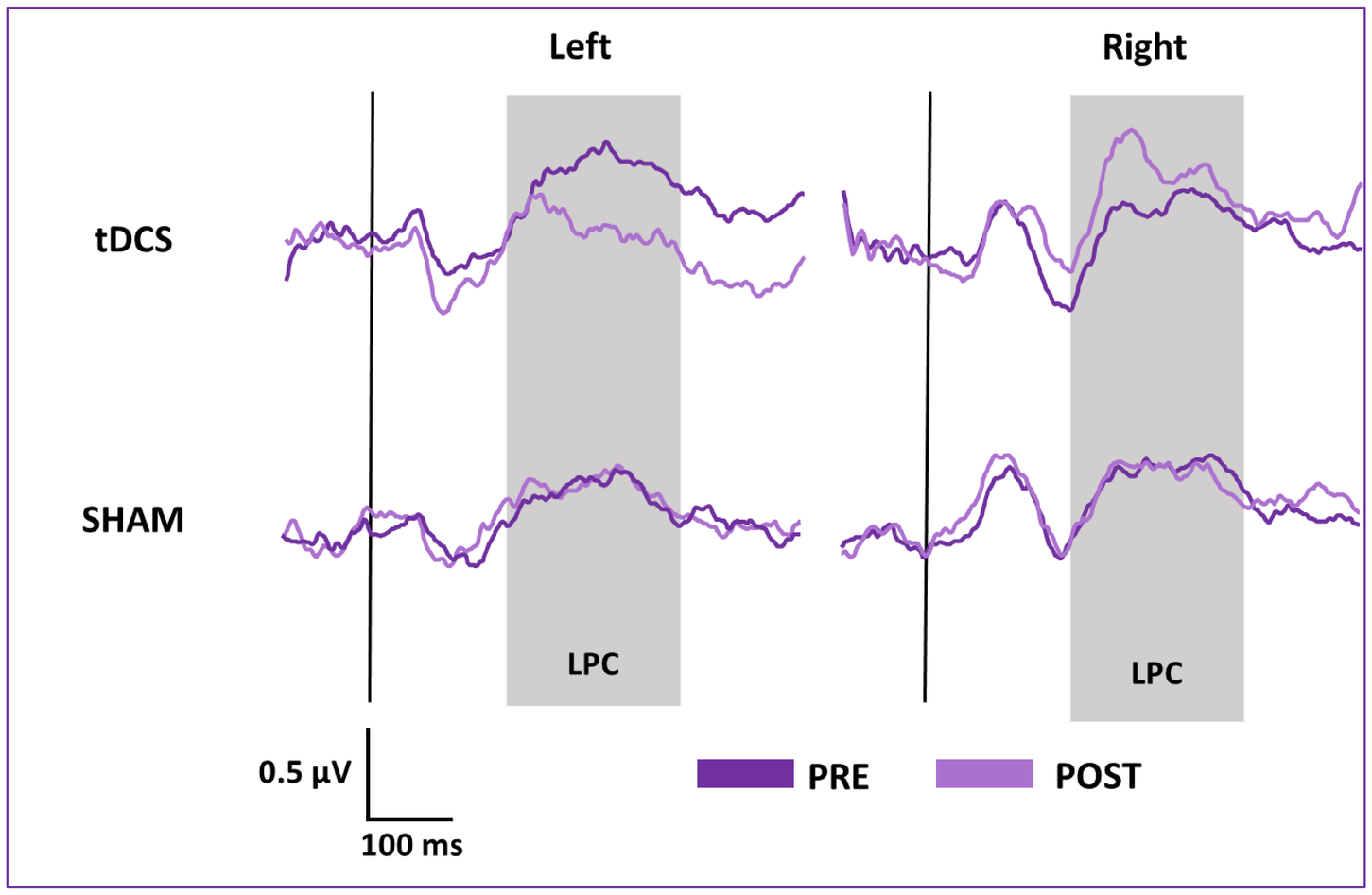


Fig. 2. . Waveforms representing the sensory gating (S1 – S2) of tDCS and SHAM groups before (PRE) and after (POST) the brain stimulation at each hemisphere.



Results

- For **LPC component** (Figure 2) a significant interaction effect of *Group* x *Time* x *Hemisphere* [F(1,36) = 5.742, p = 0.022, ηp² = 0.138] was found, showing that:
  - Sensory gating was significantly enhanced after stimulation (88.49 ± 19.90 µV*ms) compared with before (39.03 ± 17.75 µV*ms) at right hemisphere electrodes (p = 0.043) in the tDCS group.
  - An inverse significant effect was found at left hemisphere electrodes (p = 0.009), as sensory gating was reduced after stimulation (15.80 ± 26.93 µV*ms) compared with before (77.12 ± 19.97 µV*ms) in the tDCS group.
  - No significant effects were obtained in the SHAM group (all p > 0.637).
- No significant effects or interactions were obtained for P50 and N100 components.

Conclusions

A single session of anodal tDCS (1.5 mA) over the left SI elicited a significant modulation of the somatosensory gating process in FMS. This effect was mirrored by an enhancement of inhibition to repetitive somatosensory stimulation over the right hemisphere, as well as an impairment over the left hemisphere. These modulations appeared only in the later stages of the somatosensory brain response, mainly restricted to the cognitive evaluation and not to the coding and perceptual processing of bodily information. Although the above reported lateralizing pattern remains to be clarified, present results suggest that brain excitability and somatosensory processing may be modulated by using anodal tDCS in FMS patients.

References

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