

Alterations in Emotional Processing in Fibromyalgia Syndrome: Event-Related Potentials and Modulatory Effects of tDCS

Casandra I. Montoro Aguilar, Pilar Ruiz-Medina, Laura Fischer-Jbali, Gustavo A. Reyes del Paso

University of Jaén (Spain)
University of Innsbruck (Austria)

INTRODUCTION & AIM

Fibromyalgia syndrome (FMS) is a chronic pain condition associated with alterations in emotional and cognitive processing. Previous research suggests that patients with FMS show atypical attentional processing of emotional stimuli and altered cortical responses, particularly during tasks involving emotional faces (Fischer-Jbali et al., 2022, 2024). Event-related potentials (ERPs) provide a useful tool to characterize the temporal dynamics of these processes. In addition, neuromodulation techniques such as transcranial direct current stimulation (tDCS) have been proposed as potential interventions targeting cortical mechanisms involved in pain and emotion regulation. However, few studies have examined emotional processing in FMS by simultaneously integrating cortical and autonomic measures, despite the relevance of autonomic regulation in pain-related conditions. Therefore, this study aimed to examine emotional processing in FMS using an emotional Dot-Probe task and ERPs, to evaluate the modulatory effects of anodal tDCS over the left dorsolateral prefrontal cortex (DLPFC), and secondarily to explore associated autonomic responses during task performance.

METHOD

- 30 Patients with FMS and 30 healthy controls completed an emotional Dot-Probe task with facial stimuli.
- EEG/ERPs, pain perception, and autonomic parameters were recorded during the task.
- In a pre-post design, participants also received active or sham anodal tDCS over the left DLPFC (see Figure 1. Procedure)

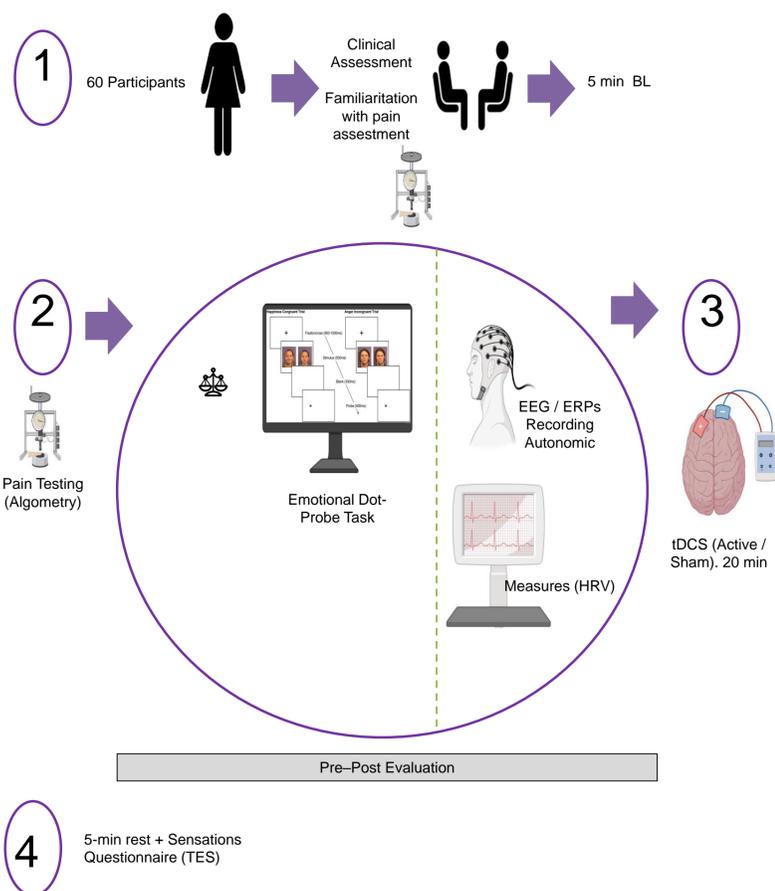


Figure 1. Procedure

REFERENCES

- Fischer-Jbali LR, Alacreu A, Gálvez-Sánchez CM, Montoro CI. Measurement of event-related potentials from electroencephalography to evaluate emotional processing in fibromyalgia syndrome: A systematic review and meta-analysis. *Int J Psychophysiol.* 2024;198:112327.
- Fischer-Jbali LR, Alacreu A, Gálvez-Sánchez CM, Montoro CI. Central nervous activity during a dot-probe task with emotional facial stimuli in fibromyalgia: An event-related potentials study. *Psychophysiology.* 2022;59:e14035.

RESULTS & DISCUSSION

Patients with FMS showed higher levels of emotional distress, alexithymia, pain catastrophizing, and poorer quality of life than controls (all $p < .001$), together with lower pain threshold ($M = 1.95$ vs. 3.02 ; $p = .001$) and pain tolerance ($M = 5.07$ vs. 6.18 ; $p = .013$). ERP analyses revealed altered cortical dynamics during emotional processing, characterized by **enhanced early responses** ($P1$: $F(1,50) = 9.60$, $p = .003$; $N1$: $F(1,50) = 8.18$, $p = .006$) and **reduced P3 amplitude** ($F(1,50) = 4.17$, $p = .047$) (see Figure 2), while structural face-processing components remained preserved. Behaviorally, patients showed **poorer task performance and reduced attentional orientation toward highly arousing positive faces** ($p = .023$). Autonomic differences were limited, with only a **shorter R-R interval** in the FMS group ($p = .030$). **tDCS over the left DLPFC did not produce generalized behavioral or autonomic changes**. ERP analyses revealed a significant time \times stimulation interaction, with **most pre-post cortical changes occurring in the sham condition** (increased P1 and P3 amplitudes and reduced N170/N250 overall at frontal level; see Figure 3), whereas active tDCS showed largely stable ERP responses across evaluations. Only subtle modulation of emotional-attentional processing was observed in patients with FMS under active stimulation.

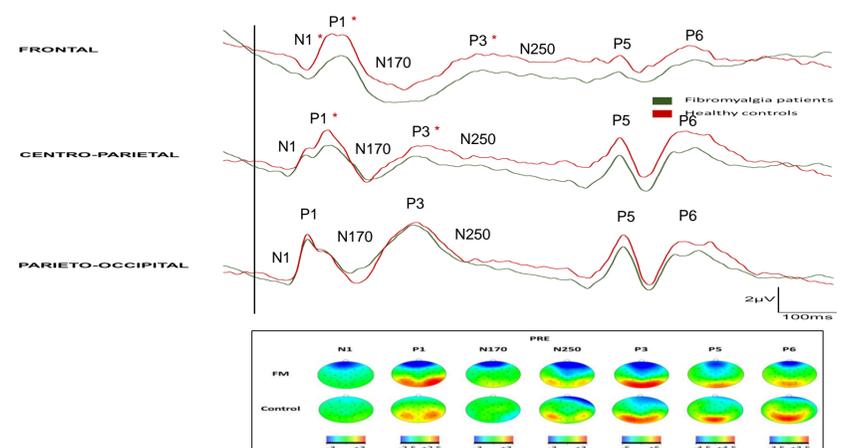


Figure 2. ERP differences between FMS patients and healthy controls

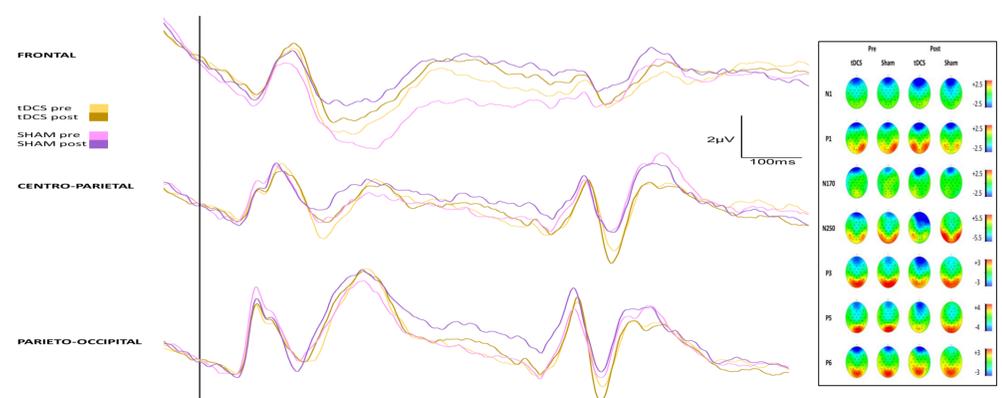


Figure 3. ERP modulation after active vs. sham tDCS

FMS is associated with altered cortical dynamics during emotional processing, characterized by increased early neural reactivity and altered later attentional-cognitive evaluation of emotional stimuli. These alterations are accompanied by poorer behavioral performance and reduced attentional orientation toward positive stimuli, suggesting disruptions in attentional-emotional mechanisms. tDCS over the left DLPFC did not produce generalized behavioral or autonomic effects, and most pre-post cortical changes were observed in the sham condition, although subtle modulation of emotional-attentional processing was observed under active stimulation.

CONCLUSION

FMS is associated with altered early and late cortical responses during emotional processing, suggesting disrupted attentional-emotional mechanisms, while tDCS over the left DLPFC shows only subtle neuromodulatory effects.

Funding: Research supported by a grant from the Consejería de Universidad, Investigación e Innovación en materia de I+D+i de la Junta de Andalucía (ProyExcel_00374) and a competitive grant for a predoctoral position within the Convocatoria de Ayudas para Contratos Predoctorales para la Formación de Doctores (PRE2023-UJA-01).