

Affective and cognitive modulation of pain by using real-time fMRI neurofeedback

ABSTRACT:

Given that neurofeedback can be used to vary the activity of the neural substrates of a region of interest in order to provoke behavioural changes, the present study tried to modify brain activity of different regions of the pain matrix through neurofeedback to induce changes in pain perception. Four experiments were carried out. Experiment I was designed to test the feasibility of real-time fMRI neurofeedback to train subjects to self-regulate the functional connectivity of insula and ACC. Preliminary data revealed significant changes in brain connectivity and reductions in pain ratings from pre- to post-training sessions. The protocol could not be applied in further subjects due to technical problems with the MR scanner. Experiment II revealed that neurofeedback training to self-regulate sensorimotor EEG (μ) rhythm was able to elicit differentially enhancements of desynchronization and synchronization of the μ rhythm, as well as to enhance functional connectivity of somatosensory cortices with different regions involved in pain processing. Experiment III demonstrated that chronic pain patients were able to learn to self-regulate the μ rhythm, but also that the neurofeedback training led to significant reduction of pain thresholds in these patients. Experiment IV showed that only good responders to the neurofeedback training of the EEG μ rhythm displayed significant differences in the power density difference between synchronization and desynchronization over somatosensory electrodes, and reduced pain ratings after the training. These findings suggested that self-regulation of neural activity within brain regions involved in pain processing can significantly modify functional connectivity of these regions and alter pain perception in chronic pain patients.

Keywords

Neurofeedback, Somatosensory cortex, Pain, Functional connectivity, Power spectral density

Published Work:

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Terrasa, J. L., Montoya, P., González-Roldán, A. M., & Sitges, C. (2018). Inhibitory control impairment on somatosensory gating due to aging: An event-related potential study. *Frontiers in Human Neuroscience*, 12: 280. doi: 10.3389/fnhum.2018.00280

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