AB053. Oscillatory activity specific to peripheral emotional treatment induced by a visual steady state

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Background: Research suggests that the analysis of facial expressions by a healthy brain would take place approximately 170 ms after the presentation of a facial expression in the superior temporal sulcus and the fusiform gyrus, mostly in the right hemisphere. Some researchers argue that a fast pathway through the amygdala would allow automatic and early emotional treatment around 90 ms after stimulation. This treatment would be done subconsciously, even before this stimulus is perceived and could be approximated by presenting the stimuli quickly on the periphery of the fovea. The present study aimed to identify the neural correlates of a peripheral and simultaneous presentation of emotional expressions through a frequency tagging paradigm.

Methods: The presentation of emotional facial expressions at a specific frequency induces in the visual cortex a stable and precise response to the presentation frequency [i.e., a steady-state visual evoked potential (ssVEP)] that can be used as a frequency tag (i.e., a frequency-tag to follow the cortical treatment of this stimulus. Here, the use of different specific stimulation frequencies allowed us to label the different facial expressions presented simultaneously and to obtain a reliable cortical response being associated with (I) each of the emotions and (II) the different times of presentations repeated (1/0.170 ms =~5.8 Hz, 1/0.090 ms =~10.8 Hz). To identify the regions involved in emotional discrimination, we subtracted the brain activity induced by the rapid presentation of six emotional expressions of the activity induced by the presentation of the same emotion (reduced by neural adaptation). The results were compared to the hemisphere in which attention was sought, emotion and frequency of stimulation.

Results: The signal-to-noise ratio of the cerebral oscillations referring to the treatment of the expression of fear was stronger in the regions specific to the emotional treatment when they were presented in the subjects peripheral vision, unbeknownst to them. In addition, the peripheral emotional treatment of fear at 10.8 Hz was associated with greater activation within the Gamma 1 and 2 frequency bands in the expected regions (frontotemporal and T6), as well as desynchronization in the Alpha frequency bands for the temporal regions. This modulation of the spectral power is independent of the attentional request.

Conclusions: These results suggest that the emotional stimulation of fear presented in the peripheral vision and outside the attentional framework elicit an increase in brain activity, especially in the temporal lobe. The localization of this activity as well as the optimal stimulation frequency found for this facial expression suggests that it is treated by the fast pathway of the magnocellular layers.

Keywords: Emotional expressions; electrophysiology; frequency labeling; steady-state visual evoked potential (ssVEP); spatial visual attention

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