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Conference Paper · December 2019

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Left DLPFC Delta-Beta Cross-Frequency Coupling in Maladaptive and Adaptive Perfectionist: An Index of Stress Regulation?

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Cross-frequency coupling (CFC) as a candidate neural mechanism of affective control between different neural oscillations coordinates complex cortical computations, such as information transfer and encoding. It seems that frontal delta-beta CFC reflects cross-talk between subcortical (delta) and cortical (beta) brain regions which correlate with attentional control (reduced trait anxiety) and predicts stress regulation efficiency. However, prior studies suggested that frontal delta-beta CFC is higher in an adaptive stress regulation mechanism (higher CFC in low social anxiety people). Perfectionism has been linked to affective and cognitive processes and mental health outcomes. Maladaptive perfectionism has a close relationship with some negative outcomes and mental vulnerabilities, such as suicidal behaviors, obsessive-compulsive disorder, stress, anxiety and depression. High or low stress is one of the major factors in distinguishing both maladaptive and adaptive groups of perfectionists. As we know left dorsolateral prefrontal cortex (dlPFC), one of the most stress-sensitive brain areas, is linked to perfectionistic behavior.

To offer a better understanding of CFC in stress regulation, in this study the 64-channel scalp electroencephalogram (EEG) from thirty participants (15 maladaptive perfectionism, 15 adaptive perfectionism) was recorded. Then, left DLPFC (F3 electrode) delta-beta phase-amplitude coupling (PAC) in maladaptive and adaptive perfectionists was estimated during the resting state.

Our results showed that significantly higher delta-beta PAC in adaptive than maladaptive perfectionist participants in the F3 location corresponds to left DLPFC. For comparisons of PAC indexes (MI value) between two groups in experimental data, the two independent samples t- test was used and there was a significant different between two groups in frontl delta-beta phase amplitude coupling with p value=0.003. This result is in line with studies which indicate increasing brain activity by rTMS over the left DLPFC can help attenuating physiological stress reactions. Together, these findings are interpreted to suggest that delta-beta PAC is a plausible neurobiological index of adaptive stress regulation and can distinguish between trait maladaptive and adaptive groups of perfectionists during stress conditions.