

Abstract

Understanding the role of the Ventrolateral Prefrontal Cortex in Emotional Memory using Transcranial Direct Current Stimulation & Transcranial Magnetic Stimulation

by

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Enhanced processing of emotional stimuli can have beneficial effects, such as being better encoded and remembered than neutral information, but task irrelevant emotional information can lead to increased distraction thereby having a negative effect on ongoing working memory tasks. Recent evidence suggests that the ventrolateral prefrontal cortex (VLPFC) has multiple roles in the enhancing effects of emotion on memory through top-down/controlled processes, including 1) coping with negative distraction and 2) elaborative encoding of negative information. Additionally, previous research has alluded to hemispheric differences in the VLPFC (Chapter 1). Two experiments tested the roles of the left and right VLPFC in working memory and/or episodic memory tasks using non-invasive brain stimulation techniques. Experiment 1 (Chapter 2) used transcranial direct current stimulation (tDCS) to test whether or not the VLPFC is involved in working memory and episodic memory, and whether or not there are hemispheric differences such that the left VLPFC has a causal role in coping with emotional distraction, whereas the right VLPFC has a causal role in deeper encoding of emotional stimuli for distractors that do not disrupt working memory. Results showed that the tDCS over left VLPFC led to improved WM tasks with both neutral and negative distractors, and also indicated that there might be a greater demand on the VLPFC with negative distraction. The right VLPFC played a role in linking together WM and EM performance. Experiment 2 (Chapter 3) used transcranial magnetic stimulation (TMS) to test whether the involvement of the VLPFC in “emotional enhancement of episodic memory effect” was: 1) dependent on the available attentional resources, and 2) dependent on valence and/or arousal. Inhibiting the right VLPFC led to a reduced emotional enhancement of episodic memory effect for both “negative arousing” and “negative nonarousing” words. In contrast, inhibiting the left VLPFC under full attention reduced the emotional enhancement of episodic memory effect for “negative nonarousing” words only, suggesting that the role of the left VLPFC is dependent upon stimulus type and controlled processing. Together, these results point to a role of the VLPFC in both: 1) working memory for both negative and neutral information and 2) enhanced episodic memory for emotional stimuli, which are likely related its role in controlled processing.