Repetitive transcranial magnetic stimulation and emotion regulation: the left prefrontal cortex is not the only option

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Repetitive transcranial magnetic stimulation (rTMS) is a non-invasive technique based on focal electromagnetic induction. Only a decade ago the first successful application in psychopathology was reported when Hoflich et al. (1993) found beneficial effects after rTMS over the left prefrontal cortex (PFC). On the premise that depression goes accompanied by left PFC hypoactivity, which can be restored by high frequency rTMS, numerous clinical studies targeting the left PFC were run. Although results have been promising, explanations for the physiological mechanisms involved remain weak or even completely absent. Moreover, there must be more to it than left PFC hypo-activation in depression. After Rosenburg et al. (2002) found antidepressant effects after both slow and fast left PFC rTMS, Schutter et al. (2003) proposed an alternative hypothesis based on the functional connectivity between the left PFC and the right parietal cortex. This hypothesis was tested in a low-frequency rTMS design over the right parietal cortex and the results will be presented.
The motivational antipole of depression is psychopathy. The psychopath is a fearless remorseless predator whose insensitivity for punishment goes accompanied by an extreme reward dependency resulting in a tendency to commit violent antisocial acts. Dysfunction of the orbitofrontal cortex seems associated with the core characteristic of fearlessness in psychopathy. In agreement, Raine et al found reductions in PFC gray matter in anti-social personality disorder that were accompanied by reduced in electrodermal activity, a reliable index of fearfulness (Fowles, 2000). Hypothetical considerations pinpointed the brain abnormalities observed by Raine et al. to the orbitofrontal cortex. We tested this hypothesis in a low-frequency slow rTMS study stimulating over the orbitofrontal cortex of normal subjects. It was hypothesized that the inhibitory effects of low-frequency rTMS would induce temporary hypo-function of the fear circuits in the orbitofrontal cortex, evidenced by a reduction in skin conductance levels.

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