

rTMS at the fronto-polar cortex reduces skin conductance but not heart rate: Reduced gray matter excitability in orbitofrontal regions

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In the February 2000 issue of the ARCHIVES, a methodologically refined study of Raine et al¹ demonstrated reduced prefrontal gray matter accompanied by a reduction in autonomic activity in patients with antisocial personality disorder (APD). An important additional observation concerns the dissociative pattern on the indexed indices of automatic activity: reduced prefrontal gray matter was linked to a reduction in electrodermal, but not cardiovascular activity. Although it was not possible to be more specific regarding the localization within the prefrontal cortex, both Raine et al. and Damasio in his attached

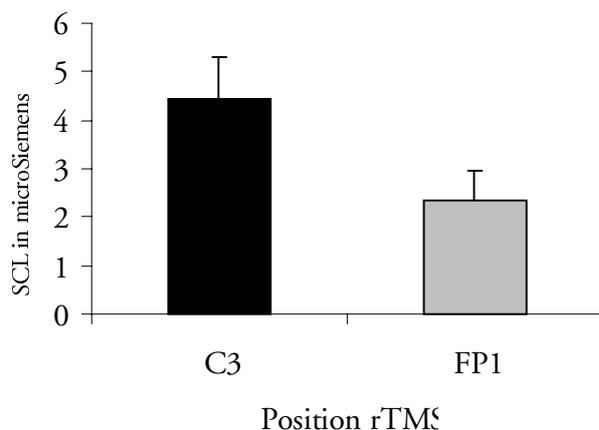


Fig 1. Mean skin conductance level (and SEM) 20 minutes after rTMS at C3 and FP1 electrode positions.

commentary² suggested that the orbitofrontal cortex constitutes the most likely candidate.

A technique suitable for investigating the role of prefrontal brain areas in autonomic activity is repetitive magnetic stimulation (rTMS). When applied to a specific cortical area, rTMS is able to induce transient gray matter inactivity, a so-called "virtual brain lesion"³ depending on stimulation parameters.

Interestingly, recently we applied slow rTMS to the fronto-polar cortex (FP1), targeting the left orbitofrontal region, to investigate involvement of this area in autonomic arousal.⁴ Included as dependent measures were skin conductance and heart rate, as in the Raine et al study. A within-subject design was used (N = 8) in which stimulation of the left central position (C3) served as the control condition. Subjects were continuously stimulated during 20 minutes at 80 % of their Motor Threshold³ with a frequency of 1 Hz. Results showed that rTMS at the FP1 position, compared to rTMS at the C3 position, induced a reduction in skin conductance, reaching significance 20 minutes after stimulation (P < .01), whereas heart rate remained unaffected (P > .90). Figure 1 shows the pattern of these results.

In sum, our repetitive transcranial magnetic stimulation data provide converging evidence for a specific role of the orbitofrontal cortex in autonomic arousal.

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