

A discriminative functional network profile of response to subcallosal cingulate deep brain stimulation for depression

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Background:

Subcallosal cingulate deep brain stimulation (SCC-DBS) is being investigated for treatment-resistant depression. However, the mechanisms underlying the modulatory effects of SCC-DBS are poorly understood, limiting its current therapeutic efficacy. Identifying functional biomarkers in SCC-DBS responders could inform the selection of DBS settings and improve response to SCC-DBS in non-responders.

Methods:

Magnetoencephalography data were obtained from 15 patients with SCC-DBS for treatment-resistant depression (seven responders) and 25 healthy subjects. Region-specific differences in neural oscillations were investigated using linear mixed models to identify discriminative nodes based on (i) differences in patients (responders and non-responders, stimulation-OFF) compared to healthy subjects, wherein (ii) activity was counteracted by stimulation in a responder-specific manner.

Results:

Oscillatory power analyses revealed differences in patients with depression compared to healthy subjects. SCC-DBS reversed these changes in responders via increased alpha (8-12 Hz) and decreased gamma (32-116 Hz) activity within nodes of the default mode, central executive, and somatomotor networks.

Conclusions:

SCC-DBS modulates oscillatory activity in brain regions involved in emotional control/processing, motor control, and the interaction between speech, vision, and memory, all of which have been implicated in depression. This modulated network profile in responders may represent a functional surrogate that can be used for DBS therapy optimization.