Modulation of response selection in a cued Go/NoGo task in STN-DBS parkinsonian patients

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The aim of this study was to assess the effect of the deep brain stimulation (DBS) of the subthalamic nucleus (STN) on response selection. The STN is associated with action selection, putting a brake on the motor output of the basal ganglia until a decision is made. However, the impact of STN-DBS on proactive and reactive control of response selection is thus far not completely understood. To investigate the effect of this stimulation, 13 STN-DBS Parkinson disease patients completed a visual cued Go/NoGo task. Participants had to respond with a button press to Go signals and to withhold the latter to NoGo signals. The visual cue (Certainly Go, CG; Maybe Stop, MS; Likely Stop, LS) informed the participants about the likelihood (0, 25 and 75%, respectively) of the current trial to present a NoGo signal. The cues MS and LS were added to elicit proactive inhibition. We measured the Response times (RTs) to the Go signals and False Alarms (response to NoGo signals). In order to assess the modulation of the neural clusters, we analyzed the response-locked electrical brain activity. We compared the behavioral performance and EEG data of STN-DBS ON vs. OFF, and of trials with (MSLS) vs. without (CG) proactive inhibition. We expected decreased RTs in STNDBS ON and CG trials, and aimed to explore the modulated neural correlates underlying response selection. The behavioral results showed faster RTs in STN-DBS ON vs. OFF trials, as well as in CG vs. MSLS trials. The stimulation of the STN did not affect the occurrence of False Alarms. The response-locked scalp voltage topographies highlighted different pattern of network activations between DBS ON vs. OFF in the late phase of the response preparation. The cluster analysis revealed that the premotor cortex/SMA and the frontopolar cortex were significantly more active when the stimulation was turned off. The time-voltage ERPs analysis suggested that DBS reduced conflict detection and did not interfere with proactive inhibition. We suggest that the DBS-induced RTs reduction could reflect a trial-by-trial modulation of decision thresholds, which are supposed to be generally higher in PD patients.

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