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Session 312 - Cortical Planning and Execution: Neurophysiology in Humans

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312.16 / N33 - The subthalamic nucleus as a potential neural driver of motor inhibition during action preparation?

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 Hall A

Presenter at Poster

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Abstract

By applying transcranial magnetic stimulation (TMS) over the primary motor cortex (M1) during reaction time (RT) tasks, many studies have revealed a suppression of motor-evoked potentials (MEPs) during action preparation (*i.e.*, compared to a resting state) - a phenomenon referred to as *preparatory inhibition*. Intriguingly, little is known about the neural structures at the origin of this suppression. The subthalamic nucleus (STN) has a strong inhibitory influence on M1 and thus represents a plausible candidate for contributing to the generation of preparatory inhibition. Here, we investigated the functional contribution of the STN to preparatory inhibition by probing MEPs during action preparation in Parkinson's disease (PD) patients treated with deep brain stimulation (DBS). Right-handed PD patients and matched healthy subjects participated in the study. They performed an instructed-delay choice RT task, in which they had to select either left or right index finger responses based on the position of a preparatory cue, but had to wait until the onset of an imperative signal to release their movement. TMS was applied over both M1 using a double coil method, eliciting concurrent MEPs in right and left index finger muscles. Pulses were applied either at rest (during the inter-trial interval) or during the preparatory period (just before the imperative signal). The patients realized the task either OFF- or ON-DBS on two consecutive days (randomized order), allowing us to probe preparatory inhibition in PD patients, and to examine the impact of the perturbation of STN activity (ON-DBS) on preparatory inhibition. In line with past research, healthy subjects exhibited a substantial suppression of MEPs during action preparation (*i.e.*, compared to MEPs obtained at rest). This effect was evident for MEPs elicited in both the left and the right finger muscles and occurred regardless of whether the preparatory cue required a left or right hand response. In contrast, such an MEP suppression was less consistent in the PD patients. Intriguingly, in these patients, preparatory MEPs even displayed some facilitation in a number of conditions and this effect was stronger when the DBS was turned ON compared to when patients were tested in the OFF-DBS state. The latter observations suggest an alteration of preparatory inhibition in PD patients, especially when DBS perturbs the STN, probably releasing M1 from its inhibitory tone.

Abstract Citation