Presentation Abstract

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Title:	Subthalamic responses to motor cortex stimulation: Selective targeting of the subthalamic motor area
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Abstract:	Introduction Over the last decades, it has been shown consistently that deep brain stimulation (DBS) of the subthalamic nucleus (STN) alleviates motor symptoms in Parkinson (PD) patients. However, in a substantial number of patients the beneficial effects of STN DBS are overshadowed by cognitive and/or limbic alterations. These side effects of STN DBS are thought to be caused by stimulation of the associative and limbic pathways that run through the STN. We hypothesize that an optimal effect of STN DBS on the motor symptoms without inducing cognitive and limbic side effects can be achieved by selective stimulation of the STN motor region by improved targeting. To achieve this goal, we made use of the cortico-subthalamic projection. We hypothesize that in PD patients motor cortex stimulation (MCS) evokes a specific response in the dorsolateral part of the STN, supposedly the STN motor area, that can be seen in both single unit activity and local field potentials (LFP). Material and Methods Here we describe the results of one PD patient in which we performed MCS during the intra-operative STN microrecordings. In total, we measured single unit activity of eight neurons at various locations in the STN and LFP's at the same locations. Data were analyzed using Matlab. All recordings were high pass filtered, the stimulus artifact was removed

by time shifting, peristimulus time histograms were constructed from which significant excitatory and inhibitory responses were determined using the change point analysis.
Results
The STN neurons had an average spontaneous firing rate of 64.6±36.3 Hz. Within the STN responses to MCS were seen, while outside the borders of the STN no responses were found. Responses differed between ventro-dorsal regions in the anterior-posterior and medio-lateral plane. In the anterior and lateral electrode at dorsal levels of the STN a significant early excitation (~10-50ms) and subsequent inhibition (50-110ms) were seen. The lateral electrode also showed a late excitation (~115-170ms). The responses we found were partially similar to reports in animal studies, but we did not observe the typical triphasic response.
Conclusion
We found responses in the STN during MCS, which were significantly different in the dorsally recorded neurons in the lateral and anterior trajectory compared to the neurons recorded in other regions of the STN. In the near future MCS could be a novel tool to determine the motor area of the STN to optimize targeting for DBS in PD patients, thereby preventing cognitive and limbic side effects.

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DEEP BRAIN STIMULATION

PARKINSON'S DISEASE

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