

Effect of Unilateral and Bilateral STN Stimulation on Eye-Hand Coordination

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Effect of Unilateral and Bilateral STN Stimulation on Eye-Hand Coordination

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5

The project/programme is most relevant to:

Parkinson's disease & PD-related disorders

Keywords

STN stimulation, eye hand coordination, Structure of subthalamic nucleus, Deep Brain Stimulation, Bilateral

Research Abstract

? DESCRIPTION (provided by applicant): High frequency deep brain stimulation of the

subthalamic nucleus (STN DBS) dramatically ameliorates most but not all symptoms of Parkinson's disease. STN DBS exerts a powerful influence over two nuclei that regulate oculomotor and skeletomotor control (substantia nigra pars reticulata and globus pallidus internus). As such, STN DBS should influence eye-hand coordination. There is also mounting evidence that STN DBS can impair performance of oculomotor and skeletomotor tasks that require using memory and use frontostriatal circuits, especially when bilateral STN DBS is used. As such the long-term objective of the application is the study of the positive and negative effects of STN DBS using tasks designed to probe neural circuits involved during visually and memory guided movements. We will pursue 4 specific aims. Aim 1 tests the hypothesis that bilateral STN DBS improves the performance of visually guided eye movements (Aim 1A) and visually guided hand movements (Aim 1B) more than unilateral STN DBS or being off STN DBS. In this aim, there are no memory requirements since targets for both eye and hand movements are always visible. We will also study the effects of STN DBS voltage level on visually guided eye-hand coordination by testing 2 fixed voltage settings. Fixed voltage settings will allow us to determine whether it is the magnitude of the voltage or bilateral stimulation itself that causes any performance decrement. Aim 2 tests the hypothesis that unilateral STN DBS can improve selected measures of performance of memory-guided saccades (Aim 2A), and memory guided movements (Aim 2B) more than bilateral STN DBS or being off STN DBS. The idea is that bilateral STN DBS adversely affects dorsolateral prefrontal cortex and this interferes with both oculomotor and skeletomotor performance. We will again study the effects of STN DBS voltage level on memory-guided eye-hand coordination by testing 2 fixed voltages. Aim 3A tests the hypothesis that the surgical lesion itself causes improvements in eye and eye-hand coordination measures compared to while being off medication prior to the surgery. Prior to surgery, Aim 3B tests the hypothesis that medication will improve eye and eye-hand coordination measures compared to while being off medication. Aim 3C compares the optimal medical treatment state prior to surgery and the optimal surgical treatment state after surgery. Aim 3C tests the hypothesis that medication will improve selected memory guided eye and eye-hand coordination measures more than bilateral stimulation. Aim 4 tests the hypothesis that three years of chronic stimulation will improve movement speed but not coordination of eye-hand movements. The outcome of the studies will meet a critical need in clinical neurology and basic neurophysiology by assessing the extent to which unilateral STN DBS, bilateral STN DBS, and dopaminergic medication affects eye-hand coordination in PD in the short and long term.

Lay Summary

PUBLIC HEALTH RELEVANCE: The ability to coordinate the eyes and hands to make accurate goal directed movements is essential for performing motor tasks, as is the ability to remember where objects are in the environment. This ability can be severely impaired in advanced Parkinson's disease. This proposal compares unilateral and bilateral stimulation of the subthalamic nucleus, and how this facilitates or impairs the coordination of eye hand movements depending on the memory requirements of the task.

Further information available at:

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Investments > €500k

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United States of America

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Parkinson's disease & PD-related disorders

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