Abstract

Automated closed-looped algorithm to rapidly optimize deep brain stimulation settings for people with Parkinson's disease.

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Deep brain stimulation (DBS) of the subthalamic nucleus (STN) can significantly reduce the cardinal motor signs of Parkinson's disease (PD), suppress levodopa-induced dyskinesias, and improve quality of life. Programming of stimulation settings is done through a time-consuming trial-and-error process in an effort to reduce symptoms and avoid side effects. Even after this long iterative process of evaluating parameters (contact combination, frequency, pulse width, voltage), it is often uncertain if optimal settings have been achieved. The fidelity and efficiency of DBS programming is compromised by the use of subjective clinical impression and ordinal ratings to evaluate the severity of motor signs and the lack of a standardized algorithm to converge upon optimal settings. This project will explore the feasibility and efficacy of a closed loop strategy that uses real-time measures of motor signs in conjunction with an optimization algorithm to rapidly converge upon DBS settings that optimally reduce symptoms. Our focus will be on improvement of forearm rigidity, but we will also evaluate the effect of the algorithm's optimized settings on tremor and bradykinesia. The goal of this project is to show proof-of-principle that a closed-loop system, using an optimization algorithm that minimizes real-time measures of motor signs, can be used to rapidly program STN-DBS parameters to achieve therapeutic benefit that is comparable, or superior, to standard clinically derived parameters.