A Promising Intervention: Dynamic Cycling Modulates Sub-thalamic Activity and Intra-Nuclear Connectivity in Parkinson's Disease Patients With Deep Brain Stimulation

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Parkinson's Disease (PD) is a chronic and progressive neurodegenerative disease associated with the deterioration of motor control and cognitive function as age advances. Representing the fastest growing neurodegenerative disorder worldwide, PD is caused by the rapid degeneration of dopaminergic neurons in the substantia nigra, the midbrain structure crucial to producing dopamine and therefore controlling movement. Clinically, PD presents with motor symptoms including bradykinesia, or the slowness of movement and speed during movement, tremor, instability in posture, and a disturbance of regular walking manner. Collectively, these features underscore the importance of targeted research to mitigate motor function decline in PD patients and therefore. Physical exercise has been widely recognized as an effective therapy for alleviating motor deficits in PD patients. However, the majority of PD patients are elderly and sustained continuous movement is not always feasible; dynamic cycling, or the usage of a tandem bicycle in which speed and intensity are controlled, aims to target this issue. This pilot study included nine Parkinson's patients who completed up to twelve biking sessions over four weeks. Resting state local field potentials (LFPs) from the Sub-Thalamic Nucleus (STN) were recorded from implanted electrodes prior to and after each session, allowing the progression of motor function depletion to be recorded. The data suggests that dynamic high-cadence cycling produces both immediate and cumulative tremor improvement and is associated with measurable changes in STN oscillatory activity and connectivity. Rather than simply providing symptomatic relief, exercise promotes functional reorganization within basal ganglia motor circuits.

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