

**Low frequency reduces interference of cognitive workload on gait in subthalamic nucleus DBS for advanced Parkinson's disease**

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*Background:* The clinical benefits of bilateral subthalamic nucleus (STN) deep brain stimulation (DBS) for advanced Parkinson's disease (aPD) may be reduced by gait disorders onset occurring months or years after the implant. Little is known about their pathophysiology and the management is usually difficult and not fruitful. Literature suggests reducing the stimulation frequency below 100 Hz and the reported efficacy of this approach for freezing of gait is variable.

*Objectives:* (1) To explore how low frequency stimulation change gait in aPD compared to conventional high frequency stimulation (HF); (2) To uncover possible pathophysiological mechanisms for LF-related gait improvement compared to HF.

*Methods:* Patients complaining freezing of gait and affected by aPD with bilateral STN DBS implant without cognitive impairment (MoCA >26/30) were enrolled. As per protocol, each participant was assessed at baseline in OnMeds/OffStim and OnMeds/ONStim with HF as well as one month after switching to LF, namely 80 Hz. Motor symptoms and gait were evaluated in each therapeutic condition through UPDRS-III, Modified Hoehn & Yahr Scale (H&Y) and gait analysis. The latter was performed by employing 3 accelerometers (one in each foot and one at L2 lumbar level) in the 2-Minute-Walk-Test as a single motor task, as a dual motor task and with a cognitive interfering task. Moreover, participants were asked to performed a modified timed-up-and-go (mTUG). Finally, PDQ-39, DBS-IS, UPDRS-I, UPDRS-II and FOG-Q were administrated at baseline and at follow-up.

*Result:* No significant changes were detected by mTUG and clinical scales. Conversely, gait analysis disclosed a remarkable improvement in a number of gait microparameters when comparing LF to HF and LF vs OFFstim condition, only. In fact, no significant differences were found when comparing these therapeutic conditions for gait as single motor task or during a concomitant motor task.

*Conclusions:* 80 Hz STN DBS improves gait disorders during interfering cognitive workload as compared to HF and OFFstim in aPD without dementia. These findings may be of help in drawing more effective flow-chart in treating gait disorders occurring after STN-DBS.