Bilateral STN DBS is Superior to Unilateral for Parkinsonian Gait under Cognitive Loading

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Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the major effects of Parkinsons Disease and cognitive loading on gait, 2) Understand the differential effects of unilateral and bilateral stimulation on gait

Introduction

Gait abnormalities are particularly challenging to subjects with Parkinson's disease (PD) due to increased fall risk. These risks may be increased under conditions of simultaneous cognitive loading. In fact, bilateral STN DBS has been shown to impair upper extremity function under cognitive loads. The aim of this study was to compare the effects of unilateral and bilateral STN DBS on gait with and without cognitive loading in advanced Parkinson's disease.

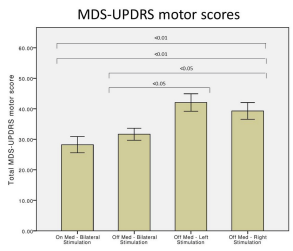
Methods

Seventeen advanced PD subjects (ages 50 to 74 years) who had bilateral STN DBS surgery at least 6 months prior were studied, off medications. All data were collected while subjects were off their anti-parkinsonian medication for at least 12 hours. Quantitative gait information was collected with a pressure-sensor mat (GaitRite) during three stimulation states: left stimulation, right stimulation and bilateral stimulation. For each stimulation state, subjects performed three tasks: gait alone, gait while counting by 3s, and gait while naming alternate letters of the alphabet.

Results

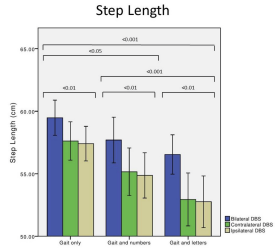
As gait task complexity increased, there was a significant decline in performance for all stimulation states. Unilateral stimulation performance was comparable to bilateral stimulation performance for most gait parameters. However, bilateral stimulation surprisingly demonstrated improvement

Figure 1. MDS-UPDRS motor scores



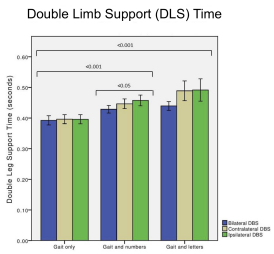
Changes in MDS-UPDRS motor scores under various stimulation states (means and standard errors). Bars spanning across various tasks indicate significant differences between stimulation states.

Figure 2. Step Length



Changes in step length with task complexity across three stimulation states. Bars spanning across tasks indicate a significant main effect for gait under cognitive load compared to gait alone. Bars spanning across a single task indicate a significant main effect for stimulation (specifically, bilateral DBS resulted in longest overall step length compared to unilateral DBS in all three tasks).

Figure 3. DLS Time



Effects of task complexity on DLS time under varying stimulation states(means and standard errors). Bars spanning across various tasks indicate a significant main effect for gait under cognitive load when compared to gait alone. Bars spanning across a single task indicate a significant main effect for stimulation (specifically, bilateral DBS resulted in a shorter DLS time than ipsilateral DBS).

Conclusions

These results underscore the efficacy of bilateral subthalamic nucleus stimulation over unilateral stimulation on gait under dual -task conditions. Our findings suggest that differential advantages of bilateral and unilateral stimulation may occur for upper and lower extremity tasks under cognitive loads.