

Low Frequency DBS in PD Patients with Gait and Speech Problems

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OBJECTIVE

To analyze the effect of bilateral low frequency stimulation (60Hz) and combination low (60 Hz) and high frequency (135 Hz) stimulation in patients with Parkinson's disease (PD).

BACKGROUND:

High frequency stimulation (>130 Hz) is the primary frequency effectively used in controlling cardinal features of PD with DBS of the STN. We looked at bilateral low (60Hz) and combination high (>130Hz)/ low (60Hz) frequency stimulation in patients with PD post DBS with gait and speech problems.

METHODS:

A prospective clinical trial of 10 Lahey Clinic patients with Parkinsons disease post DBS STN surgery who experience persistent gait freezing and falls after a clinically deemed adequate trial of high frequency programming and medication regimen exhaustion (Table 1).

Table 1. Demographics of enrolled patients (n=10)

Gender	8M 2F
Mean Age, <i>y</i>	65
Race	9 Caucasian
	1 Asian
Mean Disease Duration, y	15.2
Mean DBS Duration, y	4.2
Falls/Near Falls past 6 mos.	10
Speech impairment (<i>U5</i> , <i>U18</i>)	10 (score range 1- 4)
Use of Assistive Device	4 always
	5 occasionally
	1 never

Patients were evaluated on low frequency stimulation for a period of 1 month with Baseline, Week 2 & 4 follow up visits consisting of United Parkinsons Disease Rating Scale (UPDRS), Tinetti Gait and Balance, Berg Balance Scale (BBS), and Gait and Falls Questionnaire (GFQ). Scores were collected in all on/off states (ON high stimulation/OFF medication; OFF high stimulation/OFF medication; OFF high stimulation/ON medication; ON high stimulation/ON medication; ON low stimulation/ON medication- for safety) at baseline and collected in 2 states (OFF medication/ON low stimulation; ON medication/ON low stimulation) at weeks 2 and 4.

Patients were adjusted to bilateral low frequency settings at the baseline visit after all evaluations were completed. Patients remained on this setting throughout the study duration as tolerated. Patients who were unable to tolerate bilateral low frequency settings were then offered a combination of high (>100Hz) and low (60Hz) frequency stimulation or returned to their previous settings.

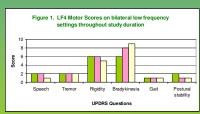
RESULTS:

A total of 10 patients were enrolled. Three patients tolerated low frequency stimulation throughout study duration and completed the 1 month study. One of these 3 patients (LF4) continued on low frequency after his final visit, one returned to his previous setting, bilateral high frequency (LF3) and one tried combination high/low frequency (LF7). Seven of the 10 patients withdrew due to intolerance. Of these 7 patients, 5 returned to previous settings and 2 tried combination high/low frequency (LF1and LF8) when they withdrew.

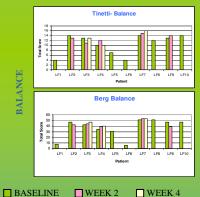
LOW FREQUENCY:

LF4 was the only patient who remained on bilateral low frequency settings at the end of the study. Throughout the study duration he experienced improvement in speech, gait and postural stability by week 4, remained fairly stable on rigidity and tremor but experienced increased bradykinesia (Figure 1.) Improvements were also noted on GFQ, Berg Balance and UII and UIV.

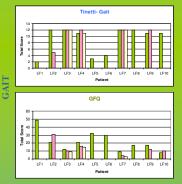
Seven patients were unable to tolerate bilateral low frequency settings. Patients with tremor predominant symptoms developed tremor recurrence within 24 hrs; bradykinesia and rigidity returned within days. Speech improved in 4 patients. Gait improved transiently for several days, but worsened due to severe immobility (Figures 2-6).

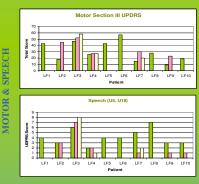


Figures 2-6: Total scores from Baseline (off meds/on high stim.) to Weeks 2 and 4 (off meds/on low stim.)



■ WEEK 4





Note: Higher scores on Tinetti Gait & Balance and Berg Balance Scale indicate symptomatic improvement Higher scores on the GFO, UPDRS scales and Speech U5/U18 indicate symptomatic worsening

Three patients tried combination frequency stimulation after stopping the study with the less affected body side on low frequency and the more affected side on high frequency. Clinical follow up post study showed improvements in gait, balance and speech. Bradykinesia and rigidity did not worsen significantly on the side with low frequency stimulation and mild dyskinesia occurred on the side with low frequency only.

CONCLUSION

Bilateral low frequency stimulation didn't show to be beneficial in our study as many cardinal PD symptoms including tremor, rigidity and bradykinesia worsened or returned shortly after frequency stimulation change. Speech was the only symptom which improved in 3/10 patients. Gait improved temporarily but immobility soon returned. Only one patient continued on low frequency settings at study end due to improvements in speech, gait and postural stability during study duration. In contrary, a combination of high/low frequency stimulation was a reasonable option for patients who experienced gait and speech issues before and after DBS for 3 patients. Combination frequency stimulation might be a reasonable option for PD patients with gait and speech problems and we continue our study to further explore this option.

This study is ongoing and enrollment continues until an additional 20 patients with gait problems and medication exhaustion are enrolled. Ten patients pre-DBS will be started on low frequency and 10 patients post DBS with worsening gait will be started on a combination high/low frequency stimulation.