

Deep Brain Stimulation Parameters and Gait in Parkinson's Disease

Aliya I. Sarwar, M.D., Eugene C. Lai, M.D., Ph.D.

Michael E. DeBakey Veterans Affairs Medical Center, Parkinson's Disease Research, Education and Clinical Center and Baylor College of Medicine, Houston, Texas

OBJECTIVE

To identify specific deep brain stimulation (DBS) parameters that improve gait in Parkinson's disease patients with bilateral DBS placement.

BACKGROUND

Deep brain stimulation is a well established therapeutic option for Parkinson's disease. Several potential combinations of stimulation parameters (contact, voltage, pulse width, pulse frequency) are available for customized therapy.

However, there is no published research defining the efficacy of individual stimulation parameters with respect to improvement in various aspects of motor disease.

This project seeks to identify a specific deep brain stimulation parameter that improves gait without a concomitant change in other parameters.

METHODS

Using a standardized chart review method, all available (40) medical records of PD patients with DBS surgery were reviewed. Thirteen (13) records met the inclusion criteria defined as :

- ❖ Bilateral DBS placement.
- ❖ No prior basal ganglia or thalamic surgery.
- ❖ At least one DBS programming session, where gait was tested using a standardized scale (Stand-Walk-Sit), with respect to a single stimulation parameter change.

The change in **speed** and **stride length** following change in a particular stimulation parameter was analyzed using Student's t test.

Fig: 1

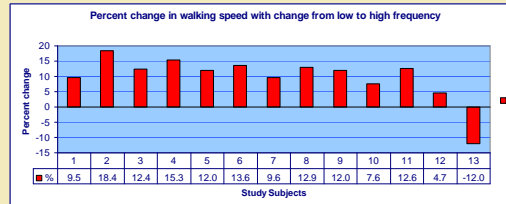


Fig: 2

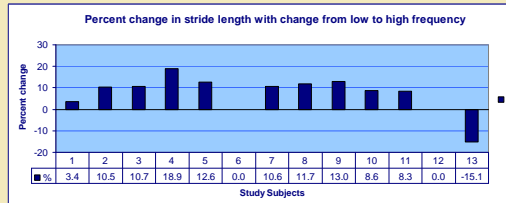
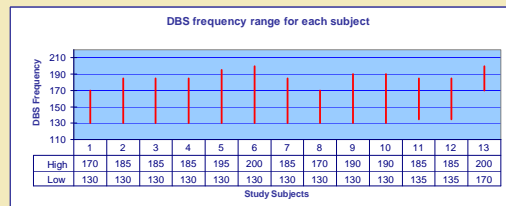


Fig:3



RESULTS

- ❖ Deep brain stimulation **frequency** was identified in 13 out of 13 records as the "**single specific**" stimulation parameter that affected gait (Stand-Walk-Sit test), without any associated programming change.
- ❖ **Higher** bilateral stimulation frequency (range 170- 200) was associated with an **increase in walking speed** in 12 out of 13 patients and **increase in stride length** in 10 out of 13 patients, as compared to the lower frequency (range 130-135) ($p < 0.0002$, $p < 0.0039$, respectively) Fig: 1, Fig: 2, Fig: 3
- ❖ Two patients showed no change in stride length.
- ❖ One patient showed progressive reduction in both speed and stride length with increasing frequency, when tested in the upper range only (170-200). No data on him was available for the lower frequency range.
- ❖ Three patients had at least one episode of freezing, in at least one test trial, in the lower frequency range. All three patients showed **improvement in freezing** when tested in the higher frequency range.
- ❖ No immediate adverse effect pertaining to any aspect of functioning was documented with high frequency setting.

CONCLUSION

- ❖ DBS stimulation **frequency** independently affects gait in PD patients with bilateral therapy.
- ❖ **Higher** bilateral frequency is associated with statistically significant **increase in speed and stride length**.
- ❖ Further exploration of this observation in a controlled setting is warranted.