



# A Controlled Study of the Long-Term Cognitive Outcome of Bilateral Subthalamic Nucleus Deep Brain Stimulation

Williams, A.<sup>1</sup>, Arzola, G.M.<sup>1</sup>, Strutt, A.M.<sup>1</sup>, Simpson, R.<sup>2</sup>, Jankovic, J.<sup>1</sup>, and York, M.K.<sup>1,3</sup>

<sup>1</sup>Department of Neurology, Baylor College of Medicine, Houston, TX

<sup>2</sup>The Methodist Hospital Neurological Institute, Houston, TX

<sup>3</sup>Michael E. DeBakey VA Medical Center, PADRECC, Houston, TX

# BCM

Baylor College of Medicine

## OBJECTIVE

To assess neurocognitive functioning 2 years following subthalamic nucleus (STN) deep brain stimulation surgery (DBS) for the treatment of Parkinson's disease (PD).

## BACKGROUND

Long-term STN DBS cognitive outcome has shown declines in verbal fluency, verbal memory and visuospatial reasoning. However, results have been inconsistent across studies and a long-term comparison of DBS patients and matched PD patients utilizing a comprehensive neuropsychological battery has not been presented.

## PARTICIPANTS

Twelve bilateral STN DBS patients and 14 matched PD patients underwent comprehensive neuropsychological assessment at baseline and 2 years post-surgery.

Table 1. Demographics

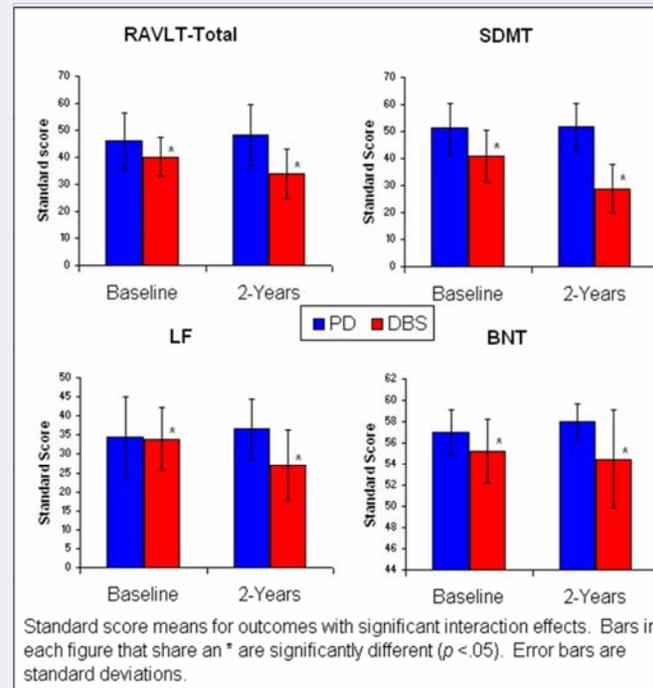
|                        | PD               | DBS              | p value |
|------------------------|------------------|------------------|---------|
| Sex (%Male)            | 57%              | 50%              | .73     |
| Age                    | 61.1<br>(7.6)    | 62.1<br>(8.8)    | .76     |
| Age of Onset           | 55.6<br>(8.9)    | 50.3<br>(7.9)    | .13     |
| Duration of Illness    | 5.3<br>(4.4)     | 11.8<br>(5.1)    | .002    |
| Education              | 15.7<br>(1.4)    | 13.4<br>(1.6)    | .001    |
| MMSE                   | 29.0<br>(1.0)    | 28.8<br>(1.8)    | .66     |
| Dopaminergic Meds (mg) | 343.5<br>(285.3) | 902.5<br>(359.7) | <.001   |

## TESTS ADMINISTERED

Mini Mental Status Exam (MMSE), Dementia Rating Scale (DRS), Rey Auditory Verbal Learning Test (RAVLT), Brief Visual Memory Test-Revised (BVMT-R), Symbol Digit Modalities Test (SDMT), Trail Making Test (Trails A, B), Digit Span, Stroop Color-Word Test, Controlled Oral Word Fluency Test: lexical (LF) and semantic fluency, Boston Naming Test (BNT), Wisconsin Card Sorting Test, and Clock Drawing.

## RESULTS

Groups were matched on age, age at PD onset, and baseline UPDRS motor scores. The STN-DBS group had significantly less education, longer duration of PD illness, and higher baseline dopaminergic medication usage. These variables were used as covariates in analyses for which they were significantly correlated with the outcome.

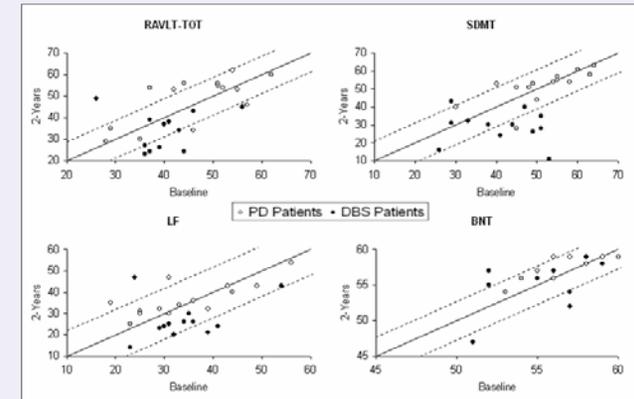


At the 2-year follow-up, STN-DBS patients demonstrated significant impairments in verbal memory (RAVLT-total;  $p = .01$ ), oral information processing speed (SDMT;  $p = .02$ ), and language (LF;  $p = .01$  & BNT;  $p = .001$ ) compared to PD patients.

33% of STN-DBS patients converted to dementia 2-years post-operatively compared to none of the PD participants.

## RESULTS CONT'D.

Reliable change indices (RCIs) examined the influence of disease progression over time by controlling for test-retest reliability.



Reliable Change Indices for outcomes with significant interaction effects. Points represent individual raw scores. Solid line represents zero change. Values above top dotted line represent a reliable increase in scores from baseline to 2-years. Values below lower dotted line represent a reliable decrease in scores from baseline to 2-years. Values between the dotted lines represent no reliable change.

**Verbal memory:** (RAVLT-tot) 58% STN-DBS declined vs. 14% PD.

**Oral information processing:** (SDMT) 50% STN-DBS declined vs. 7% PD.

**Lexical Fluency:** (LF) 25% STN-DBS declined vs. 0% of PD.

**Naming:** (BNT) 33% of STN-DBS declined vs. 0% PD.

## SUMMARY & CONCLUSION

- Neuropsychological evaluation revealed significant impairments and reliable declines for STN-DBS patients in verbal memory, oral information processing speed, and language.
- 33% of STN-DBS patients converted to dementia 2-years post surgery compared to none of the PD participants.
- Results are consistent with more recent reports on STN-DBS, showing long-term post-operative deficits in multiple cognitive domains.
- Our results suggest the need for comprehensive neuropsychological evaluations before and following surgery to reliably delineate cognitive changes that can occur following STN-DBS surgery.

**ACKNOWLEDGMENT:** This research was supported by NIH/NINDS K23 and the Veterans Affairs, Office of Research and Development.