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## OBJECTIVE

- To examine pre- to post-surgical cognitive changes associated with bilateral subthalamic nucleus deep brain stimulation surgery (STN-DBS) with emphasis on frontostriatal functioning.
- Few studies have included matched healthy controls or non-surgical Parkinson's disease (PD) patients to help account for test practice effects and disease progression.

## BACKGROUND

- While some researchers have found declines in executive functioning, working memory, episodic memory, and visuospatial functioning after STN-DBS, others have reported improvements or no change.
- Frontostriatal functioning has not been evaluated specifically following STN-DBS.

## PARTICIPANTS

- 31 advanced PD patients with bilateral STN-DBS
- 18 healthy elderly controls (HC)
- 24 medically-managed non-surgical PD patients

## STANDARD TESTS

Mental flexibility (Trails B)  
Fluency (Letter and Animal Fluency)  
Visuospatial (clock copy)  
Attention (WAIS-III Digit Span)  
Cognitive speed (Symbol Digit Modalities Test-Oral)  
Nonverbal memory (Brief Visual-spatial Memory Test-R)  
Verbal memory (Rey Auditory Verbal Learning Test)  
General ability ( Mattis Dementia Rating Scale)

## STATISTICS

- The Reliable Change Index was used to determine *clinically significant changes* in performance while taking into account the tests' reliability.
- DBS patients were significantly more depressed pre-surgically than either HC or PD patients; thus, Repeated Measures ANCOVA with depression as a covariate was used for the frontostriatal measures.

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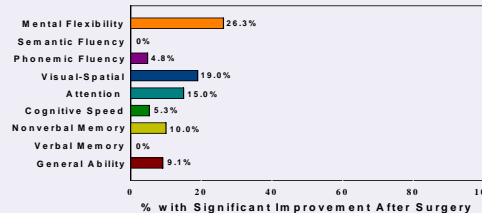
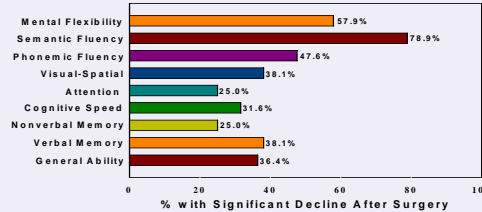
## RESULTS

Reliable Change

### Declines

Semantic fluency  
Mental flexibility  
Phonemic fluency  
Verbal memory

At least 25% of patients declined on these measures



### Improvements

Mental flexibility  
Visual-spatial  
Attention/working memory

No patients improved in semantic fluency or verbal memory abilities

## Frontostriatal Tests

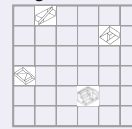
Alternating Fluency

	Phonemic		Semantic	
	Cued	Uncued	Cued	Uncued
Phonemic	N and S	D and A		
Semantic	B & Clothing	M & Food	Occupations & Boys Names	Girls Names & Furniture

Subject-Ordered Pointing Test



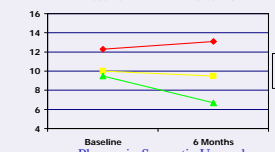
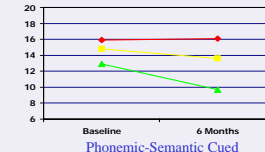
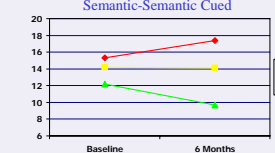
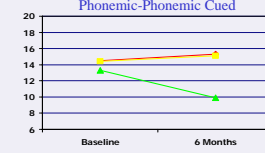
Verbal



Non-Verbal

## FRONTOSTRIATAL RESULTS\*

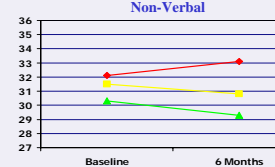
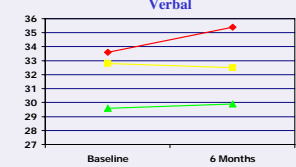
Set Shifting



\* Only significant results are depicted.

\* STN-DBS patients demonstrated decline on all cued alternating fluency measures as compared to PD and HC controls.

Working Memory



\* DBS patients demonstrated a significant decline on a nonverbal working memory measure compared to PD and HC controls.

## SUMMARY & CONCLUSIONS

- Short-term cognitive morbidity was found in a large percentage of STN-DBS patients after controlling for practice effects, disease progression, and test unreliability.
- On the frontostriatal tasks, DBS patients showed significant decline at 6 months on nonverbal working memory and cued alternating fluency measures compared to the PD and HC groups.
- Depression was not a moderating variable.
- The long-term frontostriatal cognitive outcome of DBS needs to be evaluated.
- Results provide a helpful guide for counseling surgical candidates on the possible short-term cognitive risks associated with surgery.