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The cognitive course in Parkinson's disease patients treated with Deep Brain Stimulation of subthalamic nucleus – Correlations with qEEG

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Introduction.

Deep brain stimulation of the subthalamic nucleus (STN-DBS) improves motor functioning in Parkinson's disease (PD) patients. Additionally, it can also influence cognitive functioning. In most PD patients, a decline of verbal fluency test performance after STN-DBS is often reported.

Objective: The purpose of this study was to determine whether preoperative quantitative electroencephalography (qEEG) may be useful in the preoperative assessment predicting cognitive changes in PD patients treated with STN-DBS.

Patients & Methods.

Cognitive performance of 16 PD patients who underwent bilateral STN-DBS and 15 PD controls (for sample characteristics see ***table 1***) was compared at baseline as well as after 24 months.

Cognitive domain scores were calculated combining Z-scores of different neuropsychological test, covering the following domains:

1) Attention
2) Executive function
3) Episodic & working memory
4) Verbal fluency
5) Visuo-construction

A preoperative 256-channels EEG was recorded of each patient at rest; global relative power spectra were

Statistics: Correlation and linear regression models

	PD patients with STN-DBS (*N = 16*)	PD patients without DBS (*N = 15*)	*p*
Age	66 (63, 68.5)	64 (63, 68.5)	*n.s.*
Gender (female)	5	4	*n.s.*
Education	14 (12, 16.5)	14 (12, 17)	*n.s.*
MMS	28 (28, 29.5)	29 (28.5, 30)	*n.s.*
Disease Duration	8.5 (3.5, 13.5)	6 (4, 9)	*n.s.*
LED	709.5 (442.75, 1560)	653 (477.5, 760)	*n.s.*
UPDRS_III	17.66 (7.75, 20.25)	13 (10, 19.5)	*n.s.*
Duration follow up (month)	24.50 (16.50, 40)	24 (23, 25.5)	*n.s.*

Table 1. Values represent median and interquantile range; **MMS** = Mini Mental Status; **UPDRS III** = Unified Parkinson's diease Rating Scale, subscale III; **LED** = Levodopa Equivalent Dosage

Results.

The decline of verbal fluency performance after two years in the PD group treated with STN-DBS was significant in comparison to the PD controls ($p < 0.001$). All other cognitive domains declined in the same manner as in the PD controls or remained stable. Increased global theta power (4-8 Hz) at baseline was associated with reduced post operative verbal fluency performance ($r = 0.50$, $p < 0.05$) at follow-up.

Figure 1. Global cognitive score

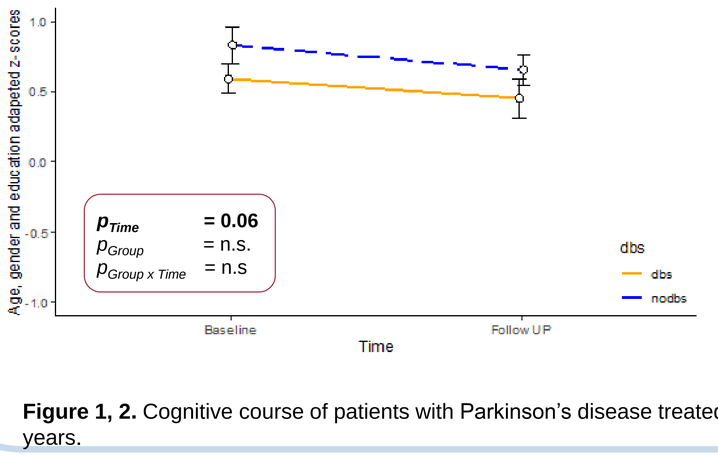

Figure 2. Verbal Fluency

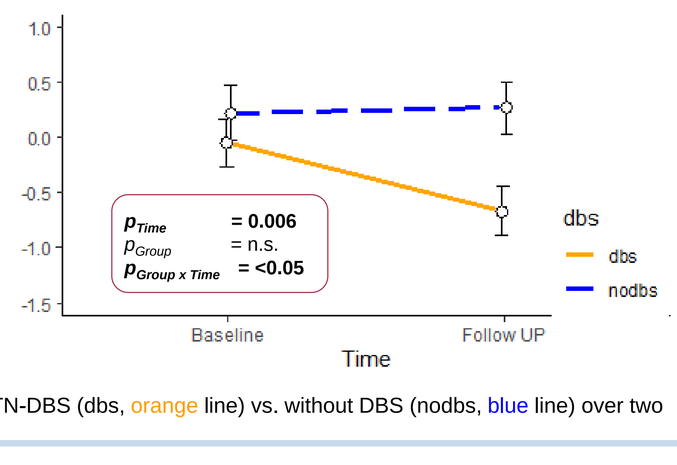

Figure 3. Correlation between Verbal Fluency and qEEG

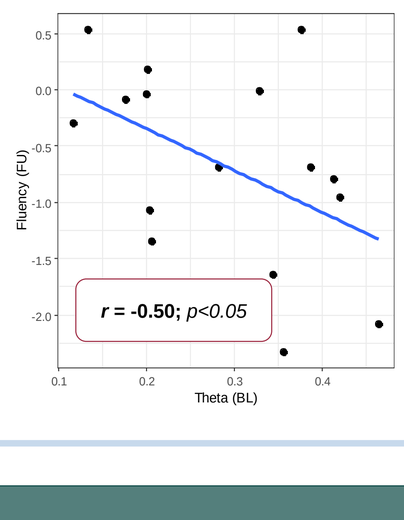

Figure 1, 2. Cognitive course of patients with Parkinson's disease treated with STN-DBS (dbs, orange line) vs. without DBS (nodbs, blue line) over two years.

Figure 3. Correlation between qEEG baseline (Theta bandpower, 4–8 Hz), in patients with Parkinson's diease before STN-DBS surgery and verbal fluency at 2 years follow up (after STN-DBS surgery).

Discussion/Conclusion.

Consistent with the results of former studies, STN stimulation deteriorates verbal fluency in the course of two years. Accordingly, we observed significant decline in tests measuring verbal fluency in the group of PD patients treated with STN-DBS compared to a control group of PD patients. The decline of verbal fluency performance could be predicted by a reduced theta power at baseline. No other significant differences in cognitive alterations between patients in the STN-DBS group and the PD control group occur over two years.

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