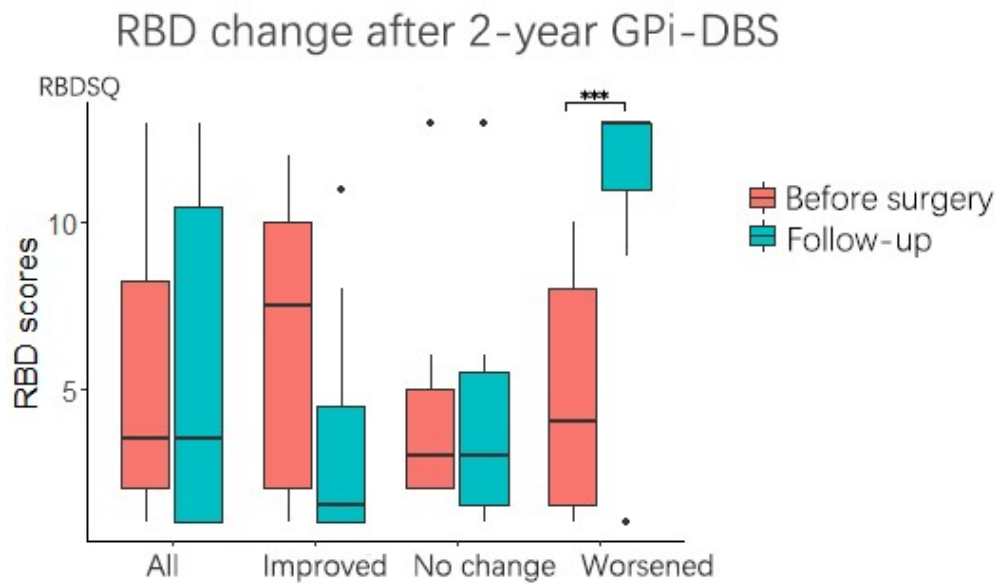
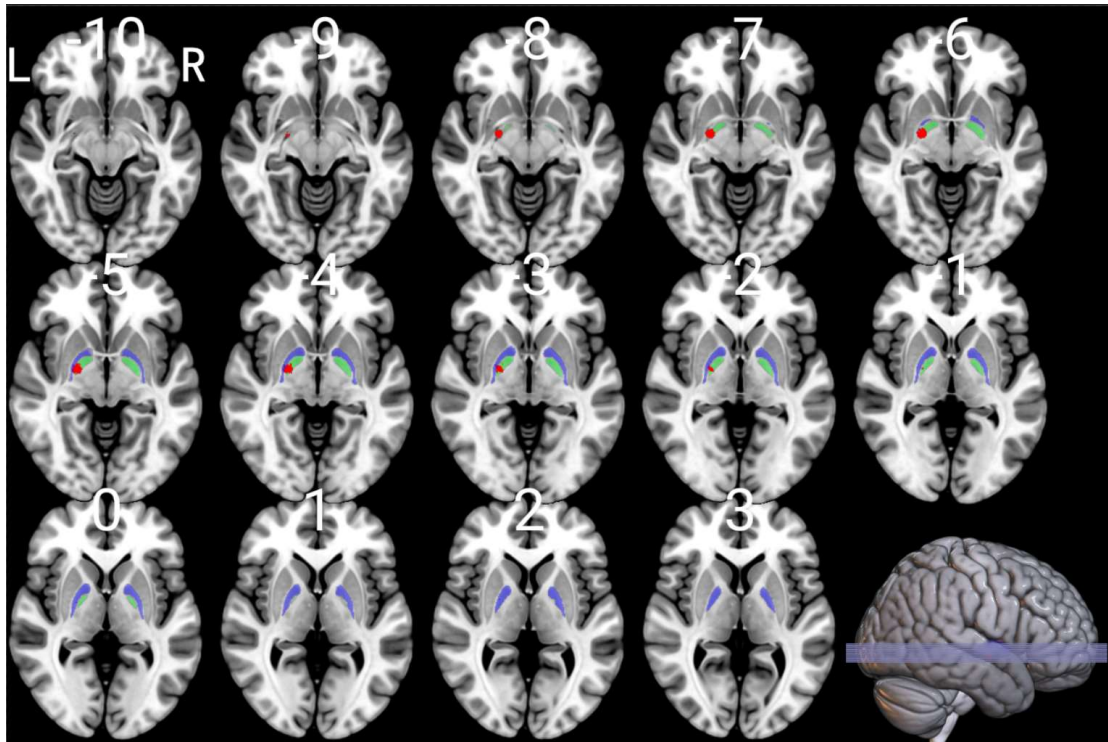


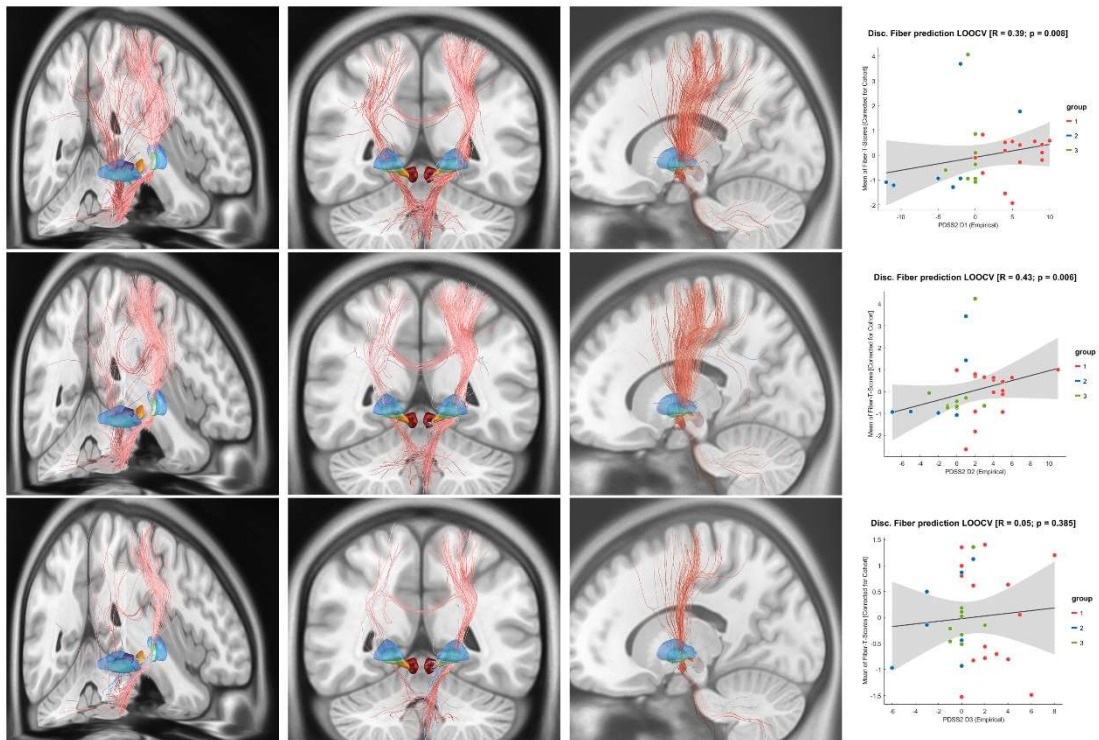
Supplementary Files



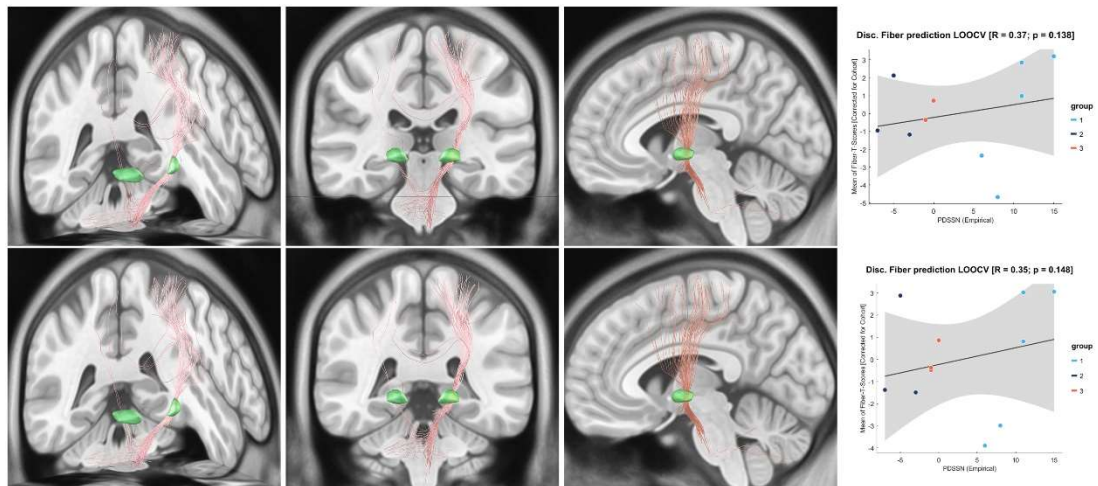
Supplementary Figure 1. Boxplots compare RBDSQ score between before surgery and at follow ups in all patients and three MID-divided subgroups. The lower and upper boundaries of a box plot represent the 25th and 75th percentiles, respectively. The median is represented by the centerline. The whisker lines extend to the smallest and largest non-outlier data points (interquartile range multiplied by 1.5). Significant P-values after Bonferroni correction are indicated. **P < 0.01, *P < 0.05, signed-rank test. *p<0.05, **p<0.01, ***p<0.001



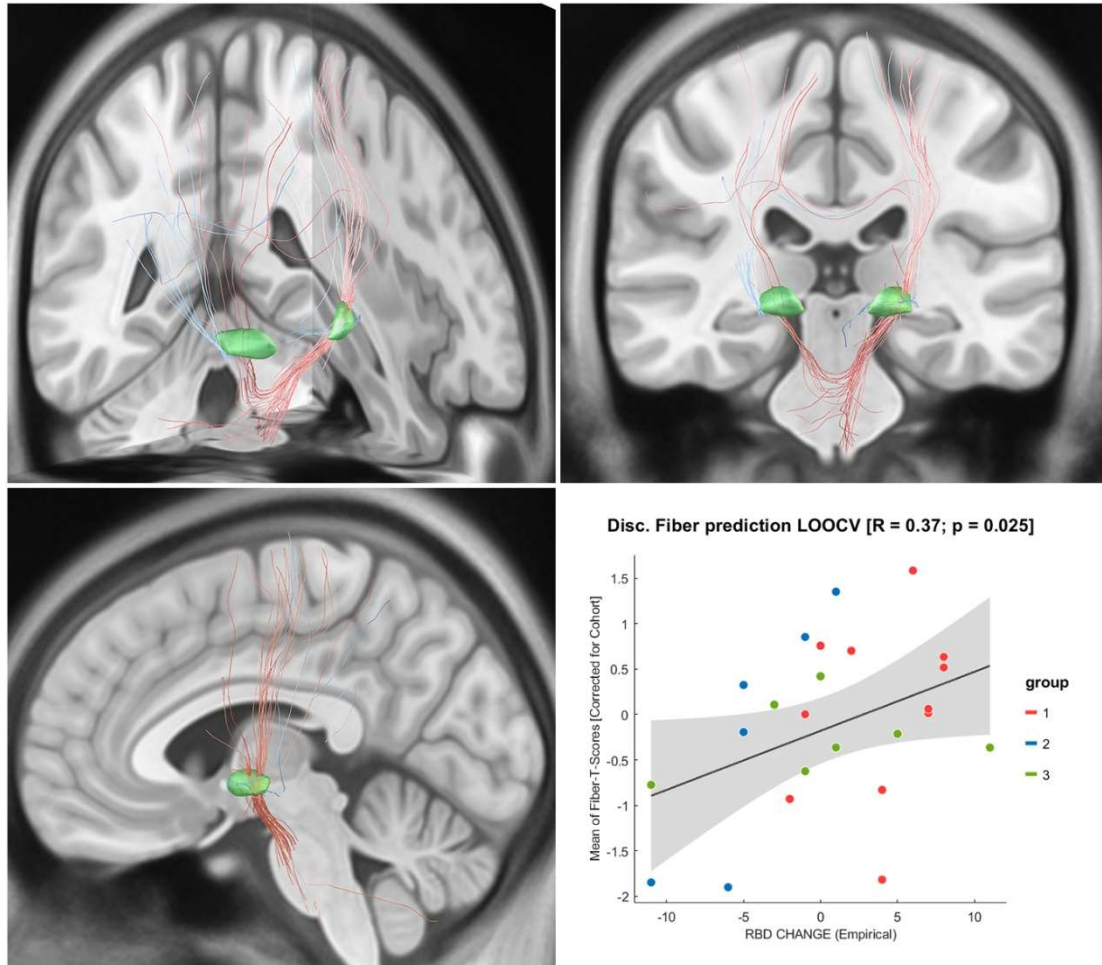
Supplementary Figure 2. Axial view of sweetspot, Globus pallidus internus, and Globus pallidus externus. In a $0.22 \times 0.22 \times 0.22$ mm space, the number of voxels of the sweetspot was 22104 (235.36 mm^3). There were 756 voxels (8.05 mm^3) in GPe and 14875 voxels in GPi (158.39 mm^3). There were 2378 voxels (25.32 mm^3) within 1mm out of GPi border and 356 voxels (3.79 mm^3) within 1mm out of GPe border.



Supplementary Figure 3. Connectome correlated with improvement and worsening of the three subdomains of PDSS-2 score. Fibers in red were correlated with improvement and in blue were the worsened. The illustrated fibers were not FDR-corrected because no fibers passed FDR-correction in “PD symptoms at night” analysis. Fibers were thresholded with top 30% T-score.



Supplementary Figure 4. We conducted a linear regression to see if UPDRS-III improvement was correlated with PDSS-2 improvement in 11 patients with follow-up UPDRS-III score. We found the t value was 0.01304 and p value was 0.927. Then they were selected to construct the connectome correlated to PDSS-2 score change. Upper row showed connectome with no covariates added; lower row showed UPDRS-III added as the covariate. The illustrated fibers were FDR-corrected with p -value < 0.05 . Fibers were thresholded with top 30% T-score. The overall connections were seemingly the same with or without the covariate.



Supplementary Figure 5. Connectome correlated with improvement and worsening of RBDSQ score in 26 patients. The illustrated fibers were not FDR-corrected because no fibers passed FDR-correction. Fibers were thresholded with top 30% T-score. There were 51 positive fibers and 4 negative fibers from left GPi and 9 negative fibers from right GPi.

Supplementary Table 1. Demographic of patients receiving GPi-DBS and STN-DBS

	GPi-DBS		STN-DBS		T test
	mean	sd	mean	sd	p
Numer of Patients(N)	32		32		1
Age	62.03	9.39	63.22	8.77	0.64
Ratio of male	0.38	0.48	0.38	0.48	1.00
Follow-up Years	1.67	1.02	1.59	1.11	0.64
LEDD	810.68	406.48	781.35	291.45	0.77
MDS-UPDRS III(off)	47.72	20.98	45.53	13.30	0.70
MDS-UPDRS III(on)	20.75	13.47	20.28	9.62	0.63
HAMA	15.84	6.34	14.59	8.46	0.51
HAMD	16.72	8.24	15.94	7.75	0.70
PDQ39	57.81	23.11	59.81	18.87	0.71
ASP SCOPA AUT	23.19	9.67	22.44	10.34	0.85
Sleep results					
PDSS-2 before surgery	18.38	8.18	18.81	5.35	0.80
RBD before surgery	5.28	4.00	5.50	3.46	0.89

MDS-UPDRS, Movement disorder society-unified Parkinson's Disease Rating Scale; IRLS, Index of Restless Legs Syndrome; HAMA, Hamilton Anxiety Scale; HAMD, Hamilton Depression Scale; PDQ-39, Parkinson's Disease Quality of Life-39 items; SCOPA-AUT, the scale for outcomes in PD for autonomic symptoms.

Supplementary Table 2. demographics of 11 patients with motor assessment vs. the whole cohort

	Sub-cohort (11)		entire cohort		Anova
	mean	sd	mean	sd	p
Numer of Patients(N)	11		32		
Age	58.32	9.50	62.03	9.39	0.27
sex (M:F)	0.45	0.50	0.38	0.48	0.65
Follow-up Years	1.50	0.92	10.74	3.76	0.98
LEDD	885.61	390.90	810.68	406.48	0.60
MDS-UPDRS III(off)	49.27	20.98	47.72	21.31	0.84
MDS-UPDRS III(on)	26.45	16.38	21.42	13.37	0.33
HAMA	14.27	7.14	15.84	6.34	0.51
HAMD	15.64	9.58	16.72	8.24	0.73
PDQ39	53.55	20.73	57.81	23.11	0.60
ASP SCOPA AUT	19.36	8.65	23.19	9.67	0.26
PDSS-2	15.73	5.69	18.38	8.18	0.34
stimulation parameters					
pulse width	79.09	13.79	79.69	15.29	0.91
frequency	128.64	20.68	132.66	19.59	0.57
voltage	2.51	0.65	2.62	0.78	0.67

MDS-UPDRS, Movement disorder society-unified Parkinson's Disease Rating Scale; IRLS, Index of Restless Legs Syndrome; HAMA, Hamilton Anxiety Scale; HAMD, Hamilton Depression Scale; PDQ-39, Parkinson's Disease Quality of Life-39 items; SCOPA-AUT, the scale for outcomes in PD for autonomic symptoms.