

## Appendix 1

### Methods

#### Calculation of sign scores

Motor signs were sum on MDS-UPDRS part III in early-stage PD: (I) bradykinesia (item 3.4–3.8), which describe finger tapping, hand movement, rapid alternating and leg agility; (II) rigidity (item 3.3), which describe rigidity of the neck, arm and leg; (III) tremor (item 3.15–3.18), which describe postural tremor, kinetic tremor, tremor rest lip/jaw and constancy of rest tremor; (IV) axial signs (item 3.1, 3.2, 3.9–3.14), which measure speech, facial, posture, postural stability and gait (item 3.10, 3.11).

**Table S1** ROI-based analysis for thalamic connectivity alterations between HC and early-stage PD

Thalamic subregions	HC (N=56)		PD (N=55)		T value	P value
	Mean	SD	Mean	SD		
01 to 02	1.27	0.28	1.18	0.22	2.055	0.042*
01 to 03	0.41	0.24	0.33	0.18	1.852	0.067
01 to 04	0.79	0.29	0.77	0.23	0.504	0.616
01 to 05	1.29	0.30	1.20	0.28	1.578	0.117
01 to 06	0.76	0.25	0.71	0.20	0.990	0.325
01 to 07	0.42	0.28	0.45	0.20	-0.585	0.560
02 to 03	0.41	0.27	0.32	0.19	2.173	0.032*
02 to 04	0.65	0.27	0.64	0.24	0.150	0.881
02 to 05	0.87	0.28	0.79	0.26	1.546	0.125
02 to 06	0.93	0.27	0.86	0.23	1.428	0.156
02 to 07	0.40	0.29	0.40	0.21	0.024	0.981
03 to 04	0.42	0.21	0.39	0.21	0.911	0.364
03 to 05	0.35	0.20	0.29	0.20	1.708	0.091
03 to 06	0.94	0.28	0.83	0.21	2.365	0.020*
03 to 07	0.65	0.27	0.63	0.23	0.299	0.765
04 to 05	1.03	0.27	0.97	0.23	1.294	0.199
04 to 06	0.68	0.26	0.66	0.22	0.427	0.670
04 to 07	0.82	0.25	0.83	0.26	-0.065	0.948
05 to 06	0.64	0.24	0.59	0.21	1.177	0.242
05 to 07	0.46	0.26	0.47	0.19	-0.292	0.771
06 to 07	0.63	0.28	0.62	0.21	0.278	0.782

01 to 07 represent primary motor, sensory, occipital, prefrontal, premotor, parietal, and temporal for thalamus, respectively. \*,  $P < 0.05$ . ROI, region of interest; HC, healthy control; PD, Parkinson's disease; SD, standard deviation.

**Table S2** The significant results for relationships between thalamic functional connectivity and the clinical scores in early-stage PD

Clinical evaluation	Brain region		R	P value	P <sub>FDR</sub> value
	Thalamic subregion	Cortex			
MDS-UPDRS I	Premotor	LING.L	-0.339	0.011	0.055
MDS-UPDRS II	Sensory	ORBsupmed.L	-0.400	0.002	0.060
	Occipital	STG.L	0.332	0.013	0.056
	Occipital	TPOsup.L	0.352	0.008	0.080
	Premotor	LING.L	-0.292	0.031	0.049 <sup>†</sup>
	Parietal	SFGdor.L	-0.269	0.047	0.050
	Parietal	DCG.L	-0.278	0.040	0.050
	Parietal	DCG.R	-0.327	0.015	0.056
	MDS-UPDRS III	Sensory	SMA.R	-0.283 <sup>#</sup>	0.037
Sensory		ORBsupmed.L	-0.322	0.017	0.057
Parietal		SFGdor.L	-0.309 <sup>#</sup>	0.022	0.055
Parietal		SMA.L	-0.312 <sup>#</sup>	0.020	0.060
Parietal		DCG.R	-0.268 <sup>#</sup>	0.048	0.050
MDS-UPDRS IV	Primary motor	STG.L	-0.290	0.031	0.047 <sup>†</sup>
	Sensory	THA.L	-0.287	0.034	0.049 <sup>†</sup>
	Parietal	THA.R	-0.273	0.044	0.053
	Parietal	STG.L	-0.293	0.030	0.053
MDS-UPDRS total	Sensory	SMA.R	-0.349	0.009	0.054
	Sensory	ORBsupmed.L	-0.362	0.007	0.105
	Sensory	DCG.R	-0.308	0.022	0.051
	Occipital	STG.R	0.273	0.044	0.051
	Occipital	TPOsup.L	0.352	0.008	0.060
	Parietal	SFGdor.L	-0.302	0.025	0.050
	Parietal	SMA.L	-0.292	0.030	0.050
	Parietal	DCG.L	-0.294	0.029	0.054
	Parietal	DCG.R	-0.307	0.023	0.049
	Bradykinesia	Occipital	STG.R	0.311	0.021
Rigidity	Parietal	THA.R	-0.272	0.044	0.049 <sup>†</sup>
Gait	Parietal	SFGdor.L	-0.267	0.048	0.048 <sup>†</sup>
Axial signs	Sensory	IFGoperc.L	-0.280	0.038	0.050

<sup>#</sup>, use Pearson and others use Spearman correlation analysis. Axial signs without gait score. The significance threshold was set at 0.05, two-tailed. \*, P<0.05. The brain regions are reported based on the Automated Anatomical Labeling atlas: DCG, median cingulate and paracingulate gyri; IFGoperc, inferior frontal gyrus, opercular part; LING, lingual gyrus; ORBsupmed, superior frontal gyrus, medial orbital; SFGdor, superior frontal gyrus, dorsolateral; SMA, supplementary motor area; STG, superior temporal gyrus; THA, thalamus; TPOsup, temporal pole: superior temporal gyrus. PD, Parkinson's disease; FDR, false discovery rate.