Supplementary Material

A Randomized, Double-Blinded Crossover Trial of Short Versus Conventional Pulse Width Subthalamic Deep Brain Stimulation in Parkinson's Disease

Supplementary Table 1. Adverse Events

Event	Number of AE in PW60	Number of AE in PW30	Total number of subjects in both conditions
Adverse Events associated with stimulation			
Dyskinesia	8	8	9
Speech impairment	2	1	3
Worsening of symptom control	1	3	4
Total	**11**	**12**	**13/30**
Adverse Events probably associated with stimulation			
Numbness in a limb	1	0	1
Spasms in fingers or toes	2	1	2
Impairment of balance	1	0	1
Total	**4**	**1**	**4/30**
Adverse Events not associated with stimulation			
Neckpain	1	1	1
Pain in a limb	2	1	3
Dorsal pain	0	2	2
Mild depressive symptoms	5	3	5
Disrupted sleep	0	1	1
Total	**8**	**8**	**11/30**
Serious Adverse Event not associated with stimulation			
DBS system infection	1	0	**1/30**

Adverse events as reported at follow-up visits or at dropout. AE, adverse event; DBS, deep brain stimulation; PW30, trial condition with 30 µs; PW60, trial condition with 60 µs.

Supplementary Table 2. Stimulation Settings at Follow-up Visits

Subject	Stimulation Setting	Current PW60 [mA]	Current PW30 [mA]
1	R: C+, 3- (100%), 119 Hz L: C+, 9- (25%), 10- (25%), 11- (25%), 119 Hz	R: 1.8* L: 8.1	R: 3.7 L: 8.4
2	R: C+, 1- (10%), 2- (10%), 3- (10%), 4- (24%), 5- (23%), 6- (23%), 130 Hz L: C+, 9- (10%), 10- (10%), 11- (10%), 12- (24%), 13- (23%), 14- (23%), 130 Hz	R: 2.7 L: 2.3	R: 4.0* L: 4.0
3	R: C+, 0- (60%), 1- (20%), 2- (20%), 130 Hz L: C+, 8- (60%), 9- (18%), 10- (22%), 130 Hz	R: 1.8* L: 2.1	R: 2.9 L: 3.1
4	R: C, 1+ (50%), 2- (100%), 3+ (50%), 130 Hz L: C+, 9- (30%), 11- (30%), 12- (40%), 174 Hz	R: 2.0 L: 1.7	R: 3.0* L: 3.0
5	R: C+, 1- (34%), 2- (33%), 3- (33%), 116 Hz L: C+, 11- (50%), 14- (50%), 116 Hz	R: 2.2 L: 3.1	R: 4.3* L: 5.0
6	R: C+, 1- (34%), 2- (33%), 3- (33%), 130 Hz L: C+, 9- (34%), 10- (33%), 11- (33%), 130 Hz	R: 3.0* L: 3.4	R: 4.3 L: 4.9
7	R: C+, 1- (34%), 2- (33%), 3- (33%), 130 Hz L: C+, 12- (34%), 13- (33%), 14- (33%), 130 Hz	R: 2.5 L: 1.5	R: 4.0* L: 2.8
8	R: C+, 7- (100%), 130 Hz L: C+, 15- (100%), 130 Hz	R: 0.2* L: 1.2	R: 0.2* L: 1.0
9	R: C+, 4- (34%), 5- (33%), 6- (33%), 130 Hz L: C+, 12- (34%), 13- (33%), 14- (33%), 130 Hz	R: 0.7 L: 0.7	R: 1.1* L: 0.7
10	R: C+, 4- (34%), 5- (33%), 6- (33%), 119 Hz L: C+, 12- (50%), 13- (50%), 119 Hz	R: 2.9* L: 2.9	R: 5.8 L: 6.3
11	R: C+, 4- (100%), 130 Hz L: C+, 9- (100%), 130 Hz	R: 0.7 L: 1.9	R: 1.4 L: 3.3
12	R: C+, 4- (33%), 5- (34%), 6- (33%), 130 Hz L: C+, 12- (10%), 13- (10%), 14- (10%), 15- (70%), 130 Hz	R: 2.1* L: 2.6	R: 4.6 L: 4.5
13	R: C+, 1- (16%), 2- (16%), 4- (33%), 5- (35%), 185 Hz L: C+, 10- (13%), 11- (15%), 13- (36%), 14- (36%), 185 Hz	R: 3.2 L: 2.7	R: 4.9* L: 3.8
14	R: C+, 4- (31%), 5- (42%), 6- (27%), 130 Hz L: C+, 12- (42%), 13- (42%), 14- (16%), 130 Hz	R: 2.3 L: 2.3	R: 3.3* L: 3.3
15	R: C+, 4- (34%), 5- (33%), 6- (33%), 130 Hz L: C+, 12- (34%), 13- (33%), 14- (33%), 130 Hz	R: 2.2* L: 2.4	R: 2.8 L: 3.3
16	R: C+, 3- (100%), 204 Hz L: C+, 12- (34%), 13- (33%), 14- (33%), 204 Hz	R: 2.7 L: 0.8	R: 4.0* L: 1.0
17	R: C+, 4- (33%), 5- (34%), 6- (33%), 198 Hz L: C+, 12- (34%), 13- (33%), 14- (33%), 198 Hz	R: 1.5 L: 1.3	R: 2.6* L: 1.9
18	R: C+, 1- (34%), 2- (33%), 3- (33%), 130 Hz L: C+, 9- (50%), 10- (50%), 130 Hz	R: 1.2* L: 1.9	R: 2.4 L: 2.9
19	R: C+, 1- (18%), 2- (16%), 3- (16%), 4- (18%), 5- (16%), 6- (16%), 130 Hz L: C+, 12- (34%), 13- (33%), 14- (33%), 130 Hz	R: 2.6* L: 2.6	R: 3.4 L: 3.1
20	R: C+, 2- (34%), 3- (33%), 4- (33%), 130Hz L: C+, 10- (34%), 11- (33%), 12- (33%), 130Hz	R: 2.4 L: 2.9	R: n.a. L: n.a.
21	R: C+, 4- (100%), 130Hz L: C+, 9- (100%), 130Hz	R: n.a. L: n.a.	R: 1.1 L: 1.7
22	R: C+, 5- (34%), 6- (33%), 7- (33%), 179Hz L: C+, 13- (50%), 15- (50%), 179Hz	R: n.a. L: n.a.	R: 4.6 L: 6.4
23	R: C+, 5- (34%), 6- (33%), 7- (33%), 130Hz L: C+, 13- (34%), 14- (33%), 15- (33%), 130Hz	R: n.a. L: n.a.	R: 3.1 L: 4.0
24	R: C+, 5- (34%), 6- (33%), 7- (33%), 174Hz L: C+, 10- (18%), 11- (16%), 12- (16%), 13- (18%), 14- (16%), 15- (16%), 174Hz	R: n.a. L: n.a.	R. 0.6 L: 3.5

Asterisk marks the patient's preferred stimulation setting. C, Case; L, left hemisphere; n.a., not available due to dropout; PW30, trial condition with 30 µs; PW60, trial condition with 60 µs; R, right hemisphere.

Supplementary Table 3. Motor Diary Outcomes per period

Motor States [h]	Period A N = 24	Period B N = 19	LME Period A vs. Period B	
	Mean (SD), [90%-CI]	Mean (SD), [90%-CI]	Estimate (SE)	p
"On"	11.95 (4.34) [10.4 to 13.5]	10.65 (4.92) [8.7 to 12.6]	-1.39 (0.68)	0.2
"Off"	2.18 (3.14) [1.1 to 3.3]	2.76 (3.51) [1.4 to 4.2]	0.97 (0.52)	0.3
"Dyskinesia"	1.57 (3.19) [0.5 to 2.7]	2.14 (3.71) [0.7 to 3.6]	0.36 (0.38)	1.0
"Sleep"	8.41 (1.29) [7.9 to 8.9]	8.39 (1.64) [7.7 to 9.0]	-0.04 (0.18)	1.0

Comparison of motor diary outcomes between Period A and Period B (see Fig. 1).
90%-CI, 90% confidence interval; SD, standard deviation; SE, standard error.

Supplementary Table 4. Motor Diary Outcomes for paired data only

Motor States [h]	PW60 N = 19	PW30 N = 19	PW60 vs. PW30 N = 19	
	Mean (SD), [90%-CI]	Mean (SD), [90%-CI]	Estimate (SE)	p
"On"	11.68 (4.19) [10.0 to 13.3]	11.04 (5.05) [9.0 to 13.1]	-0.39 (3.21)	1.0
"Off"	2.02 (3.67) [0.9 to 3.0]	1.93 (3.55) [1.1 to 3.8]	1.16 (2.27)	1.0
"Dyskinesia"	1.95 (2.60) [0.6 to 3.5]	2.49 (3.38) [0.5 to 3.3]	1.89 (1.67)	1.0
"Sleep"	8.30 (1.39) [7.7 to 8.9]	8.53 (1.57) [7.9 to 9.2]	-1.37 (0.67)	0.2

Comparison of motor diary outcomes between PW60 and PW 30 only including patients completing the trial. 90%-CI, 90% confidence interval; SD, standard deviation; SE, standard error; PW30, trial condition with 30 µs; PW60, trial condition with 60 µs.

Supplementary Table 5. Subgroup analysis: Comparison of Non-preferred Settings

	npPW60 (N = 9)		npPW30 (N = 9)		
	Mean	SD	Mean	SD	p
Motor states [h]					
"On"	11.95	4.38	10.35	4.30	1.00
"Off"	1.96	3.00	3.83	3.85	0.955
"Dyskinesia"	2.20	3.03	0.83	1.65	1.00
"Sleep"	7.78	1.20	8.98	2.01	0.562
Secondary outcomes					
VAS "ability to speak"	3.77	3.06	5.07	2.28	1.00
Intelligibility	8.26	1.40	7.79	1.10	1.00
VAS "ability to walk"	5.12	2.60	5.16	2.77	1.00
10-m timed walk [s]	8.20	1.56	9.78	1.37	0.80
UPDRS-I	1.22	1.20	1.89	2.42	1.00
UPDRS-II	8.44	3.88	8.22	2.91	1.00
UPDRS-III	18.67	7.52	16.33	6.61	1.00
PDQ39-SI	58.12	40.42	74.36	62.74	1.00
NMSQ	6.78	3.15	8.22	5.02	1.00
Energy indices					
Change in current (PW60→PW30) [%]	38.23	41.05	31.87	55.53	1.00
Battery charge index [μJ]	40.09	24.06	42.49	29.79	1.00
Charge per pulse [nC]	226.00	87.05	254.00	130.06	1.00
Total electrical energy delivered [μJ/s]	76.41	54.05	83.39	64.20	1.00

npPW60, 60 μs condition of patients preferring 30 μs setting; npPW30, 30 μs condition of patients preferring 60 μs setting; SD, standard deviation