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Attention training improves attention and gait in Parkinson disease: A pilot study

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Attention failure is an early component of cognitive dysfunction in Parkinson disease (PD) and a common deficit among elderly fallers [1]. Some of the cognitive deficits of PD may be amenable to cognitive training [2]. We conducted a pilot, uncontrolled study of an established attention training protocol [3] to determine if it would improve attention and gait in non-demented ambulatory outpatients with PD.

Participants had a PD diagnosis according to the UK Brain Bank diagnostic criteria; below average performance on any one of Comprehensive Trail-Making Test (CTMT), Paced Auditory Attention Test (PASAT), or Symbol Digit Modalities Test (SDMT); Mini-Mental State Exam (MMSE) > 25; Beck Depression Inventory (BDI) < 16; no diagnosis of dementia, learning disability, stroke, epilepsy, brain tumor, or psychotic disorder; no use of centrally acting anticholinesterases, memantine, anticholinergics, benzodiazepines, antipsychotics, sedatives, or narcotics; no brain surgery for PD; and, no chemical substance overuse. The study protocol and consent were approved by the Park Nicollet Institutional Review Board. All participants signed written informed consent per the standard institutional procedures.

Intervention consisted of 12 one-on-one sessions of visual attention using the Attention Process Training II protocol (APT) [3] with an occupational therapist over a 4 week period. The APT protocol is designed to address deficits in attentional processing, including managing distraction, mental control, and shifting attention between different activities, and has been used in traumatic brain injury and stroke rehabilitation.

Outcomes were collected at baseline, immediately, and at 1 month after training. Participants did not have access to training between the end of treatment and the 1-month retesting. Assessments were performed in the ON state, at the same time of day. Primary outcomes were the change in CTMT, PASAT, and SDMT between baseline and immediately post-intervention. Secondary outcomes were the change in the same measures between baseline and 1 month post-intervention. Changes in GV and TUG were exploratory outcomes. T-scores were utilized for the CTMT, and z-scores for the SDMT and PASAT. The CTMT [4] comprises five visual search and sequencing tasks that assess attention, concentration, resistance to distraction, and cognitive flexibility. The PASAT [5] is a serial addition task of numbers presented at 3 or 5 sec intervals, and assesses working memory, divided attention, and information processing speed. The SDMT assesses divided attention, visual scanning, tracking, and motor speed. GV is calculated from the time to walk 10 m without or with physical (carrying a tray with a cup of water– GVP), cognitive (counting back by sevens from 100 – GVC), or both (GVCP) concomitant tasks. TUG is the time needed to arise from a standard height seat, walk 3 m, walk back, and return to the sitting position. Changes from baseline to immediately post-training and between baseline and 1 month post-training were assessed with paired t-tests.

Fifteen participants, 9 men and 6 women, aged 68.5 ± 5.2, with disease duration 4.1 ± 2.4 years completed the protocol. There were 10 screen failures due to not meeting the cognitive screening criteria; 4 due to prohibited medications; 1 due to inability to complete assessments; and 1 due to relevant deficits from previous stroke. One participant withdrew due to failing general health. PASAT and CTMT scores improved immediately post-training and at 1 month post-training. CTMT subtests showed variable responsiveness. Improvements were more robust at 1 month after the end of training. Improvements in GV generally paralleled those of cognitive tests. SDMT and TUG did not change significantly (Table 1).

Results indicate that the APT protocol has good potential to improve attention in people with PD without dementia. Effectiveness of cognitive training has been previously reported in PD [2]. A novel finding was that improvements expanded one month after the completion of training, learned strategies being possibly amplified with practice through neuroplasticity. Practice effect on test performance was thought unlikely, as the instruments have good test-retest reliability, and testing was sufficiently spaced in time. Gait improvements paralleled those in attention and were similarly sustained 1 month later. Participants in our study had a disease duration from 1 to 9 years, and were highly educated and motivated. These skewed characteristics were the result of our strict selection criteria, necessitated by the small sample and the pilot nature of the study, and limit the generalizability of the results.

Declarations of interest

None. All authors have no relevant conflicts of interest to declare.

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Table 1
Outcome Measures: Improvement from Baseline (T-score for CTMT; z-score for SDMT; PASAT; m/s for GV, GVC, GVP, GVCP; s for TUG).

	Baseline	Immediate Post-Training		1-month Post Training	
		Change	p-value	Change	p-value
CTMT					
Trail 1	46.9 ± 8.4	2.47 ± 5.9	0.128	4.93 ± 6.41	**0.01**
Trail 2	45.3 ± 9.1	1.14 ± 3.90	0.293	4.20 ± 6.28	**0.021**
Trail 3	42.2 ± 11.5	3.00 ± 6.92	0.115	6.67 ± 8.01	**0.006**
Trail 4	46.3 ± 11.5	4.80 ± 7.46	**0.026**	6.53 ± 8.60	**0.011**
Trail 5	49.5 ± 12.2	0.40 ± 5.58	0.785	0.67 ± 5.75	0.660
Composite	45.3 ± 10.6	2.36 ± 4.60	**0.078**	6.40 ± 6.56	**0.002**
PASAT					
3-s	−1.37 ± 1.50	0.57 ± 1.03	**0.049**	0.92 ± 1.71	**0.009**
5-s	−1.32 ± 1.26	0.63 ± 0.84	**0.011**	0.79 ± 0.83	**0.002**
SDMT	−0.3 ± 1.1	0.13 ± 0.60	0.430	0.70 ± 0.78	0.206
GV	1.38 ± 0.21	0.12 ± 0.20	**0.037**	0.15 ± 0.20	**0.05**
GVC	1.07 ± 0.35	0.27 ± 0.21	< **0.001**	0.33 ± 0.25	< **0.001**
GVP	1.31 ± 0.23	0.12 ± 0.18	**0.022**	0.18 ± 0.21	**0.008**
GVCP	1.11 ± 0.34	0.22 ± 0.19	**0.001**	0.21 ± 0.24	**0.007**
TUG	10.32 ± 2.63	−0.30 ± 1.57	0.486	−0.66 ± 1.02	0.334

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Author contibutions

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2. A. Drafting, B. Critical revision for important intellectual content.
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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.parkreldis.2018.08.015.

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