



Cognitive Neurorehabilitation of Movement Initiation in Parkinson's Disease

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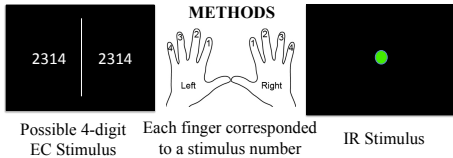
BACKGROUND

- One common deficit in Parkinson's disease (PD) is in the initiation of internally represented (IR) movements, while externally cued (EC) movements are less affected.
- We evaluated the efficacy of a PC-based cognitive neuro-rehabilitation training program.
- Our hypothesis was that the training program would decrease reaction time and error rate for IR trials, and that the benefits of training would generalize to measures involving motor sequencing and cognitive switching.**

| | Controls | PD unimpaired | PD impaired |
|--------------------------|----------|---------------|-------------|
| N (female) | 1(0) | 2(1) | 5(2) |
| Age | 61 | 63.5±2 | 69±3 |
| Years of Education | 24 | 18±3 | 16±3 |
| Years Since Diagnosis | -- | 2±1 | 7±4 |
| H&Y | -- | 2.0±0 | 1.8±1 |
| Digit Span Pre/Post | 19/27 | 17±5/16±5 | 17±5/17±2 |
| MMSE Pre/Post | 30/30 | 29±0/29±0 | 30±0/29±1 |
| GDS Pre/Post | 0/0 | 3±1/2±1 | 9±8/9±7 |
| Dopamine Equivalent (mg) | -- | 188 | 570 |

PD participants were divided into two groups, those who showed impairment in IR motor sequence production in the pre-test (I-PD) and those who performed similarly to controls (U-PD).

METHODS



- Training consisted of a two-phase button press task. First, participants produced an EC digit sequence, typing numbers displayed on the computer screen using their left, right, or both hands. Second, participants were prompted to generate the same sequence in the absence of the number display (IR sequence).
- Sequence length varied from 1 to 4 digits and was adapted to maintain 87% accuracy. Participants trained for 30 sessions over a six-week period.
- Participants were evaluated before and after training on a fixed version of the task.
- Participants were also evaluated before and after training using tests targeting executive function, activities of daily living and motor performance. These tests included:

- DKEFS, Color-Word Interference Test (CWI)
- Functional Dexterity Test (FDT), Standard Administration
- Modified Emory Functional Ambulation Profile (mEFAP)
- Timed Instrumental Activities of Daily Living (TIADL)
- Unified Parkinson's Disease Rating Scale using the CleveMed Kinesia Quantitative Motor Assessment System

RESULTS

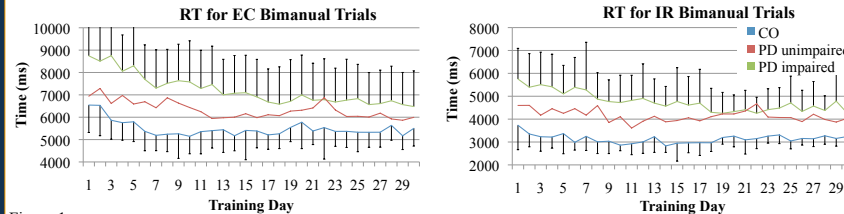


Figure 1. Training Performance. During training the I-PD group showed a greater reduction in reaction time for both EC and IR trials.

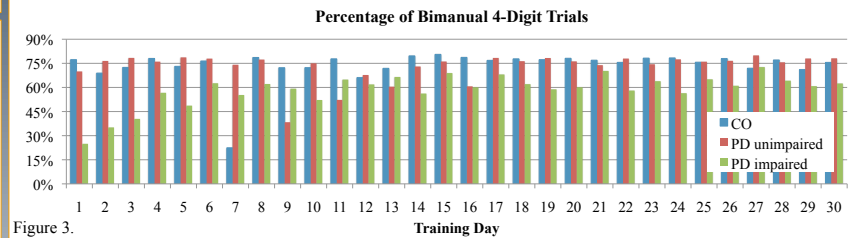
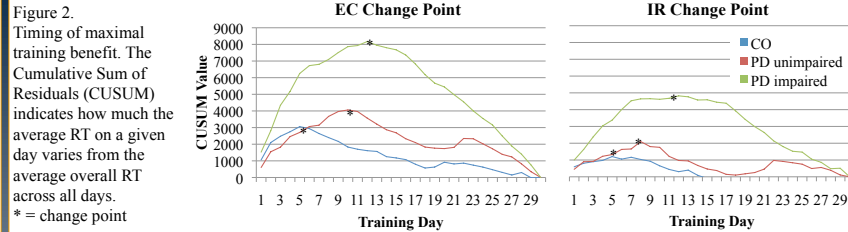


Figure 3. During training the I-PD group showed a reduced % of bimanual 4-digit trials compared to the U-PD and CO groups.

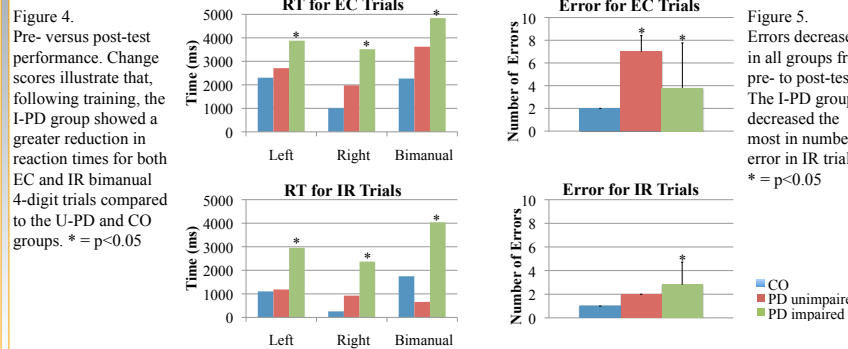


Figure 4. Pre- versus post-test performance. Change scores illustrate that, following training, the I-PD group showed a greater reduction in reaction times for both EC and IR bimanual 4-digit trials compared to the U-PD and CO groups. * = p<0.05

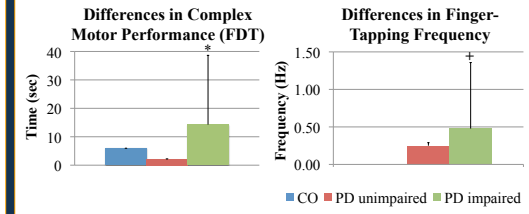


Figure 5. Generalization of training. Following training the I-PD group showed greater improvement in complex motor performance compared to the U-PD and CO groups. Finger tapping frequencies from the dominant hand (right) from the UPDRS Motor Evaluation show a trend toward greater improvement in the I-PD group than in the U-PD and CO groups. * = p<0.05, + = p<0.07

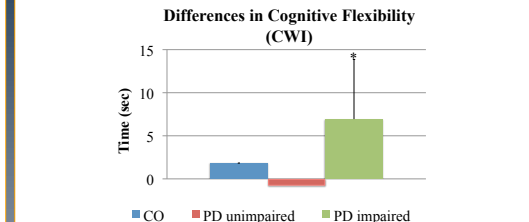


Figure 6. Following training the I-PD group showed greater improvement in cognitive flexibility compared to the U-PD and CO groups. * = p<0.05

CONCLUSIONS

- Following the neurorehabilitation training program the I-PD group showed a significant reduction in reaction time and number of errors for EC and IR trials.
- Maximum training benefit occurred later in training for the I-PD group compared to the U-PD and CO groups.
- The benefit of the training generalized to measures of complex motor performance and cognitive flexibility.
- Computer-based neurorehabilitation tailored to the specific cognitive deficits of Parkinson's disease is a promising adjunct therapy for cognitive symptoms that affect motor behavior.

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