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 neurorehabilitation 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.

METHODS

- Participants were evaluated before and after training on a fixed sequence length varied from 1 to 4 digits and was adapted to participants’ production in the pre-test (I-PD) version of the task.
- 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 performance and cognitive flexibility.

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

Figure 2. Timing of maximal training benefit. The Cumulative Sum of Residuals (CUSUM) indicates how much the average RT on a given day varies from the average overall RT across all days.

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. Errors decreased in all groups from pre-to post-test. The I-PD group decreased the most in number of error in IR trials. * = p<0.05

Figure 6. 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

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.

ACKNOWLEDGEMENTS

The authors would like to thank Kimberly Lanni and Maria Ventura for their guidance with the neuropsychological tests and Richard Mellinger for his assistance with the MATLAB scripts that were used to analyze UPDRS data.

Funding provided by VA Merit Rehabilitation R&D grant #101 RX/000181 to ED.