



Plasticity-Based Cognitive Remediation in Multiple Sclerosis (MS)

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Objective

A pilot the compliance and preliminary efficacy of a plasticity-based, adaptive, computerized cognitive remediation (“PACR”) program in adults with multiple sclerosis (MS) reporting cognitive dysfunction.

Background

Cognitive impairment occurs in more than half of all adults with MS, with the most common deficits in the areas of information processing, attention, and new learning. There is no consistently effective treatment and these deficits often strike individuals during their key years of productivity with tremendous cost in quality of life. Cognitive remediation holds particular promise because it is safe and noninvasive and works to restore functional abilities. Recent technological advances have allowed home-based delivery of remediation programs through internet-connected computers. PACR is web-based cognitive remediation program currently considered an investigational device and limited by Federal (or United States) law to investigational use.

Methods

After having received Institutional Review Board approval as a non-significant risk study, 10 participants, three men and seven women ranging in age from 27 to 64 years (mean of 49 years) enrolled in the PACR program. Six participants were diagnosed with relapsing-remitting and four with primary progressive MS, with a median EDSS score of 3.7 and a range from 1.0 to 6.5.

At baseline, participants completed a neuropsychological evaluation, received a laptop computer, and were given PACR program usage instructions. During the home-based treatment period, participants completed the study games for five hours per week for a total of 40 hours over eight weeks.

Compliance and performance data were collected remotely and provided by the developer Brain Plasticity, Inc. At the end of study, participants underwent repeat neuropsychological testing and reported their impression of their cognitive functioning (memory and global cognition) as a result of completing the PACR program. A study staff member also completed the Clinician Interview-Based Impression of Change (CIBIC) rating with both the participant and an informant when available (n=4, either a spouse or other family member).

Results

COMPLIANCE: As shown in Table 1, all participants were close to the target of 40 hours. Nine of the ten completed or exceeded the target amount of hours. The remaining participant (#106) completed 31 hours. Two participants (102, 107) requested to continue sessions on their home computer after the eight week assessment.

Table 1: Total Program Hours

Participant	Hours
101	40
102	59+
103	42
104	51
105	50
106	31
107	73+
108	40
109	42
110	42
MEAN	47

PACR PERFORMANCE: Performances are compared to a large normative database, provided by the program developers, and each participant is assigned a percentile to their current skill level. Change in percentile ranking between the participant’s initial and best performance serves as an indicator of skill progression within the program. As shown in Figure 2, all participants showed improvement in their percentile ranking (combined across tasks), with the average group gain of 30.9 points, indicating marked improvement on the program tasks.

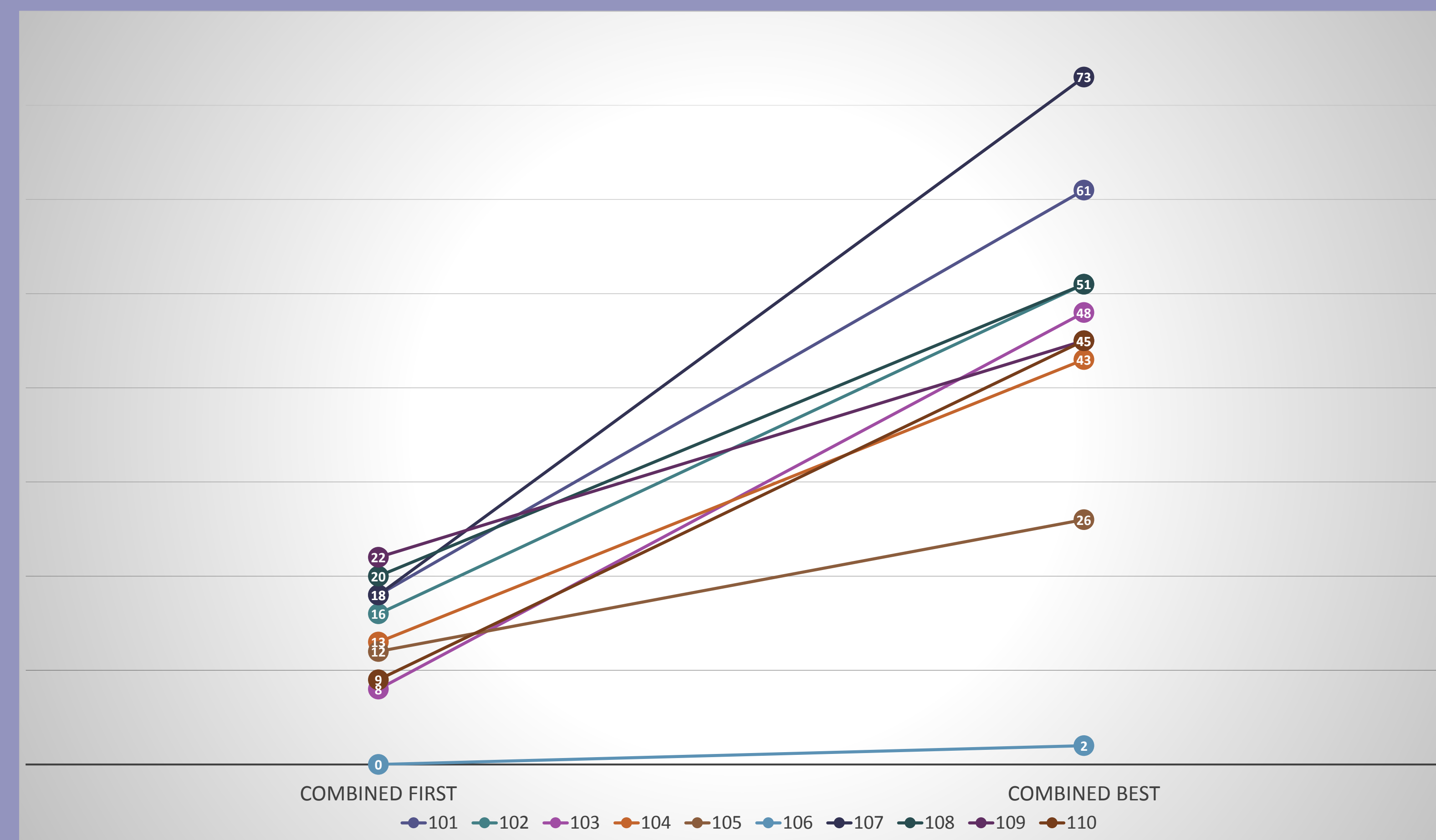


Figure 1: PACR Task Performance Over Time

RATINGS: At the study end visit, the majority of the completed participants reported improvement. Seven of the 10 participants reported improved general cognition, and six reported improved memory. Similarly, seven of the 10 received ratings of at least mild improvement on the CIBIC. No participant reported nor received a rating of decline.

NEUROPSYCHOLOGICAL PERFORMANCE: As shown in Table 2, A composite of the participants’ baseline neuropsychological test scores indicated a range of cognitive abilities across the sample trending towards low average to mild impairment (mean composite score z = -0.75). After completing the PACR program, all but one participant showed improvement (mean composite score increase z =0.33).

Table 2. Neuropsychological Performance

Participant	Composite Cognitive Z Score		
	Baseline	Study End	Change Score
101	-.51	.13	.64
102	-1.01	-1.03	-.02
103	-.11	.34	.45
104	-1.20	-1.03	.17
105	-2.36	-1.75	.61
106	-.54	-.31	.23
107	-2.58	-1.88	.70
108	.46	.79	.33
109	.09	.07	.02
110	.23	.39	.16
MEAN	-.75	-.43	.33

Conclusions

In this preliminary study, MS participants showed program compliance and a positive treatment signal with improvement on PACR program exercises, participant ratings, and standardized cognitive measures. Home delivery of the PACR program may be an option for MS patients experiencing cognitive dysfunction.

References

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