

# The Efficacy of Neurocognitive Training upon a Diagnosed Mild Cognitive Decline/ Dementia Population in a Clinical Setting: Ongoing Study Since 2011

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## Abstract

This study has been ongoing since 2011 established in an outpatient clinic setting. The program is individually designed based upon neuropsychological evaluation and each plan is patient specific based upon NP testing. Neurocognitive training occurred in the context of psychotherapy session addressing behavioral health issues as well as related neurological and neuropsychological deficits and concerns. Re-evaluation was completed, using the same testing at the same time of day, after generally six months of treatment to ascertain changes and efficacy of the program. The study now consists of 77 patients referred by their treating physician or specialist, diagnosed with memory deficits related to mild cognitive decline and/or dementia. Six months was the average for elapsed time between pre and post testing. Educational level ranged from high school to graduate degrees. Findings indicate that numerous areas of memory function improved using an individually designed program of activities/games to improve neurocognitive function delivered in the context of a therapy session addressing all aspects of the individual's behavioral health. The individualized therapeutic program appears to be effective in enhancing memory function in a clinical outpatient population of varying degrees and types of dementia or cognitive decline.

**Keywords:** Neurocognitive therapy; Dementia; Mild cognitive decline; Neuropsychological evaluation

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## Introduction

This study has been ongoing since 2011 established in an outpatient clinic setting; the last publication was in 2017 [1]. The program is an individually designed program based upon neuropsychological evaluation and executed in a therapeutic setting. Neurocognitive therapy accompanies conventional cognitive behavioral therapy to address behavioral health issues, as well as related neurological and neuropsychological deficits and concerns. Sleep, exercise and remaining active are stressed during therapeutic intervention to address all aspects of the individual's daily life.

The therapist stresses positive self-care and continuing to address medical and neurological disorders in a preventative and positive manner, whether that is medication management, CPAP compliance, good nutrition and eating properly. Contact is

maintained with treating physicians and specialists. Patients are typically referred by the medical field resulting from an outreach effort to encourage early testing and diagnosis for mild cognitive decline based upon common risk factors of cardiovascular disease or specific neurological disorders (e.g., Parkinson's disease, Huntington's disease, stroke, brain injury, cancer and radiation treatment, long term sleep apnea) or family history of dementia.

Neuropsychological assessment is completed using a specific battery of tests to evaluate for mild cognitive decline/dementia, consisting of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Memory Assessment System (MAS), Doors and People Test, and Brief Visuospatial Memory Test-Revised (BVMT-R). A specific plan of care is created based upon the neuropsychological evaluation. Each plan is created based upon symptoms presented and neuropsychological evaluation suggesting a specific targeted focus for therapeutic

intervention (i.e., memory, word retrieval, impact of executive reasoning deficits). Re-evaluation is completed using the same testing at the same time of day with the goal of making changes in the treatment program and establishing efficacy. This occurs at the request of the treating therapist, based upon patient request, staff review and discussion of the patient and the general time frame of six months.

Neurocognitive rehabilitation or intervention has been in the forefront along with addressing the modifiable risk factors (exercise, nutrition, sleep) given the poor progress with medication intervention to address cognitive decline. There are commercial programs, large scale studies have been conducted and various programs have emerged suggesting the benefit of cognitive training upon cognitive decline and graceful aging. Cognitive training is seen as distinctly beneficial yielding the suggestion that perhaps white matter changes and reduced risk of dementia may occur as a result [2-8]. Videogame training was not as robust, revealing only modest support, specific effects and mixed results regarding the impact upon everyday life [9-11]. An active lifestyle was seen as more effective than short term training intervention in a dementia risk group.

## Method

Adults were referred by their primary care physician, internist, cardiologist, neurologist or sleep specialist for the assessment of memory difficulties and diagnosed with mild cognitive decline/dementia (age 51 to 90 years, n= 77). (Diagnosis changed to MCI in accordance with changes in diagnostic coding). The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Memory Assessment System (MAS), Doors and People Test, and Brief Visuospatial Memory Test-Revised (BVMTR) were utilized to measure memory functioning pre and post treatment. Six months was the average for elapsed time between pre and post testing.

Educational level ranged from high school to graduate degrees. All patients were diagnosed with memory deficits by neuropsychological evaluation using the specific battery of tests listed above; diagnosis was primarily multifactorial dementia, predominated by cardiovascular dementia; 2.5 percent were diagnosed with early onset Alzheimer's dementia and 11.6 percent with dementia secondary to traumatic brain injury.

The RBANS has been used extensively for critical care and in research with patients diagnosed with cognitive deficits or dementia [12,13]. The RBANS provides evaluation in areas of immediate (verbal learning tasks) and delayed memory (verbal and visual memory) language (naming and word retrieval) attention (short term number recall and a coding task) and visual processes (visual spatial/visuoconstructive) (line judgment task and copying a visual figure). The Doors and People is an accepted memory test for visual and verbal retrieval and recognition [14-16]. It provides separate scores for visual and verbal memory, visual and verbal forgetting (based upon visual and verbal learning tasks) as well as visual and verbal recognition tasks and an overall total score. The BVMTR has been used in the aging population as a measure of visual memory [17]. This is a learning

task involving six shapes and recalling their exact position on the page. There are three learning trials, total recall score, delayed recall and learning score.

The neurocognitive training is presented during the course of a therapy session providing treatment of emotional issues, addressing modifiable risk factors and ongoing daily life. Patients are generally seen twice per week and encouraged to play the games during the course of their week in the home setting with a carryover home program. Each patient is assigned a different protocol based upon neuropsychological evaluation and the diagnosis of specific memory types (short term, working, visual, verbal, recognition versus retrieval) as well as the impact of executive reasoning deficits (selective attention, cognitive rigidity, integration, poor sequential processing).

There are over 200 games and activities to choose from (published games are used as well as games created specifically for our program at United Psychological Services). During the course of therapy, the use of the game is altered; timing may be added and/or increased items to remember. As the individual improves, there are increased levels of difficulty for the activities. For example, there is a Geoboard that involves the use of patterns created with different colored rubber bands matching a picture presented in black and white or color that provides increasing complexity. The person copies the design and then has to recall it from memory. The task involves the use of planning, memory processes and visual perceptual analysis.

## Results

Areas of short-term, delayed, visual, verbal, and overall memory, as well as visuospatial functioning evaluated improved following treatment. Paired samples t-tests revealed significant differences between pre and post treatment scores on the RBANS for immediate memory ( $p=0.021$ ), delayed memory ( $p=0.004$ ), visuospatial functioning ( $p=0.014$ ) and overall memory ( $p=0.000$ ), as well as on the MAS for visual memory ( $p=0.015$ ). Significant findings were also present on the Doors and People Test for verbal memory ( $p=0.030$ ), overall age ( $p=0.007$ ) and the BVMTR trial one ( $p=0.004$ ), total recall ( $p=0.042$ ) (**Tables 1-8 and Figures 1-4**).

**Table 1** Effect of cognitive training on immediate memory performance.

		Pre-Testing	Post-Testing
RBANS Immediate Memory	Mean SD	83.45	89.73
		20.5	20.22

**Table 2** Effect of cognitive training on delayed memory performance.

		Pre-Testing	Post-Testing
RBANS Delayed Memory	Mean $\pm$ SD	82.66	90.46
		23.58	23.05

**Table 3** Effect of cognitive training on visuospatial functioning.

		Pre-Testing	Post-Testing
RBANS Visuospatial Functioning	Mean $\pm$ SD	82.66	102.15
		17.07	20.57

**Table 4** Effect of cognitive training on overall memory performance.

		Pre-Testing	Post-Testing
RBANS Total Memory	Mean ± SD	87.02	91.28
		18.84	17.57

**Table 5** Effect of cognitive training on visual memory performance.

		Pre-Testing	Post-Testing
MAS Visual Memory	Mean ± SD	97.68	105.38
		18.01	14.1

**Table 6** Effect of cognitive training on verbal memory performance.

		Pre-Testing	Post-Testing
Doors and People Verbal Memory	Mean ± SD	7.5	8.26
		3.65	3.52

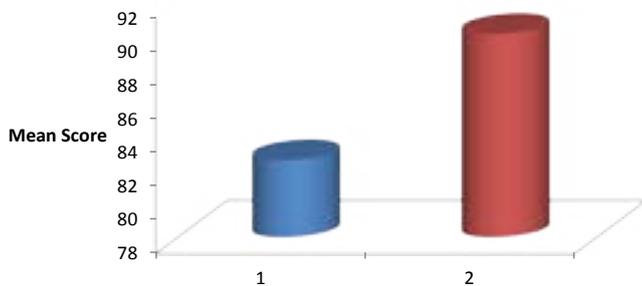
**Table 7** Effect of cognitive training on overall memory.

		Pre-Testing	Post-Testing
Doors and People Overall Age	Mean ± SD	7.45	9.1
		3.82	3.65

**Table 8** Effect of cognitive training on visual memory performance.

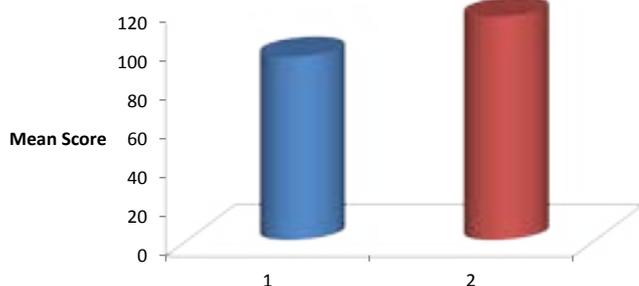
		Pre-Testing	Post-Testing
BVM-T-R Trial One	Mean ± SD	52.11	62
		19.18	2.82

### RBANS Delayed Memory



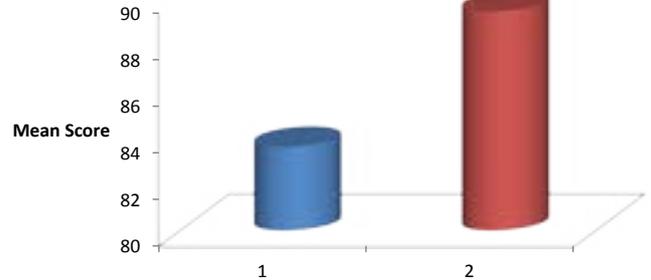
**Figure 1** Relationship between delayed memory functioning prior to introduction of therapy and post-evaluation after therapy commenced.

### RBANS Visuospatial



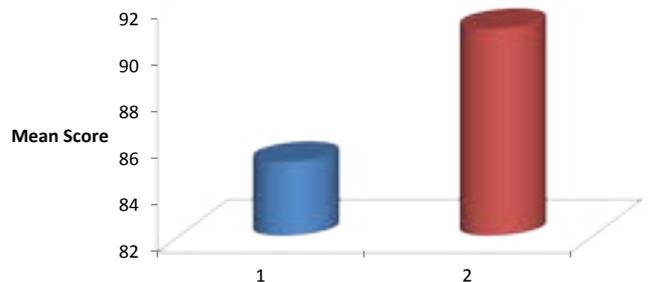
**Figure 2** Relationship between visuospatial functioning prior to introduction of therapy and post-evaluation after therapy commenced.

### RBANS Immediate Memory



**Figure 3** Relationship between immediate or short-term memory functioning prior to introduction of therapy and post-evaluation after therapy commenced.

### RBANS Overall



**Figure 4** Relationship between general memory functioning prior to introduction of therapy and post-evaluation after therapy commenced.

## Conclusions

Findings indicate that numerous areas of memory function improved using neurocognitive training; specifically, an individually designed program of activities/games to improve memory function delivered in the context of a therapy session while addressing all aspects of the individual’s behavioral health. Improvement can be seen following generally six months or greater of treatment. The individualized therapeutic program appears to be effective in enhancing memory function in a clinical outpatient population of varying degrees and type of dementia or cognitive decline. Findings have been documented at this facility shown in abstracts presented at area conferences since 2012.

## Limitations of the Study

This is a clinical study, lacking a control group due to being completed in an outpatient setting. The risk of a practice effect is always present for re-evaluation given the familiarity with the measure although this becomes minimized by time. Six months has been the known general rule for practice effects no longer being considered as a variable which is specifically noted in various test manuals. On the RBANS there was a largely absent

practice effect after one year, mean re-test scores increased by 5 points for the index scores excluding language which was 2 points after 39 weeks. Depending upon the form, there was a

gain of 2 to 4 raw score points for the BVMT-R after 56 days in healthy participants. On the Doors and People Test there was no change in the brain injured group over time. Testing typically was six months or greater.

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