Cognitive Impairment in Multiple Sclerosis: A Pilot Study of the Effects of Cognitive Retraining on Quality of Life and Cognitive Function.

Presenting Author: Meagan Adamson, FNP-BC
Neurology Center of Fairfax

Co-Authors: Joan M. Ohayon, NP-C, Mary Elizabeth Quig, PhD, Tatjana Lyons, BS, CHES, Allison Logemann, MA, James P. Simsarian, MD

Background

• Approximately 45-60% of Multiple Sclerosis (MS) patients are reported to develop some degree of cognitive impairment.

• Cognitive retraining, also referred to as cognitive rehabilitation, is a potential intervention for those who suffer from cognitive impairment.

• There are only a few studies examining the effects of cognitive rehabilitation in MS. Cognitive retraining has been studied in Alzheimer’s Disease, Traumatic Brain Injury, and mild cognitive impairment.

• A review of current research reveals mixed findings on the efficacy of cognitive rehabilitation in MS.

• Some studies suggest that cognitive retraining can be beneficial and improve the quality of life of MS patients.
Reported Benefits of Cognitive Retraining in Normal Aging

• Improves processing speed
• Improves measures of memory and attention
• Improves measures of cognitive function
• Improves performance in measures of functional independence
• Decreases risk of developing depressive symptoms
• Improves feelings of control over one’s life
• Self-reported overall health improvement

Purpose & Objectives

• **Purpose**: To determine the effects of cognitive retraining on quality of life and cognitive function in Relapsing Remitting Multiple Sclerosis patients with mild cognitive impairment.

• **Objectives**:
  – **Primary**: Improvement in quality of life after cognitive retraining.
  – **Secondary**: Improvement in cognitive function after a course of cognitive retraining as measured by short form cognitive testing.

  – The short form cognitive testing has been validated against formal neuropsychological measures (Burchette et al., 2007).
Neurology Center of Fairfax

- The Multiple Sclerosis Center at the Neurology Center of Fairfax provides treatment to over 2,000 Multiple Sclerosis patients
  - 70 patients were recruited as possible study participants
  - 45 patients agreed to pre-screening for mild cognitive impairment
  - 22 patients were eligible based on study criteria
    - 100% of eligible patients agreed to be study participants
    - 18 Women; 4 Men
    - Average Age: 43

Population of Interest

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relapsing MS patients</td>
<td>Progressive MS patients</td>
</tr>
<tr>
<td>Mild cognitive impairment as determined by short form cognitive testing.</td>
<td>&gt; Age 50</td>
</tr>
<tr>
<td>Ages 21-50</td>
<td>Moderate to severe cognitive impairment</td>
</tr>
<tr>
<td>Immunomodulatory therapy for at least one year</td>
<td>Co-existing conditions which may affect cognitive function</td>
</tr>
<tr>
<td>No medication regimens used to treat cognitive symptoms or fatigue</td>
<td>Patients currently on medication regimens to treat cognitive symptoms or fatigue</td>
</tr>
<tr>
<td></td>
<td>Patients currently treated with natalizumab or administered natalizumab in the previous 12 months.</td>
</tr>
<tr>
<td></td>
<td>A documented relapse within the course of the study or within 50 days prior to enrollment.</td>
</tr>
<tr>
<td></td>
<td>Use of corticosteroids 50 days before or during the study</td>
</tr>
<tr>
<td></td>
<td>Change in immodulatory therapy during the study</td>
</tr>
</tbody>
</table>
Methods

• Each participant was tested for mild cognitive impairment using the Neurology Center of Fairfax short form cognitive testing tool.

• Eligible participants were randomly assigned into control and treatment groups. All participants completed the Perceived Deficits Questionnaire (PDQ).

• Participants in the treatment group completed 5 weeks (3 sessions/week; 30 mins each session) of computer-based cognitive retraining with the computer software program BrainHQ.

• Cognitive retraining sessions focused on memory, attention, and information processing.

Description of Assessments

The Perceived Deficits Questionnaire (PDQ)

• A component of the Multiple Sclerosis Quality of Life Inventory (MSQLI).
• Designed specifically for MS to provide a self-report of cognitive impairment.
• A 20-item Likert Scale
• Addresses cognitive measures that effect quality of life: retrospective memory, prospective memory, planning/organization, and attention.

Short form Cognitive Testing (COG1)

• Verbal Category Fluency
• Boston Naming
• Mini-Mental State Examination
• Hopkins Verbal Learning
• Digit Span (Forward, Backward, and Sequential)
• Hopkins Verbal Learning Recall
• Hopkins Verbal Learning Recognition
• Trails A & B
• Beck Depression Inventory.
Cognitive Retraining Intervention

Based on the Science of Brain Plasticity
The ability of the brain to change functionally, physically, and chemically throughout life.

- >20 randomized controlled trials
- >75 peer-reviewed published studies
- >10,000 participants involved in clinical trials
- Published studies in schizophrenia, chemobrain, HIV-associated neurocognitive disorder, mild cognitive impairment, and traumatic brain injury
Study Design & Duration

Study Design
• Pretest/post test experimental design with random assignment of control and treatment groups

Study Duration
• A total of 10 weeks was allowed for pretesting, cognitive retraining (treatment group), post testing, and data collection

Intervention
• The treatment group received 5 Weeks (Three 30 minute sessions/per week) of cognitive retraining.
• The control and treatment groups completed post testing 5-8 weeks after pretesting.

Data Analysis
• Results were obtained from the pretest and post test short form cognitive testing and Perceived Deficits Questionnaire scores.

• Paired t-test statistical analysis was used to evaluate the differences between pretest and post test scores of each group.

• Independent t-test statistical analysis was used to evaluate differences in post test scores between control and treatment groups.
Treatment Group: Quality of Life

- A comparison of pretest and post test results for the treatment group did not identify any statistically significant difference for any of the quality of life measures

Control Group: Quality of Life

- A comparison of pretest and post test results for the control group identified a statistically significant improvement in the attention/concentration quality of life measure, as well as total quality of life score.
Treatment Group: Cognitive Function
• Comparing pre and post test cognitive function scores for the treatment group indicated a statistically significant improvement after treatment.

Control Group: Cognitive Function
• Comparison of pre and post test cognitive function scores in the control group indicated a statistically significant improvement. This may be due to practice effect.
Comparative Quality of Life Scores

- Post test quality of life scores did not yield a statistically significant difference between control and treatment groups.

Comparative Cognitive Function Scores

- Post test cognitive function scores improved in both the control and treatment groups, but did not reach statistical significance.
Discussion Points

• One treatment patient was excluded due to inactivity on the training schedule.

• One control patient was removed due to a clinical relapse.

• Three treatment patients reported an increased perceived deficit in the planning/organization quality of life measure.

• Two treatment patients reported a perceived decline in at least three of the quality of life measures; thus influencing the average total scores.

• One treatment patient’s cognitive function post test scores increased to 4 impaired domains compared to 2 impaired cognitive domains on pretesting.

Discussion Points

• Mood was excluded as a cognitive measure in the determination of mild cognitive impairment
  – Cognitive function pretesting indicated mood was impaired in 3 of 10 control patients.
    • 2 of 3 patients continued to have impaired mood on post test cognitive function scores.
  – Cognitive function pretesting indicated mood was impaired in 3 of 10 treatment patients.
    • 1 of 3 patients continued to have impaired mood on post testing cognitive function scores.
Patient Responses

• Patient 110: “I had so much fun…”

• Patient 105: “I needed to break after 10 minutes…”

• Patient 111: “I enjoyed it, but I couldn’t always understand the computer program…”

• Patient 121: “On the days I was tired, I could tell I didn’t do well…”

Limitations

• Small sample size
  – Inclusion and Exclusion Criteria Limits

• Practice Effect

• Short study Duration

• Methodology (computer-based versus 1:1 training)

• Computer Literacy of patients
Future Research

- More studies directly comparing methods of cognitive retraining.
- Studies accounting for more variables that can contribute to cognitive function and quality of life.
- Longer duration of training periods.
- Larger sample sizes
- Studies addressing the best age and disease duration at which to begin cognitive retraining.
- Studies on whether cognitive retraining can reduce disability.
- Standardized definition of cognitive impairment.
- The need for more standardized cognitive batteries.

References


Acknowledgements

• Patients of the Neurology Center of Fairfax
  • James P. Simsarian, MD
  • Tatjana Lyons, CHES
• Joan M. Ohayon, NP-C
• Neuropsychology Associates of Fairfax
  • Mary Elizabeth Quig, PhD
  • Allison Logemann, MA
• Joanna Luzzi
• Sharaya Testa
### Current Evidence

#### Literature

- **Glanz et al. (2009)**
  - Cross sectional design; 92 patients;
  - Linkage between QOL and information processing after accounting for depression.

- **Baumstarck-Barrau et al. (2011)**
  - Cross sectional design; 124 patients;
  - No links between quality of life measures and cognitive testing.

- **Anhoque et al. (2012)**
  - 18 CIS patients; Correlational study;
  - Cognition, but not disability, anxiety, or depression was associated with reduced QOL.

- **das Nair et al. (2011)**
  - Systemic Review (8 studies, 521 participants);
  - No association between QOL and cognitive retraining.

#### Evidence

- **Stuifbergen et al. (2012)**
  - Single blind RCT; 61 patients;
  - Computer-based and group session;
  - Improvements in verbal memory.

- **Flavia et al. (2010)**
  - Double blind control; 150 patients;
  - Computer-based retraining;
  - Improvements in depression, information processing, and executive function.

- **Edgar et al. (2010)**
  - Longitudinal design; 43 patients;
  - Computer-based retraining;
  - Improvements in attention and information processing.

- **Chiaravalloti et al. (2013)**
  - Double Blind Placebo Controlled; 86 patients;
  - Imagery technique;
  - Improvements in encoding, learning, and memory. Booster sessions little benefit. **CLASS I EVIDENCE**