Optical Coherence Tomography Metrics and Third Ventricular Width are Associated With Cognition in Persons with MS

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Introduction
Cognitive impairment is highly prevalent, disabling, and difficult to treat in persons with MS. Brain atrophy estimated by an increase in third ventricular width (TVW) has been most strongly predictive of cognitive impairment in this population (Benedict et al., 2004). Optical coherence tomography (OCT) is a non-invasive technique which measures retinal nerve fiber layer thickness (RNFLt) and total macular volume (TMV). A decrease in RNFLt and TMV correlates to radiographic markers of brain atrophy (e.g., Saidha et al., 2011). To date, we are unaware of research comparing the relationships among MRI, OCT, and cognition in persons with MS.

Purpose
The primary aim of this investigation was to determine whether OCT variables of RNFLt and TMV are as strongly correlated to cognitive function as TVW in persons with MS.

Participants
The total sample included 29 persons with MS (Table 1).

Measures
Optical Coherence Tomography Measure: Stratus OCT Scanner (Carl Zeiss Meditec Inc, Dublin, California).

Third Ventricular Width: Maximum width of third ventricle on axial T2-weighted brain MRI.

Cognitive Processing Speed: Symbol Digit Modalities Test (SDMT).

Measures (continued)


Table 1: Demographic characteristics of 29 persons with MS

<table>
<thead>
<tr>
<th>Variable</th>
<th>MS (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>49.8 (10.6)</td>
</tr>
<tr>
<td>Sex (0, % female)</td>
<td>21 (72%)</td>
</tr>
<tr>
<td>Education (n, %)</td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>9 (31%)</td>
</tr>
<tr>
<td>Some College</td>
<td>7 (24%)</td>
</tr>
<tr>
<td>College Graduate</td>
<td>13 (45%)</td>
</tr>
<tr>
<td>MS Type (n, % RRMS)</td>
<td>23 (79%)</td>
</tr>
<tr>
<td>MS Duration (years)</td>
<td>7.9 (7.3)</td>
</tr>
<tr>
<td>T25FW (s)</td>
<td>7.1 (4.0)</td>
</tr>
</tbody>
</table>

Note: Data are presented as mean (SD) unless noted otherwise. RRMS=Relapsing-remitting multiple sclerosis; T25FW=Timed 25-foot walk

Results
Parametric correlations indicated that SDMT scores were significantly correlated with RNFLt (r=.55, p<.01), TMV (r=.45, p<.01), and TVW (r=.82, p<.01). The scatter plots for these associations are presented in Figure 2. Partial correlation analyses indicated that cognition was significantly associated with RNFLt (r=.62, p<.01), TMV (r=.39, p=.03), and TVW (r=.41, p=.02), even after controlling for age, education, and 25-foot walk time.

Procedure
Persons with MS undertook the Symbol Digit Modalities Test (SDMT) as a measure of cognitive processing speed followed by completion of the timed 25-foot walk. Each participant also underwent a neurological examination for EDSS scoring, followed by RNFLt and TMV measurement on a Stratus OCT scanner (Zeiss, 2005). TVW was measured using the maximum width of the third ventricle on axial T2-weighted brain MRI (Figure 1).

Data Analysis
The statistical analyses were performed using bivariate and partial correlations in PASW Statistics 18 (SPSS Inc., Chicago, IL).

Conclusions
RNFLt and TMV are both significantly associated with cognitive processing speed, similar to TVW. These associations remained after controlling for age, education, and 25-foot walk time, suggesting that OCT may be another biomarker of cognitive impairment in persons with MS.

Acknowledgments
This study was funded by a grant from the OSF Foundation.

Figure 1: Sample MRI scan measuring 3V (right panel)

Figure 2: Scatter plots of Symbol Digit Modalities Test (SDMT) performance and average RNFLt, TMV, and TVW, respectively, in 29 persons with MS along with lines of best fit and 95% confidence intervals.