

## Retinal nerve fiber layer thickness and neurologic disability in relapsing–remitting multiple sclerosis



Raed Behbehani<sup>a,b,\*</sup>, Abdullah Abu Al-Hassan<sup>a</sup>, Abdullah Al-Khars<sup>a</sup>, Devarajan Sriraman<sup>c</sup>, Raed Alroughani<sup>d,e</sup>

<sup>a</sup> Ophthalmology Clinic, Dasman Institute, Dasman, Kuwait

<sup>b</sup> Al-Bahar Ophthalmology Center, Ibn Sina Hospital, Kuwait

<sup>c</sup> Tissue Bank Core Research Facility, Dasman Institute, Kuwait

<sup>d</sup> Neurology Clinic, Dasman Institute, Dasman, Kuwait

<sup>e</sup> Division of Neurology, Amiri Hospital, Sharq, Kuwait

### ARTICLE INFO

#### Article history:

Received 11 August 2015

Received in revised form 7 October 2015

Accepted 9 November 2015

Available online 10 November 2015

#### Keywords:

Optical coherence tomography

Retinal nerve fiber layer

Multiple sclerosis

Axonal loss

Neurologic disability

### ABSTRACT

**Objective:** To assess the correlation between disability progression assessed by expanded disability status scale (EDSS) and peripapillary retinal nerve fiber layer thickness (RNFLT), macular thickness and macular volume obtained by spectral domain OCT (SDOCT) in patient with relapsing–remitting multiple sclerosis.

**Methods:** We conducted a cross sectional study by recruiting 104 with relapsing–remitting MS patients and 51 healthy controls. Patients' clinical characteristics and neurologic disability was recorded from the subject clinical records. All patients had complete neuro-ophthalmic and neurological assessments. SDOCT performed to obtain peripapillary RNFLT, macular thickness and volume.

**Results:** There was a statistically significant correlation between the mean EDSS scores and the average RNFLT ( $p = 0.006$ ;  $r = -0.268$ ) along with superior ( $p = 0.020$ ;  $r = -0.228$ ), inferior ( $p = 0.007$ ;  $r = -0.262$ ) and temporal ( $p = 0.031$ ;  $r = -0.212$ ) quadrants. However, macular thickness ( $p = 0.205$ ;  $r = -0.125$ ) and volume ( $p = 0.178$ ;  $r = -0.133$ ) were not significantly correlated with EDSS scores.

**Conclusion:** Our study showed a significant correlation between RNFLT and disability progression assessed by mean of EDSS in patients with relapsing–remitting MS. RNFLT can be a useful tool to estimate neurological disability in newly diagnosed patients or patients with early RRMS.

© 2015 Elsevier B.V. All rights reserved.

### 1. Introduction

Multiple sclerosis (MS) is a chronic demyelinating inflammatory disease of the central nervous system (CNS), which affects predominantly patients aged 20–40 years of age. Residual neurological disability may accumulate with time due to axonal damage [1]. Visual pathway involvement is common in MS as 30% of patients may present initially with optic neuritis (ON) and as many as 70% of patients may develop ON throughout their disease course [2]. Optical coherence tomography (OCT) is a non-invasive tool used to measure the retinal nerve fiber layer thickness (RNFLT) in the peripapillary area and the macula, thereby assessing axonal loss and ganglion cell viability [3]. It is known that optic neuritis can cause thinning of the RNFLT. [4] However, thinning of the RNFLT has been demonstrated in patients even without history of optic neuritis. [5,6] Moreover, RNFLT has been shown to correlate with neurological disability measured by means of expanded disability status scale (EDSS), and brain volume loss in Magnetic Resonance Imaging (MRI) [7]. Different conclusions were drawn about the correlation between RNFLT and disability progression due to the heterogeneity

of the MS population across studies and different methodologies used. In this study, we assessed the correlation between RNFLT and EDSS using spectral domain OCT in patients with relapsing–remitting MS (RRMS) with and without history of optic neuritis.

### 2. Materials and methods

This is a cross-sectional study conducted at the MS clinic in Dasman Institute. Patients with RRMS according to the revised 2010 McDonald diagnostic criteria were included if they had a disease duration of less than 10 years [8]. Patients with progressive MS, other demyelinating disorders (neuromyelitis optica or acute disseminated encephalomyelitis), and patients with optic neuritis within the 6 months of assessment were excluded. All patients had complete ophthalmologic assessment including visual acuity, contrast sensitivity, applanation tonometry, pupillary reaction testing and fundus examination. Patients' demographics (age, gender), clinical characteristics (age at disease onset, disease duration, presentation at onset, baseline EDSS score) were extracted from their medical records. Data of OCT results (RNFL thickness, macular thickness and volume) were obtained using spectral domain OCT (SDOCT) (Topcon 3D OCT 2000). The OCT scan was performed by an experienced operator and only measurements of good quality were

\* Corresponding author at: FRCS, P.O Box 1180, Dasman 15462, Kuwait.  
E-mail address: [raed.behbehani@dasmaninstitute.org](mailto:raed.behbehani@dasmaninstitute.org) (R. Behbehani).

considered. This study was approved by the ethical committee of Dasman Institute and all patients provided written informed consents.

### 2.1. Statistical analysis

Statistical analysis was performed using the IBM SPSS for windows version (23.0; IBM SPSS Inc., Chicago, IL, USA). The results were defined as mean  $\pm$  standard deviation (Mean  $\pm$  SD), frequency and percentage. Data were analyzed using independent student t-test (for quantitative variables) and chi-square and Fisher's exact test (for categorical variables). The Pearson correlation was applied for the assessment of the association between OCT measurements (average peripapillary RNFLT and individual four quadrants, macular thickness and macular volume) and mean EDSS and the history of ON. Coefficient of variation (COV) was calculated using standard deviation divided by the mean thickness expressed as a percentage. A P-value  $< 0.05$  was considered significant.

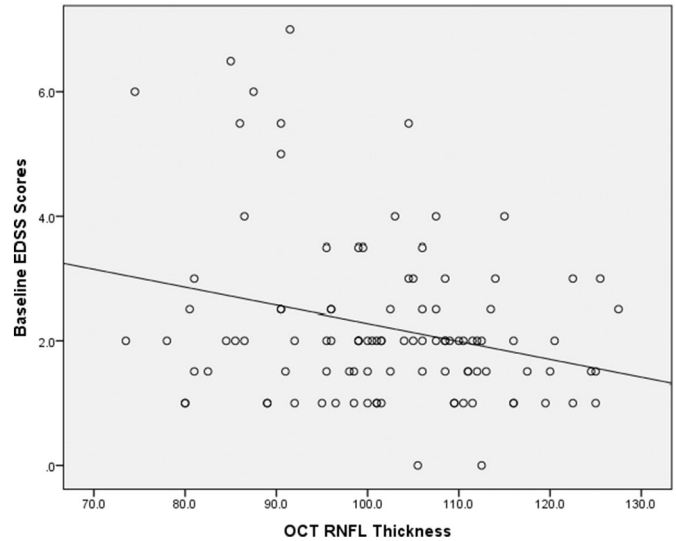
### 3. Results

In the current study, 104 MS patients and 51 healthy controls were included in the analysis; of whom 99 (63.9%) were females. The demographics of MS patients and control group are outlined in Table 1. Of the 104 MS patients, 32 (31%) presented with ON at onset. The mean disease duration and EDSS score of the studied cohort were  $36.45 \pm 9.32$  months and  $2.21 \pm 1.34$  (range 0–6) respectively. There was a statistical significant reduction in the RNFLT ( $p < 0.001$ ), macular thickness ( $p < 0.001$ ), and macular volume ( $p < 0.001$ ) in MS group compared to controls [Table 1]. The mean EDSS was significantly correlated with the average RNFLT ( $p = 0.006$ ;  $r = -0.268$ ) along with superior ( $p = 0.020$ ;  $r = -0.228$ ), inferior ( $p = 0.007$ ;  $r = -0.262$ ) and temporal ( $p = 0.031$ ;  $r = -0.212$ ) quadrants as shown in Fig. 1 [Table 2]. However, macular thickness ( $p = 0.205$ ;  $r = -0.125$ ) and volume ( $p = 0.178$ ;  $r = -0.133$ ) failed to show any significant correlation with EDSS. Furthermore, when MS patients were categorized into those with history and those without history of ON, there was significant correlation between EDSS and average RNFLT ( $p = 0.011$ ;  $r = -0.300$ ), superior ( $p = 0.031$ ;  $r = -0.256$ ), inferior ( $p = 0.030$ ;  $r = -0.257$ ) and temporal ( $p = 0.037$ ;  $r = -0.247$ ) quadrants in patients without history of ON [Fig. 2 and Table 3]. This correlation was not statistically significant ( $p = 0.180$ ;  $r = -0.239$ ), however, in MS patients with history of ON [Table 3]. The coefficient of variation (COV) using the baseline scores are presented in Table 4. The overall RNFL had the lowest COV and the temporal quadrant had the highest COV in both MS patients and control groups.

**Table 1**  
Comparison of demographic and OCT variables between MS patients and healthy controls.

Characteristics	MS patients N = 104	Healthy controls N = 51	P value
Gender			
Male	38 (36.5%)	18 (35.3%)	0.880
Female	66 (63.5%)	33 (64.7%)	
Mean age (in years)	$29.88 \pm 8.71$	$29.77 \pm 6.43$	0.924
Symptoms at presentation: n (%)			
Optic neuritis	32 (30.7%)		
Supratentorial	27 (26.0%)		
Brainstem–cerebellar	21 (20.2%)		
Spinal	24 (23.1%)		
History of optic neuritis relapses post initial presentation (>6 months)			
Yes	06 (5.8%)		
No	98 (94.2%)		
Mean EDSS score	$2.21 \pm 1.34$	–	
Mean OCT RNFL ( $\mu\text{m}$ )	$101.99 \pm 12.4$	$111.26 \pm 8.73$	$<0.001$
Mean OCT macula Thickness ( $\mu\text{m}$ )	$257.14 \pm 17.29$	$269.81 \pm 12.34$	$<0.001$
Mean OCT macula Volume ( $\mu\text{m}$ )	$7.28 \pm 0.50$	$7.62 \pm 0.35$	$<0.001$

EDSS: expanded disability status scale; RNFL: retinal nerve fiber layer; OCT: optical coherence tomography.



**Fig. 1.** OCT RNFLT ( $\mu\text{m}$ ) showed decreasing trend with EDSS score ( $p = 0.006$ ;  $r = -0.268$ ) in the overall studied MS cohort. OCT: optical coherence tomography, RNFL: Retinal nerve fiber layer.

### 4. Discussion

Our findings showed a correlation between RNFLT and disability progression assessed by mean of EDSS in RRMS patients ( $p = 0.011$ ;  $r = -0.300$ ), whereas macular thickness ( $p = 0.476$ ;  $r = -0.086$ ) and volume ( $p = 0.424$ ;  $r = -0.096$ ) did not show such significant correlation. This correlation was still present even in cases with no prior history of ON (Table 3). We have chosen the cutoff of 10 years disease duration to primarily focus on early MS patients with mild disability. It is known that EDSS is heavily biased towards gait and ambulation and does not accurately assess other functional domains such as visual pathway function. Few studies investigated the correlation between RNFLT with disease duration and neurological disability [5,7,9–12]. The findings were inconclusive across studies due to variable inclusion criteria used, different OCT machine specifications, the proportion of patients with optic neuritis in each study and the variable range of disability progression (EDSS). Many of these studies were done in the era of time-domain OCT (TDOCT), which has lower spatial resolution than SDOCT and thus is likely to be less accurate in measuring RNFL [3,5,7,13]. Some studies did find a correlation between RNFLT and EDSS, progressive course and longer disease duration [5,10,14]. Abalo-Lojo et al. showed a significant correlation between RNFL using spectral domain OCT and EDSS ( $r = -0.43$ ;  $p = <0.003$ ) in 68 RRMS patients [14]. Toledo et al. found correlation between both physical and cognitive disability with the temporal quadrant of RNFL being most strongly associated with physical disability among patients with different MS phenotypes [5]. Although there was no significant

**Table 2**  
Correlation of OCT variables in MS patients with mean EDSS ( $n = 104$ ).

OCT variables	Mean EDSS score	
	Pearson correlation coefficient	P value
OCT RNFL ( $\mu\text{m}$ )	–0.268	0.006
OCT macula thickness ( $\mu\text{m}$ )	–0.125	0.205
OCT macula volume ( $\mu\text{m}$ )	–0.133	0.178
OCT superior ( $\mu\text{m}$ )	–0.228	0.020
OCT inferior ( $\mu\text{m}$ )	–0.262	0.007
OCT temporal ( $\mu\text{m}$ )	–0.212	0.031
OCT nasal ( $\mu\text{m}$ )	–0.164	0.095

OCT: optical coherence tomography, EDSS: expanded disability status scale.

Download English Version:

<https://daneshyari.com/en/article/8275558>

Download Persian Version:

<https://daneshyari.com/article/8275558>

[Daneshyari.com](https://daneshyari.com)