SD-OCT Imaging of the Retina in Primary Progressive Multiple Sclerosis

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INTRODUCTION

Multiple Sclerosis (MS) is an autoimmune disease that affects the central nervous system and is characterized by altered permeability of the blood-brain barrier resulting in lesions and neurodegeneration. Primary Progressive Multiple Sclerosis (PPMS) is a type of MS that is characterized by steady worsening of neurologic function without any distinct relapses or periods of remission. Optical coherence tomography (OCT) can be used to assess retinal degeneration in MS. It can provide values that represent the retinal nerve fiber layer (RNFL) and the macular volume. Some of the literature suggests that PPMS may actually have a distinct pathophysiology different than the typical Relapsing Remitting Multiple Sclerosis (RRMS) and may represent a primary neurodegenerative disorder. OCT can be used to study the layers of the retina and may give clues as to the mechanism of this disease.

PURPOSE

To evaluate the feasibility of using spectral domain OCT (SD-OCT) to evaluate the different retinal layer thicknesses and macular volume measurements in patients with PPMS compared to those with RRMS and normal controls.

METHODS

Subjects: A group of ten patients diagnosed with Primary Progressive Multiple Sclerosis were scanned and compared to age matched patients with Relapsing Remitting Multiple Sclerosis and normal healthy controls.

OCT imaging: RNFL and total macular volume scans were obtained using a spectral-domain OCT (Heidelberg Spectralis SD-OCT, Heidelberg Engineering, Germany) for each eye of the patients. All scans were acquired by experienced operators and were reviewed for sufficient signal strength, correct centering and segmentation. Together the Ganglion Cell and Inner Plexiform layers, and the Inner Nuclear Layer were manually segmented on the RNFL scans for all of the patients.

Figure A:
OCT analysis of the RNFL thickness circumferentially in a normal, RRMS, and PPMS patient.

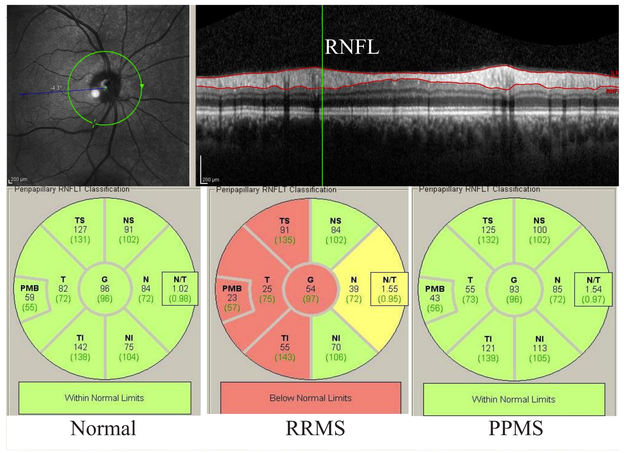


Figure B:
OCT analysis of the segmented GCL + IPL thickness circumferentially in a normal, RRMS, and PPMS patient

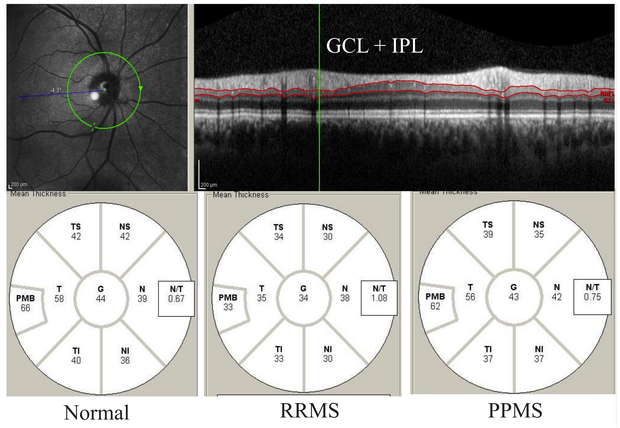


Figure C:
OCT analysis of the segmented INL thickness circumferentially in a normal, RRMS, and PPMS patient.

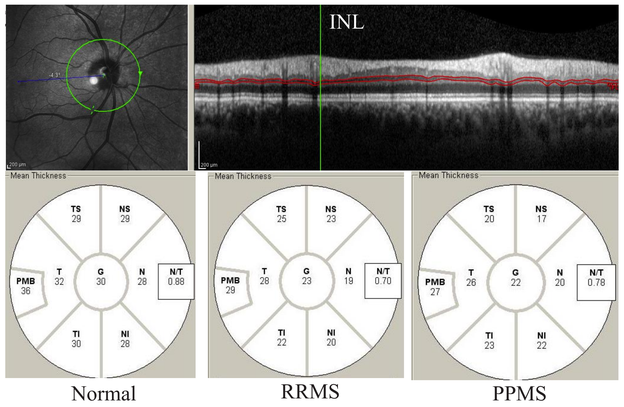


Figure D:
Macular thickness and volume of a normal control patient.

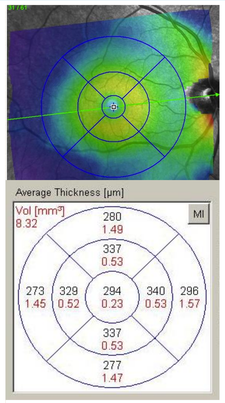


Figure E:
Macular thickness and volume of a RRMS patient.

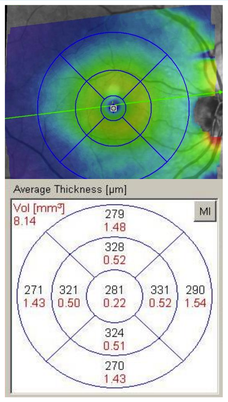
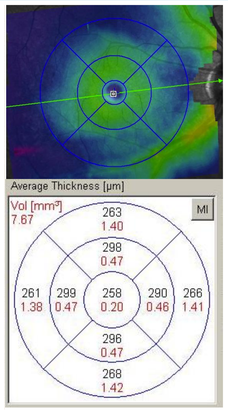


Figure F:
Macular thickness and volume of a PPMS patient.



RESULTS

Segmentation of the Ganglion Cell Layer (GCL) and Inner Plexiform Layer (IPL) in patients with PPMS showed that the Papillomacular bundle (PMB) thickness was consistently higher than patients with RRMS. Similar findings were also noted in the temporal segment of PPMS patients. However, these changes were not seen in other segments of PPMS patients (temporal superior, temporal inferior, nasal, nasal superior, nasal inferior) compared to RRMS patients and controls. Segmentation of the Inner Nuclear Layer (INL) in PPMS patients in our study did not confirm the findings stated previously using similar technology (Heidelberg Spectralis SD-OCT), which found a reduction in the INL thickness in PPMS patients compared to RRMS patients and controls. 1 It was also noted that the macular volume and thickness was decreased in patients with PPMS compared to those with RRMS and controls.

CONCLUSIONS

It is possible to obtain high quality manually segmented SD-OCT images of the GCL, IPL, and INL in patients with PPMS. Further studies are needed using SD-OCT in a larger group of patients with PPMS to determine the mechanism as to why the thickness of the PMB and temporal segments of the GCL and IPL are preserved compared to patients with RRMS.

REFERENCES

1. Albrecht P et al, Degeneration of retinal layers in multiple sclerosis subtypes quantified by optical coherence tomography. Mult Scler. 2012 Oct;18(10):1422-9. Epub 2012 Mar 2. PubMed PMID: 22389411

CONTACT INFORMATION

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