Journal Article Review

Glaucoma Diagnostic Capability of Circumpapillary Retinal Nerve Fiber Layer Thickness in Circle Scans With Different Diameters

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Background and Purpose

Circumpapillary retinal nerve fiber layer (RNFL) thickness is a common OCT parameter used in the diagnosis and monitoring of glaucoma. In an early time-domain optical coherence tomography (TD-OCT) study, a circular OCT scan with a diameter of 3.4 mm was found to provide the most reproducible RNFL thickness measurements compared to circular scans with diameters of 2.9 and 4.5 mm[1]. Based on these results, most OCT instruments use a circular scan of ~3.4 mm to measure circumpapillary RNFL thickness.[2] However, the diagnostic accuracy of circumpapillary RNFL thickness measurements using OCT circle scans of varying diameters has not been demonstrated. This study investigated the diagnostic capabilities of the SPECTRALIS® SD-OCT Glaucoma Module Premium Edition (GMPE) circumpapillary OCT scans with diameters of 3.5, 4.1, and 4.7 mm.

Methods

A total of 68 healthy and 95 glaucoma patients were included in the study. Each patient was scanned using the SPECTRALIS SD-OCT GMPE, which provided RNFL thickness measurements based on three circumpapillary RNFL scans (3.5, 4.1, and 4.7 mm) placed on the center of Bruch's Membrane Opening (BMO). The ability of global and sectoral RNFL thickness measurements to discriminate between healthy and glaucomatous eyes was assessed for all three circle scans using areas under receiver operating characteristic curve (AUCs).

Discussion

While the global and sectoral RNFL thickness measurements performed well in discriminating healthy from glaucoma eyes (AUC range, 0.774 to 0.983) for all three circle scan diameters, the temporal inferior RNFL thickness results of the 4.1-mm scan had the highest AUC. Furthermore, the 4.1-mm and 4.7-mm circle scan results showed diagnostically accurate results for two eyes that presented with parapapillary atrophy (PPA), while the 3.5-mm circle scan results were confounded due to a segmentation error prompted by the PPA.

Conclusions

While a ~3.4-mm circumpapillary RNFL scan has become the standard diameter for measuring RNFL thickness on many OCT devices, this study demonstrates the potential diagnostic value of concentric scans with larger diameters. Due to considerable anatomical and vascular variation in eyes, larger diameter circle scans "…sample RNFL areas that are less affected by blood vessel variation and irregularity because large blood vessels branch into more evenly distributed smaller vessels further from the optic disc." The SPECTRALIS GMPE offers RNFL thickness measurements using three concentric scans of varying diameters, including the conventional 3.5-mm scan. The results of this study indicate that RNFL thickness measurements from a circle scan of 4.1 mm rather than the conventional 3.5-mm circle scan may be better at discriminating between healthy and glaucomatous eyes. In addition, the authors illustrate that larger RNFL circle scans may avoid areas of parapapillary atrophy, which can typically lead to segmentation errors and subsequently confounded results.

[1]Schuman JS, Pedut-Kloizman T, Hertzmark E, et al. Reproducibility of nerve fiber layer thickness measurements using optical coherence tomography. Ophthalmology. 1996; 103:1889–1898. [2]Giani A, Cigada M, Choudhry N, et al. Reproducibility of retinal thickness measurements on normal and pathologic eyes by different optical coherence tomography instruments. Am J Ophthalmol. 2010; 150:815–824.

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