Recent Study Addresses the Value of Assessing Ganglion Cell Loss by Fourier-Domain OCT

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Detection of Macular Ganglion Cell Loss in Glaucoma by Fourier-Domain Optical Coherence Tomography

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(Ophthalmology 2009;116:2305–2314 © 2009 by the American Academy of Ophthalmology.)

It has long been recognized that structural loss in glaucoma is characterized by loss of ganglion cells and their corresponding axons. To this point in time, the standard methods of assessment for glaucoma have included observation of the optic nerve head, visualization of retinal nerve fiber layer dropout, visual field testing and various forms of imaging the retinal nerve fiber layer exiting the optic nerve head. Prior to FD-OCT with RTVue®, the measurement of the Ganglion Cell Complex had not been clinically available. RTVue brought both speed and higher resolution to achieve accurate and repeatable imaging of the GCC™. It has been postulated in the literature that evaluation of the ganglion cell complex in the patient with glaucoma would add significant information regarding both diagnosis and management.

This study assessed the mapping of the ganglion cell complex thickness with Fourier domain OCT (The RTVue FD-OCT system) and computation of macular parameters for diagnosis. Participants were from within the longitudinal Advanced Imaging for Glaucoma Study (AIGS) and three groupings of patients were categorized based on visual field, optic nerve head appearance (related to rim thinning, vertical CD and disc hemorrhage), central corneal thickness, and anterior chamber evaluation. These groups were considered: 1) Normal (65), 2) Pre-perimetric glaucoma (52), and 3) Perimetric glaucoma (78). The authors designed a scan for the RTVue FD-OCT to provide 3-dimensional assessment of the macular region with 14,928 a-scans over a 7 mm square performed in 0.6 seconds. The scan pattern consisted of 1 horizontal line and 15 vertical lines at 0.5 mm intervals with the center of the scan shifted 0.75 mm temporal to the macula to improve sampling of the temporal periphery. The GCC thickness was measured from the Internal Limiting Membrane to the outer –inner plexiform layer boundary. Scans were also performed using Stratus Time Domain OCT.

Within the framework of the analysis a number of parameters were assessed including: 1) overall average thickness (GCC-AVG), 2) the difference between superior and inferior hemispheric averages (GCC-SID), 3) a fractional deviation (FD) map, 4) a pattern deviation (PD) map, 5) the focal loss volume (FLV) and 6) the global loss volume (GLV).

The results of the study indicated that Macular Retinal thickness by either FD-OCT or Stratus TD-OCT was less accurate at glaucoma detection than Stratus TD-OCT NFL thickness. Additionally, the GCC average measured by the RTVue FD-OCT was significantly better at diagnosing glaucoma in the perimetric (statistically significant) and pre-perimetric (not statistically significant) glaucoma group compared to both FD OCT and TD OCT macular retinal thickness. Of interest is the fact that the authors found that ***"FLV and GLV had higher diagnostic accuracy than the simple average for the diagnosis of PG (perimetric glaucoma)."*** They also found that ***"An advantage of the GCC map is that it could be correlated with the VF (visual field) defects point by point. When they (VF and GCC) correspond, one may be more confident that the defects are real rather than artifacts."***

The authors state that ***"In summary, we found that GCC measurements with FD-OCT have better diagnostic accuracy and repeatability compared with MR measurements by either TD-OCT or FD-OCT. Analysis of GCC loss pattern further boosted diagnostic accuracy. Independent investigations are needed to validate the findings of this pilot study."***

In this report the authors establish one more piece of the puzzle to assist the health care practitioner in the differential diagnosis and management of the patient with glaucoma. However, the doctor must consider correlation of GCC results with other patient characteristics and other clinical tests such as but not limited to: age, gender, ethnicity, refractive status, family history, associated medical conditions, current medications, pachymetry, visual field testing, and angle assessment. With that caveat recognized, the authors concluded from their work that ***"The higher speed and resolution of FD-OCT improved the repeatability of macular imaging compared with standard TD-OCT. Ganglion cell mapping and pattern analysis improved diagnostic power. The improved diagnostic power of macular GCC imaging is on par with, and complementary to, peripapillary NFL imaging. Macular imaging with FD-OCT is a useful method for glaucoma diagnosis and has potential for tracking glaucoma progression."***

RTVue FD-OCT from Optovue offers the clinician the advantage of GCC evaluation to add to the diagnostic and management armamentarium for the glaucoma patient.