Role of Ganglion Cell Complex (GCC) in Evaluation of Glaucoma

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• Retinal ganglion cells encompass three layers in the retina:
  - The retinal nerve fiber layer (NFL)
    - Made up of the ganglion cell axons,
  - The ganglion cell layer (GCL)
    - Made up of the ganglion cell bodies,
  - The inner-plexiform layer (IPL)
    - Made up of a network of axons and dendrites from ganglion cells, bipolar cells, and amacrine cells

All three layers, collectively known as the ganglion cell complex (GCC)
• Loss of the retinal ganglion cells and their axons is known to occur in the posterior pole, where these cells may constitute 30% to 35% of the retinal thickness in the macular region

Zeimer et al., 1998

• Approximately 50% of retinal ganglion cells are located in the macular region 4 to 5 mm from the center of the fovea with the peak density occurring 750 to 1100 µm from the foveal center where the cell density may be 4 to 6 cell bodies thick

Wässle H et al., 1989
Curcio CA et al., 1990
Area of Concern ..........

OCT and GCC
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- Focal Loss Volume % 
  - Localized field defects

- Global Loss Volume % 
  - Generalized Retinal Sensitivity
Maps obtained

The Deviation Map

- Shows the percent loss from normal as determined by the normative database
- Map is calculated by taking the actual value from a scan at each pixel location in the map, subtracting the normal value, and then dividing that by the normal value
- The result is a percent loss value at each pixel location in the map
- The map is color coded where blue represents GCC thinning from 20-30% relative to normal. Black coloring in the Deviation Map represent a 50% loss or greater, relative to an age-matched normal

Normal GCC Parameters

- The thickness map is color coded where thicker regions are displayed in hot colors (yellow & orange), and thinner areas are displayed in cooler colors (blue & green)
- The GCC map for a normal eye shows a bright circular band surrounding the macula representing a thick GCC from healthy ganglion cells
Relation between GCC thickness and RNFL thickness

Severe GCC damage
Severe GCC damage
Verification of Structural Damage of GCC
24-2 Threshold Field Print-out

- 10-2 strategy (usually used for evaluation of macular diseases e.g. drug toxicity, AMD):
  - Maximizes detection of defects centrally & provides the ability to follow disease progression through increasing the number of points tested
Normal macular structural and Functional Findings

Mild-Moderate macular structural and Functional Damage
Follow-up of GCC parameters

Follow-up of GCC parameters
Follow-up of GCC parameters

Take-Home Message
• Ganglion Cell Complex status should be considered on evaluation of glaucoma patients
  ▫ It would also explain the common complaint of the patient of un-satisfaction with the quality of BSCVA

• A significant correlation exists between GCC affection and RNFL findings

• The significant correlation between macular field affection and macular GCC thickness should drive the ophthalmologists’ attention to the hazards of neglecting macular affection in glaucoma patients
  Residual tubular field