Optical coherence tomography (OCT) in the inner retinal layers is a new and very interesting tool for glaucoma diagnosis and follow-up. New spectral domain-OCT with layer segmentation analysis is able to measure thickness from the 3 layers containing parts of the retinal ganglion cells. Dendrites from the retinal ganglion cells form the inner plexiform layer, cellular bodies form the ganglion cell layer and axons form the nerve fiber layer. Glaucomatous apoptosis of ganglion cells causes thinning of the inner layers. Numerous OCT devices produce macular maps of thickness for these layers, with a reference to a normative database. Nevertheless, the thickness difference between normal and glaucomatous patients is small and OCT must be realized and analyzed very carefully to avoid false results due to artifacts or poor quality scanning. Macular inner layers mapping is a very promising tool for glaucoma, complementary with peripapillary retinal nerve fiber layer and optic nerve head analysis.

Glaucoma diagnosis at the beginning of treatment, and during follow-up, to determine disease progression is often a difficult challenge.

Clinical optic disc examination proves the existence of physiological excavations in normal patients as well as in glaucoma patients with small discs without excavation. Even experienced clinicians find it difficult to affirm progression on successive disc examinations.

Defects on the visual field are delayed compared with structural changes. At long-term follow-up, fluctuations are found that could be confused with disease progression.

Glaucomatous neuropathy causes insidious apoptosis of the retinal ganglion cells (RGC). This is followed by progressive thinning of the inner retinal layers. Different parts of the RGC create 3 different inner retinal layers: dendrites from the RGC form the inner plexiform layer (IPL), cellular bodies form the ganglion cell layer (GCL) and axons form the nerve fiber layer (NFL).
In the macular area, precise and reproducible measurements from tissular structural changes on the RGC could bring substantive input for the diagnosis and follow-up of glaucoma.

We here describe the new possibilities offered by spectral domain-optical coherence tomography (OCT) for this macular analysis (OCT also provides a very contributive analysis of the peripapillary retinal nerve fiber layer (RNFL) and direct optic disc excavation measurements, but this is not described here).

**Structural Changes Are Earlier than Visual Field Losses**

Histopathologic studies showed long ago that structural damage occurs earlier than functional loss. Visual field peripheral defect occurs after 30–35% RGC losses and visual field central defect occurs in 50% of RGC losses. RNFL losses occur in 60% of patients with ocular hypertension, i.e. 6 years’ visual field loss [1] (fig. 1).

**OCT Macular Analysis and Glaucoma**

In 2004, a study compared full macular thickness and peripapillary RNFL measurements with time domain-OCT, for glaucoma diagnosis [2]. It found macular thinning in glaucomatous patients, but full macular thickness appears less sensitive than RNFL for glaucoma detection.

With spectral domain-OCT, higher resolution and powerful software, segmentation of the retinal layers and separate thickness analysis of each layer throughout the macular area has become possible. Results are compared with a normative database with healthy subjects of the same ages.

The macular ganglion cell complex (GCC) is defined as the three innermost retinal layers: it represents 30% of the full retinal thickness. The NFL is composed of RGC axons, the bodies form the GCL, and RGC dendrites form the IPL (fig. 2).

The GCC only is damaged in glaucoma (photoreceptors do not seem to be lost in glaucoma).
With thickness measurements, the machine’s software built macular maps of the GCC, as reported to a normative database. Normative databases are segmented according to age categories.

**Optical Coherence Tomography Devices**

Many companies have built and sell more and more advanced OCT devices. Here are the characteristics of some models.

**Optovue® RT Vue**

This was the first OCT device used to measure the GCC. The acquisition protocol was named the MM7 protocol. It acquired 7-mm long scans, 1 horizontal scan and 15 vertical scans spaced 0.5 mm apart (fig. 3). The acquisition area is shifted by 1 mm on the temporal side of the fovea.

After scan acquisition, the RT Vue computes 3 GCC macular maps: a thickness map where blue-colored areas indicate a 20–30% GCC loss and black areas indicate a 50% loss, a deviation map where percentage of thickness loss is reported to the normative database, and a significance map with three colors: red for statistically significant deviation p < 1%, yellow for p < 5% and green for normal values for age category (fig. 4).

Analysis software also calculates two very interesting indexes: FLV (focal loss volume in %) is significant volume losses reported to the macular area, and GLV (global loss volume in %) is total volume of significant GCC loss.

**Nidek® OCT**

The Nidek OCT has the largest macular acquisition area. Scan acquisitions take a macular cube 9 × 9 mm.

Then, scan analysis is done on 6 or 9 mm with 128 B scans (512 A scans) and delivers 3 maps: a thickness map, a deviation map, and a thickness compared to normative database map.
The G Chart grid cuts the macular area into 8 regions. One grid shows the mean thickness values in the 8 regions and the other shows the hemisuperior and hemiinferior thicknesses [3] (fig. 5).

**Topcon® 3D OCT 2000**
Scan acquisition takes a macular cube 7 × 7 mm in size (512 × 128 scans).

Data analyses produce a report with a thickness map, a significance map and an asymmetry superior-inferior map. It is possible to choose to analyze the thickness of one or of contiguous retinal layers. The report also gives the values of the average, superior and inferior thicknesses. The Topcon is the only device to acquire a color fundus photograph at the same time [4] (fig. 6).