RNFL and GLAUCOMA

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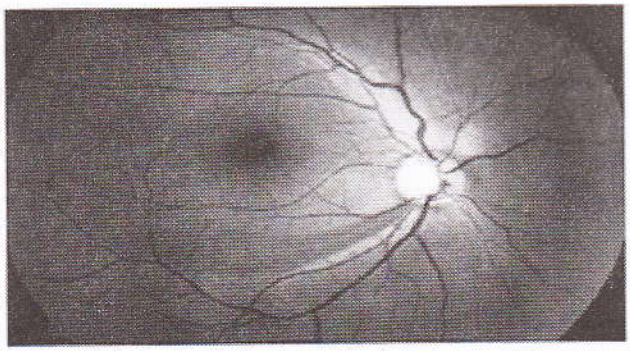
The retinal nerve fiber layer is formed by about 1.2 million ganglion cell axons. The axons of the ganglion cells nasal to the optic disc run directly toward the optic disc, similarly to the axons originated in the macular area that form the papillomacular bundle. The axons coming from ganglion cells situated in the temporal fundus describe an arc around the fovea and run toward the superior or inferior poles of the optic disc.

The nerve fiber layer is thickest at the vertical optic disc poles and thinner at the temporal and nasal optic disc borders.

This pattern can be observed in black and white, red-free, wide-angle fundus photographs, which show the nerve fiber bundles as bright striations in the retinal reflex.



Nerve fiber layer defects: Black-and-white nerve fiber layer photograph showing a typical defect in the inferior bundle compatible with glaucomatous optic nerve damage.

In 1987, Hoyt and Newman first described retinal nerve fiber layer (RNFL) defects as an early sign of glaucoma. Subsequently, several studies confirmed the importance of RNFL assessment in the diagnosis and management of glaucoma.

Sommer and colleagues have shown that RNFL abnormalities are one of the firstclinically detectable changes in patients with glaucoma, and may precede visual field damage by up to 5 years.[1]

Histological studies support these findings and suggest that a 40% loss of nerve fibers is possible in the presence of a normal visual field examination.

RNFL defects may be localized (wedge and slit defects), or diffuse.

Localised defects are visualized as dark areas without striations,by contrast to the adjacent normal RNFL.

Although localized defects are easier todetect, diffuse RNFL loss is more common and more difficult to diagnose. It is characterized by the visualization of second order retinal vessels, which are normally invisible and hidden by the RNFL.

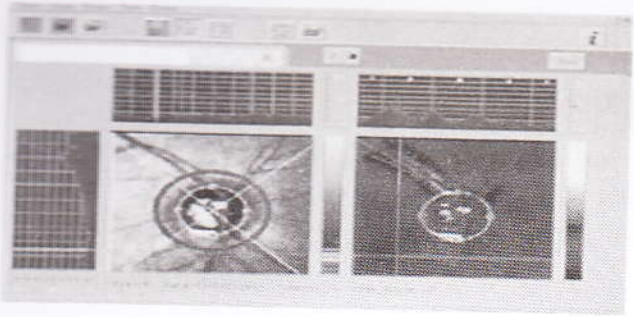
As the glaucomatous damage increases, there is a progressive loss of the RNFL in both the superior andinferior poles, but the RNFL in the papillomacular bundle remains intact.[2]

In end-stage glaucoma, nostriations are found, and a diffuse RNFL loss is observed.

Examination of RNFL

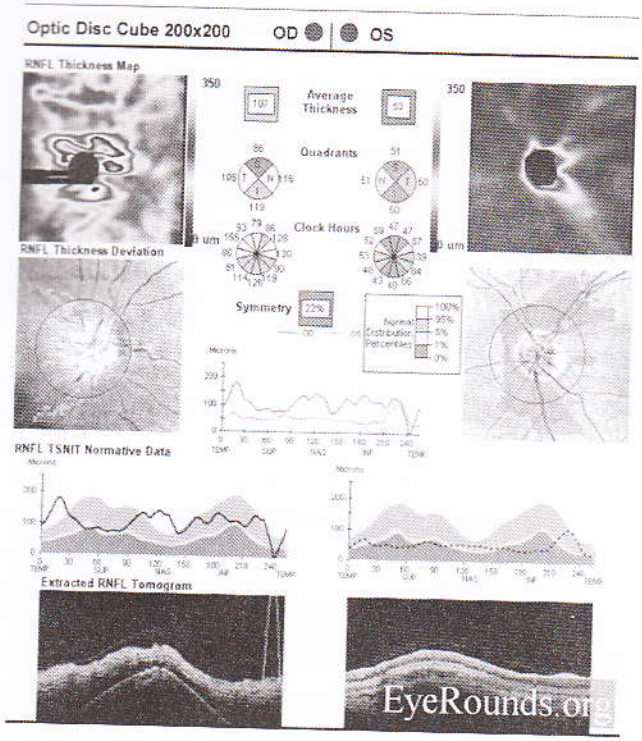
- The RNFL may be examined through a dilated pupil, with a red - free light and a directophthalmoscope. However, a better view can be obtained with a 78D or 90D lens or a contact lens at the slit lamp with a green filter.

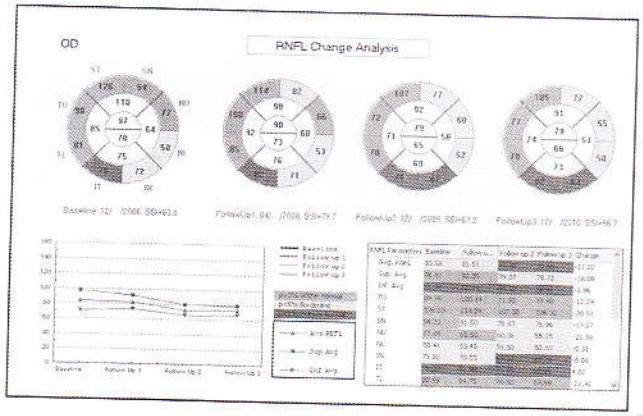
- Scanning Laser Polarimetry (GDx, Laser Diagnostic Technologies, San Diego, USA) measures the RNFL thickness.[3] It is based on the birefringent properties of the RNFL, which has its neurotubules disposed in an organized, parallel fashion.



Scanning laser polarimetry (GDx, Laser Diagnostic Technologies, San Diego, USA). Redsignals show areas with greater retardation and nerve fiber layer thickness.

The RNFL thickness can also be assessed through Optical Coherence Tomography (OCT), an optical analog of B-scan ultrasound that can create high-resolution cross- sectional images of the RNFL.[4]





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Irrespective of the instrument, it is important to emphasize that, although these technologies seem promising, optic disc topography and RNFL thickness among the general population are highlyvariable, which limits their use in the detection of early glaucoma.

At present, they cannot replace anexperienced examiner. Longitudinal studies are being done to determine the ability of these systems to detect changes in the optic disc or RNFL, indicating what can be considered a true sign of progressionin glaucomatous patients. The increasing use of image analysers in research and office settings, and the introduction of modifications specifically designed to neutralize their limitations, will increase theirrole in clinical practice.

References

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