Not long ago, eye care providers used retinal photography and visual fields to document glaucomatous damage. Although perimetry is still the primary test used to establish functional status, many clinicians rely on optical coherence tomography (OCT) exclusively for their structural assessment. Meanwhile, studies looking at workload have shown how infrequently photography is being performed.

That change in practice patterns presents problems.

**THE BENEFITS OF PHOTOGRAPHY**

Although OCT provides useful information for recognizing glaucomatous damage, retinal photography offers information that may not be found on an OCT printout. For example, color is not easily identified on an OCT scan, and signs such as disc hemorrhage will not be apparent. Retinal nerve fiber layer dropout is often easily observed with photography, but it may not be recognized on OCT unless the damage has reached a significant stage. Photography also offers the advantage of constancy: it has been around for years, and unlike with OCT systems, the "data" will not become obsolete if a doctor switches to a different manufacturer.

**A NEW DEVICE**

A new device incorporates confocal scanning laser ophthalmoscopy (photography) with a threshold perimeter. The Compass Automated Fundus Perimeter (CenterVue) uses a white light-emitting diode that obtains true color photographs (as compared to pseudo-color images). The device takes an infrared picture at the onset, with the blind spot marked by the technician. A 24-2 (or 10-2) template is then placed onto the fundus, allowing the technician to observe the test locations. An eye-tracking device (similar to a microperimeter) ensures that the target is presented at the proper position, with corrections made automatically as needed. In addition, the target is focused directly onto the retina, reducing the need for trial lenses.

The Compass integrates photographic assessment with visual field analysis, which requires a qualitative view. The clinician needs to observe where structural damage occurs and check for the spatial correlation with perimetry. The device incorporates both structural and functional assessment in one test, as opposed to having to do visual fields and photographs at separate times.

**CASE EXAMPLES**

No. 1

A 77-year-old African American man has bilateral primary open-angle glaucoma, more significant in the left eye. The Compass printout for the right eye (left side of Figure 1) shows both the retinal photographs and the visual field. The top of the printout shows the reliability indices, which are of excellent quality (0 losses on either false-negative or false-positive trials). The wide-angle photograph is visible at the bottom of the page, and a magnified view of the optic nerve appears in the top right corner. For the right eye, the mean deviation (MD) of -0.8 dB and the pattern standard deviation of 2.32 dB are listed at the top of the page, with the wide-angle infrared image overlaid with perimetry data.

The data are color-coded for probability values (green, orange, red) and are positioned as they would be placed onto the retina. This is opposite of how the field will appear. Only two points in this eye are flagged at a borderline level, and the foveal score is 37 dB. The grayscale is clean, as are the total and pattern deviation plots. At bottom left of the printout is the fixation performance.

**AT A GLANCE**

- Many clinicians use optical coherence tomography (OCT) exclusively for their structural assessment. Retinal photography is performed infrequently.
- Although OCT provides useful information for recognizing glaucomatous damage, retinal photography offers information that may not be found on the OCT printout.
- The Compass Automated Fundus Perimeter incorporates both structural and functional assessment in one test: confocal scanning laser ophthalmoscopy (photography) with a threshold perimeter.
Compass perimeter uses real-time retinal tracking to place the image at the correct retinal position. This patient’s performance is excellent, as evident from the tracking performance indices. He has a full visual field and a suspicious optic nerve with an enlarged cup-to-disc ratio and thin neuroretinal rim.

The 24-2 test pattern is also used for the left eye, along with the Zest algorithm. The MD is -11.87 dB, and the pattern standard deviation is 14.51 dB, indicating a significantly damaged visual field. The retinal photograph shows an enlarged vertical cup shape, with cupping extending to the rim inferiorly. There is a larger amount of parapapillary atrophy in the patient’s left versus right eye. The infrared image shows...
extensive visual field damage inferiorly, correlating to the inferior rim loss. The inferior points are reduced, many to 0 dB. The cluster MD analysis on the right side of the page shows the asymmetry between the top and inferior portions of the field. The grayscale shows a superior arcuate scotoma that is also evident on the deviation plots. The tracking performance for the left eye is good, but eye movement is seen midway through the test.

Using photographs integrated with visual fields can improve the eye care provider’s ability to diagnose glaucomatous damage. In this case, the asymmetric appearance makes clinical sense when one looks at the photographs and fields in one view.

No. 2

There is great value in examining fundus perimetry. Direct and localized correlation of the field defect with the fundus image provides important details for long-term evaluation.

A 56-year-old white man is referred for possible glaucoma. He has no complaints or symptoms of vision loss, although the prior examination makes reference to cupping. The highest reported IOP is 21 mm Hg.

On examination, visual acuity measures 20/20 OU, IOP 21 mm Hg OU, and pachymetry is 510 µm OD and 490 µm OS. The anterior segment is unremarkable. The Humphrey visual field (Carl Zeiss Meditec) reveals a superior arcuate defect in the left eye. Fundus photography is more revealing. The right eye has a superior retinal vascular occlusion. The left eye has a disc hemorrhage and a loss of nerve fiber layer inferiorly. It is important to note the fundus perimetry to 24º detailing threshold loss directly correlating with the nerve fiber layer defect and disc hemorrhage in the left eye (Figure 2).

CONCLUSION

Fundus perimetry is a new frontier in glaucoma diagnosis. Specific localization of anatomic defects with functional mapping will enhance eye care providers’ understanding of the pathophysiology of glaucoma. It is to be hoped that it will enhance physicians’ recognition of disease and patients’ treatment as well.