

NEW DIAGNOSTIC TOOLS

OCT angiography, PERG, and corneal hysteresis.

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Often, it is hard to know when to initiate treatment in borderline glaucoma cases. The Ocular Hypertension Treatment Study (OHTS) yielded a lot of important data for patients and clinicians to consider for patients with elevated pressures, but there are many clinical gray zones when the visual field or optical coherence tomography (OCT)

is suspicious, or when the pressure is marginal, but the testing is still normal. Alternative testing, which might more clearly reveal who is at risk for progression, would be of great value to indicate when the burden of earlier treatment is justified.

OCT ANGIOGRAPHY

Joel Schuman, MD, gives an eloquent, brief summary of OCT's development, including newer OCT angiography (OCT-A) in "OCT Technology: Past, Present, and Future" (bit.ly/InsideEyetube). There is a host of recent studies



AT A GLANCE

- New diagnostic tools could more clearly reveal who is at risk for glaucomatous progression and guide early treatment decisions. Optical coherence tomography angiography may identify glaucomatous damage before standard achromatic perimetry shows defects. Furthermore, optical coherence tomography angiography retinal vessel density measurements could differentiate primary open-angle glaucoma, preperimetric glaucoma, and normal eyes.
- The pattern electroretinogram has shown reversible changes in early glaucoma in some studies. A recent provocative study showed that normal-tension glaucoma patients developed abnormal changes in pattern electroretinogram amplitude compared with normal subjects and other glaucoma patients.
- Hysteresis is going to be of increasing interest to clinicians and researchers. Recent studies showed that higher corneal hysteresis was associated with less risk of progression, and lower hysteresis has been associated with faster retinal nerve fiber layer loss in glaucoma.



WATCH IT NOW

Joel Schuman, MD, gives an eloquent, brief summary of the development of optical coherence tomography.



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investigating OCT-A in glaucoma, that correlate angiography, retinal nerve fiber layer thickness, and perimetry. An interesting recent article by Yarmohammadi and colleagues showed that OCT-A may identify glaucomatous damage before standard achromatic perimetry shows defects.¹ Akli et al also showed that OCT-A retinal vessel density measurements could differentiate primary open-angle glaucoma, preperimetric glaucoma, and normal eyes.² OCT-A is at an early stage in its clinical development, but it clearly may increase both our understanding of pathology and our ability to detect pathology earlier.

PATTERN ELECTRORETINOGRAM

The pattern electroretinogram (PERG), the focus of "Early Glaucoma Detection with Pattern ERG" (bit.ly/EyetubePERG), has shown reversible changes in early glaucoma in some studies.³ A recent provocative study showed that normal-tension glaucoma patients developed abnormal changes in PERG amplitude compared with normal subjects and other glaucoma patients.⁴ It should be noted that, in the technology's current form, the specificity of PERG abnormalities may be low, possibly reducing PERG's utility in clinical decision making.⁵

CORNEAL HYSTERESIS

Two recent videos delve into the possibility of corneal hysteresis as a risk factor for the development and progression of

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WATCH IT NOW

Felipe Medeiros, MD, describes his recent study using corneal hysteresis for predicting glaucomatous progression.



glaucoma: “Understanding Corneal Hysteresis in Glaucoma” (bit.ly/cornealhysteresis) and “The Role of Corneal Hysteresis in Glaucoma Progression” (bit.ly/hysteresisglaucoma). The literature on corneal hysteresis is fairly extensive. Recent studies showed that higher hysteresis was associated with less risk of progression,⁶ and lower hysteresis has been associated with faster retinal nerve fiber layer loss in glaucoma.⁷ A novel study investigating the effects of prostaglandin analogues on corneal biomechanics suggested that some of the measured IOP reduction might be related to changes in structural properties such as hysteresis.⁸ Hysteresis is going to be of increasing interest to clinicians and researchers.

In summary, OCT-A, PERG, and corneal hysteresis all show promise for increasing clinicians’ insight into pathology that may indicate greater susceptibility for or early progression in glaucoma. The science is not yet at a point to offer clear clinical guidelines, but it is exciting to have these new avenues of investigation. ■

1. Yarmohammadi A, Zangwill LM, Diniz-Filho A, et al. Peripapillary and macular vessel density in patients with glaucoma and single-hemifield visual field defect [Published online ahead of print February 10, 2017]. *Ophthalmology*. doi: 10.1016/j.ophtha.2017.01.004.

2. Akil H, Huang AS, Francis BA, et al. Retinal vessel density from optical coherence tomography angiography to differentiate early glaucoma, pre-perimetric glaucoma and normal eyes. *PLoS One*. 2017;12(2):e0170476.

3. Wilsey LJ, Fortune B. Electroretinography in glaucoma diagnosis. *Curr Opin Ophthalmol*. 2016;27(2):118-124.

4. La Mancusa A, Horn FK, Kremers J, et al. Pattern electroretinograms during the cold pressor test in normals and glaucoma patients. *Invest Ophthalmol Vis Sci*. 2014;55(4):2173-2179.

5. Bach M, Unsoeld AS, Philippin H, et al. Pattern ERG as an early glaucoma indicator in ocular hypertension: a long-term, prospective study. *Invest Ophthalmol Vis Sci*. 2006;47:114881-4887.

6. Murphy ML, Pokrovskaya O, Galligan M, O'Brien C. Corneal hysteresis in patients with glaucoma-like optic discs, ocular hypertension and glaucoma. *BMC Ophthalmol*. 2017;17(1):1.

7. Zhang C, Tatham AJ, Abe RY, et al. Corneal hysteresis and progressive retinal nerve fiber layer loss in glaucoma. *Am J Ophthalmol*. 2016;166:29-36.

8. Meda R, Wang Q, Paoloni D, et al. The impact of chronic use of prostaglandin analogues on the biomechanical properties of the cornea in patients with primary open-angle glaucoma. *Br J Ophthalmol*. 2017;101(2):120-125.

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