PRACTICING PREVENTIVE MEDICINE

Visual electrophysiology can enable physicians to detect glaucoma before it causes damage.

BY WILLIAM BOND, MD

Detecting glaucoma early allows for better treatment strategies and improved outcomes, but traditional visual field testing and optical coherence tomography (OCT) are not always sufficient to determine when disease is present. Often, by the time glaucoma has been detected, ganglion cell death and optic nerve damage have already occurred. Although visual field testing and OCT certainly provide valuable information, they do not detect disease early enough to preserve optimal vision health.

Electrophysiology testing of the retina and neuro-visual pathways is objective and capable of detecting cell distress prior to actual cell death, making possible the treatment and potential restoration of distressed cells. In-office systems such as the Diopsys NOVA ERG and VEP Vision Testing System (Diopsys) allow physicians to efficiently and accurately detect disease while there is still time to prevent and possibly reverse permanent damage.[1]

THE VALUE OF PATTERN ELECTRORETINOGRAPHY

Electrophysiology objectively tests the function of the visual pathway. Pattern electroretinography (PERG) focuses on retinal ganglion and macular cell function, making it suitable for detecting early glaucoma. Such testing allows doctors to practice truly preventive medicine, because they can use the information obtained to prevent and sometimes restore damaged cells. Multiple studies have found that PERG testing can detect differences between healthy and glaucomatous eyes, including identifying dysfunction within inner retinal layers, even in the presence of normal optic disc morphology and visual field analysis.[2,3] Additionally, PERG has been found capable of detecting ganglion cell loss up to 8 years earlier than traditional testing.[1]

Structural damage to the optic nerve is permanent once it occurs. Studies have shown that detecting impending damage prior to actual cell death, in conjunction with lowering IOP, makes it possible not only to slow disease progression but, in many cases, to reverse the dysfunction of the retinal ganglion cells.[4,5] The earlier disease is detected, the better the possibility that suffering cells can be restored.

PERG testing can also be used to measure the functionality of the retinal ganglion cell complex and determine the efficacy of treatment. This allows the physician to establish whether therapy is working or if treatment requires adjustment.

HOW IT WORKS

In the past, eletroretinography (ERG) testing was conducted by placing sterilized electrodes on the eye for a long duration. Now, disposable sensors are placed under the eye on the lower eyelid, and information is generated quickly, providing greater comfort and convenience for the patient. The electrodes collect information while a stimulus is presented to the patient.

ERG can be conducted via various modules, including full-field ERG and the previously mentioned PERG. The

AT A GLANCE

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A FLICKER OF LIGHT ON RETINAL FUNCTION

By Mitchell Jackson, MD

They present to eye care practices across the country—patients with cataracts so dense that what is happening behind them is a mystery. I would like to assume that their vision will improve dramatically once the cataract is removed. I want to tell them how much better they will see after surgery, but what if there is hidden pathology? If all is healthy behind the cataract, these patients could be great candidates for a premium lens, but possible retinal problems could render the technology a poor option.

What I need is quality preoperative information.

THE TEST

Full-field flicker electroretinography (ffERG) allows me to evaluate patients' retinal health even in the presence of a dense media opacity cataract. My ffERG device uses a mini-Ganzfeld stimulus that produces high-frequency flash stimuli. A sensor placed on the patient's lower eyelid records the retinal response, demonstrating the health of the cone photoreceptors. The magnitude of the signal reflects the function of the cones, and the phase is a measure of the timing of the response. The variance of these measurements represents the consistency of the strength and speed of the signal.

The test is conducted on an eye with a nondilated pupil. If patients have dense cataracts, I order ffERG testing to be performed when they come back for their scheduling appointment. The test is only a few minutes long, and the results tell me if patients have normal or abnormal retinal function.

BENEFITS

The ffERG results help me in two ways. First, they enable me to set realistic expectations for my patients. If their retinas are healthy, cataract surgery will likely greatly improve their vision. If ffERG testing shows problems, cataract surgery may only restore some central vision, but the procedure will allow me to better visualize the retina and determine if the other pathology is treatable. Second, ffERG results help me to decide if a patient could benefit from a premium lens.

CASE EXAMPLES

I recently saw two separate patients who each had amblyopia in one eye and brunescent cataracts in both eyes. The visual acuity of both eyes of both patients was 20/200 or worse. In one case, ffERG testing showed normal retinal function in both eyes, and I was able to tell the patient that cataract surgery would greatly improve his vision (Figure 1). The patient ended up with 20/40 BCVA in the amblyopic eye and 20/20 BCVA in the other eye. The second patient had a very similar profile, but ffERG showed decreased macular function in the amblyopic eye (Figure 2). I was able to warn the patient ahead of time.

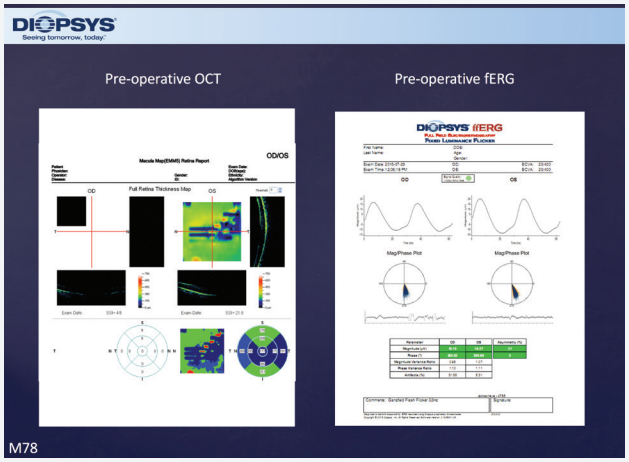

Figure 1. Prior to cataract surgery, ffERG testing was normal in both eyes.

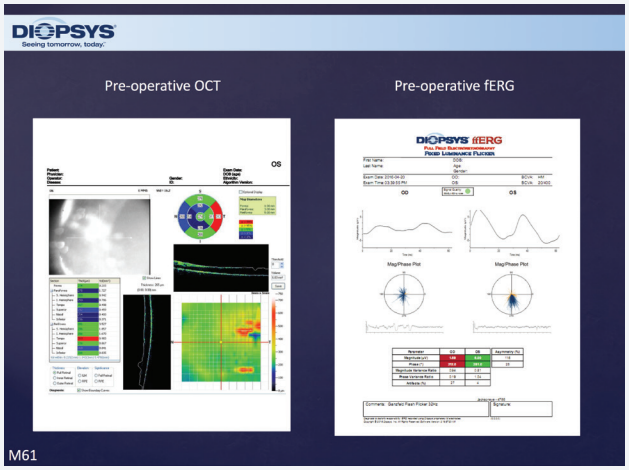

Figure 2. In this patient, preoperative ffERG testing was abnormal in the right eye and normal in the left eye. This information allowed Dr. Jackson to set realistic expectations for the patient about his postoperative visual recovery.

Postoperatively, he had a BCVA of 20/200 in the amblyopic eye and 20/20 in the other eye.

CONCLUSION

As a surgeon, I never want to overpromise and underdeliver. I want to be confident and provide patients with realistic expectations. In my experience, ffERG provides me with preoperative information I need to achieve those goals.

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In my experience, ERG testing can fit seamlessly into the flow of a practice.

latter evokes a response from the ganglion and macular retinal cells by using an alternating checkerboard or set of bars as a stimulus. When this stimulus is presented, the system detects the amplitude and phase of the electrical signal that passes through the cells and provides information on which cells are dysfunctional. Clinicians can then use this information to determine how far the disease has progressed and whether or not treatment is working.

INCORPORATING THE TECHNOLOGY INTO PRACTICE

In my experience, ERG testing can fit seamlessly into the flow of a practice. Most glaucoma patients are seen at least twice a year, and incorporating these tests into their treatment routine is typically unproblematic. ERG can easily be used in conjunction with other tests and should serve as a supplement to more structural tests such as OCT. I perform PERG on anyone who has glaucoma or is a glaucoma suspect.

I have found PERG to be a valuable test that allows me to intervene before glaucoma begins damaging the visual system. When used together with OCT and visual field testing, PERG provides valuable information on the patient's condition and on treatment efficacy. ■

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