

Electroretinography: Coming out of the laboratory and into the clinic

Method for diagnosing and managing macular diseases has great potential

By **Professor William Ayliffe**



Prof. Ayliffe

Optical coherence tomography (OCT) has developed into an incredible tool for diagnosing and managing macular diseases. Cross-sectional imaging of the retina enables measurement of macular thickening, quantification of diabetic macular oedema and detection of vitreoretinal traction.

A newer technique, spectral-domain OCT, is rapidly advancing as a necessary tool for diagnosing glaucoma by measuring optic nerve health parameters and comparing them with a normative database.

Objective data on the structural health of the eye is invaluable. However, it only detects cells that have already died and fails to indicate whether living cells are under stress and would benefit from additional therapy, or if a suspicious structure may still have stable cells.

The only objective, functional method at our disposal for diagnosing and managing retinopathies and glaucoma is electroretinography (ERG). These tests are unique in their ability to not only measure disease progression, but also improvement of cellular function.

Visual electrophysiology tests have been used for decades in research settings, and are a trusted tool for detecting retinal abnormalities. The most commonly performed ERG vision tests are pattern ERG (PERG), which measure retinal ganglion cell function, and full field ERG (ffERG), which measure global retinal function. However, these technologies have only recently been made accessible to ophthalmic practice.

Which patients benefit?

I have used visual electrophysiology testing as a diagnostic tool for many years. However, the expense and inconvenience associated with the tests necessitated a certain level of discernment on my part; deciding which of my patients would get the benefit of the additional information and who would not.

Thankfully, scientific advances now have enabled this testing modality to be incorporated

into the clinic. I use an ERG and visual evoked potential (VEP) testing system (Diopsys NOVA), which employs non-invasive sensors and a straightforward operating system to make it more comfortable and less expensive for both patients and clinicians.

The test results are colour-coded based on documented reference ranges, creating an output summary that enables intuitive interpretation.

The only objective, functional method at our disposal for diagnosing and managing retinopathies and glaucoma is electroretinography.

The uses of ERG tests are widespread, with applications for glaucoma; central retinal vein occlusion; retinal ischaemia; macular degeneration; and many other pathologies. This means that I use this testing in my clinic daily.

I perform pattern electroretinogram (PERG) on patients who have suspicious nerve shape and thickness, to determine if they have pre-perimetric glaucoma. If the tests show non-optimal cell function, I am able to start the patient on treatment that will prevent damage and preserve their vision. If the result shows good function, I can save the patient the hassle and expense of starting unnecessary treatment.

IN SHORT

► **OCT has many benefits, yet falls short of reliably diagnosing and managing retinopathies and glaucoma. ERG remains the stalwart method for this application and this article highlights how technological advancements have enabled its introduction to the clinic.**

In patients with inflammatory retinal diseases, I use ffERG to understand the activity of the inflammation. This allows me to adjust the amount of steroid a patient is using, or indicates what their maintenance amount should be.

While the test is clear-cut, we made sure to invest the appropriate amount of time in training.

Talking cost

As a result of working in a private practice, I see both patients with medical insurance and those without. For those who have insurance that covers electrophysiology testing, we bill their insurance company.

If a patient does not have insurance, or their insurance does not cover such testing, they are billed directly for the test.

Fortunately, the cost is affordable for patients who are not covered.

Getting started

We placed our ERG and VEP vision testing device in the anteroom to the theatre—which is an area that we can make dark—and its small footprint means there is easily sufficient space.

While the test is clear-cut, we made sure to invest the appropriate amount of time in training to ensure good, reproducible results. The ERG sensors are placed on the lower eyelids and are quite comfortable for patients.

If, for some reason, the sensors are not well connected to the patient, or there is interference, the software and printout have quality indicators. However, this does not happen often.

ERG testing has more than proven its worth in evaluating retinal pathologies. Now that newly available technology has made it accessible and affordable for the clinic, I am grateful to have this additional tool at my disposal for all patients who may benefit.

REFERENCES

1. Sheybani A, Brantley MA Jr, Apte RS. Pattern electroretinography in age-related macular degeneration. *Arch Ophthalmol*. 2011;129:580-584.
2. Holder GE. Pattern Electroretinography (PERG) and an integrated approach to visual pathway diagnosis. *Prog Retin Eye Res*. 2001;20:531-561.
3. Noma H, et al. Association of electroretinogram and morphological findings in branch retinal vein occlusion with macular edema. *Doc Ophthalmol*. 2011;123:83-91.
4. Larsson J, Andreasson S. Photopic 30Hz flicker ERG as a predictor for rubeosis in central retinal vein occlusion. *Br J Ophthalmol*. 2001;85:683-685.
5. Neveu MM, et al. A comparison of pattern and multifocal electroretinography in the evaluation of age-related macular degeneration and its treatment with photodynamic therapy. *Doc Ophthalmol*. 2006;113:71-81.

PROFESSOR WILLIAM AYLIFFE, FRCS, PHD

E: profayliffe@gmail.com

Professor Ayliffe is emeritus professor of physiat at Gresham College and a consultant ophthalmologist at the Lister Hospital in London. Professor Ayliffe reports that Diopsys has helped with travel expenses to two conferences. He has no other financial disclosures.

OT OphthalmologyTimes.com Online Exclusive



VIDEO Watch the phaco sleeve with a dense, grade 4+ nuclear cataract. (Video courtesy of Dr Takayuki Akahoshi)
Go to OphthalmologyTimes.com/PhacoSleeve



VIDEO Watch a DMEK procedure in which fluid waves are used to centre the tissue without incurring any damage. (Video courtesy of Dr Mark A Terry)
Go to OphthalmologyTimes.com/DMEK



VIDEO Dr Peter Kaiser gives a more in-depth talk about the SAKURA programme.
Go to OphthalmologyTimes.com/SAKURA