Healio OCULAR SURGERY NEWS

THE PREMIUM CHANNEL **PUBLICATION EXCLUSIVE**

The impact of electrophysiological testing for the premium surgeon

Visual evoked potential and electroretinogram testing methods provide an objective analysis of the functionality of the neural visual pathway.

Ocular Surgery News U.S. Edition, February 10, 2015
Mitchell A. Jackson, MD

I remember the first time I encountered a patient who required electrophysiological testing. It was more than 20 years ago during my residency training for a possible retinal toxicity associated with the original formulation of Plaquenil in the treatment of advanced rheumatoid arthritis. At that time, University of Chicago was — and remains — one of the elite visual psychophysics center globally, led by Joel Pokorny, PhD, and his research team.

In 1860, Gustav Theodor Fechner coined the term "psychophysics" to describe research intended to relate physical (visual) stimuli to the contents of consciousness as it relates to the processing of the mind. Fast forward, modern approaches to sensory perception, at least in the realm of vision, measure the perceiver's judgment extracts from the stimulus leading to signal detection theory. I am not a scientist and never breached the sacred science halls of Dr. Pokorny and his team of electrophysiologists, and the eye as we knew it decades ago was really a university-based scientific analysis with a report generated and interpreted for the physician involved in a specific case, such as was there Plaquenil (hydroxychloroquine) retinal toxicity or not.

Electrophysiological testing and the premium surgeon

Today's premium surgeon now has access to similar electrophysiological diagnostic data in a matter of minutes in-office and is capable of changing therapeutic decisions for a wide array of conditions we see daily: ocular hypertension, glaucoma suspect, frank glaucoma, most maculopathies, many retinopathies, malingering, Plaquenil and other retinal drug toxicity, and most recently separating out cataract and macular disease to make a sounder decision to provide medically necessary cataract surgery in a patient with coexistent morbidities.

Two in-office technologies have evolved to make our jobs easier and make premium surgeons more proficient to identify many of these disease processes early, before permanent irreversible damage has occurred. Visual evoked potential (VEP) and electroretinogram (ERG) are electrophysiological testing methods that provide an objective analysis of the functionality of the neural visual pathway. These two

modules are provided on a mobile in-office setup (Diopsys), and technicians take only minutes to provide valuable diagnostic information to the premium surgeon. These tests also provide insight on the efficacy of therapy and can determine if therapy is actually working or needs to be modified, so this testing is dynamic and measures the functionality of the retinal ganglion cell complex.

Over the last 15 years or so, we have relied on the excellent imaging of optical coherence tomography of the optic nerve and/or retina in terms of two- or three-dimensional cross-sectional images of the retinal nerve fiber layer and ganglion cell complex thickness and similar imaging for the anterior segment structures of the angle and cornea. OCT provides images of the structures of the eye but lacks the functional analysis associated with these structures. VEP and ERG in conjunction with OCT and even visual field testing provide a global analysis for most ocular conditions seen daily by the premium surgeon.

VEP

VEP testing involves measuring electrical activity at the visual cortex by having a patient look at a patterned flashing light stimulus. It is measured in amplitude (strength of signal in relation to how many functional ganglion cells are present) and latency (the time it takes for signal to travel to visual cortex from the retina) and presents in an international standard graphic form known as the N75-P100-N135 complex. Low-contrast testing demonstrates degradation of the magnocellular pathways suggestive of an early indication of glaucoma and ganglion cell suffering. High-contrast testing demonstrates degradation of the parvocellular pathways as an early indicator of central vision loss mostly caused by problems before the signal reaches the optic nerve.

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ERG

ERG is performed in a similar manner to VEP but represents the combined output of the electrically active cell types in the retina. By varying the stimulus conditions, you can elicit a stronger response from some cell types over others. For example, the most common pattern tested is alternating checkerboard, useful in measuring drug toxicity such as from Plaquenil and early-stage glaucoma changes at the ganglion cell level before the onset of OCT structural changes to the optic nerve and/or visual field defects. Flash ERG is the newest module on the Diopsys unit and will provide an additional means to differentiate cone disease at the retinal level or determine if the visual problem is mostly cataract-related, a much more advanced way than the original potential acuity meter test.

Earlier detection, treatment

In the end, I am able to determine from electrophysiological testing at a much earlier stage if a patient has functional glaucoma damage, Plaquenil toxicity and/or separation in diagnosis in a comorbidity situation with cataract and macular disease. I am able to start treatment earlier in glaucoma suspects and be preventive in many other situations discussed. Electrophysiology in the office setting is here to stay and is effective as an objective test in diagnosing retinal and optic nerve dysfunction earlier compared with subjective tests such as visual field, although the latter is needed to look at the patient as a whole.

Stay tuned for my next Premium Channel column on PET scans of the eye and newer approaches to screening cataract and refractive surgery patients.

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For more information:

Mitchell A. Jackson, MD, can be reached at Jacksoneye, 300 N. Milwaukee Avenue, Suite L, Lake Villa, IL 60046; 847-356-0700; email: mjlaserdoc@msn.com.
Disclosure: Jackson is a consultant for Diopsys.