Visual Evoked Potentials (VEPs) have been used in academic institutions for decades to objectively assess the integrity of the afferent visual pathway. Modifications to the technology and technique have allowed VEPs to aid in the diagnosis of a variety of pathologies, including glaucoma, in the clinical office setting.

**BACKGROUND**

VEP is an electrical signal recorded from the scalp over the visual cortex after light-evoked (pattern reversal or diffuse flash) stimulation of the retina. Pattern reversal (commonly a reversing black to white and white to black checkerboard) is the preferred light stimulus. The conventional waveform analyzed for pattern-reversal VEP is the N75-P100-N135 waveform (Figure 1). The N denotation stands for a negative waveform, and the P denotation stands for a positive waveform. The number following the letter is the time in milliseconds of the average occurrence of the peak (eg, P100 is a positive peak normally occurring around 100 milliseconds). P100 is a commonly examined feature of the conventional waveform. Latency and amplitude are other important characteristics of the VEP. Latency is the time it takes for the signal to travel to the visual cortex from the retina. The amplitude or difference from the trough of N75 to the peak of P100 represents the strength of the signal reaching the visual cortex in relation to how many functional retinal ganglion cells are present. The conventional waveform analyzed for diffuse flash VEP is made up of a series of negative and positive peaks (N1-P1-N2-P2). N2, P2, and the amplitude between the two values are often closely examined during interpretation.

**CLINICAL APPLICATIONS**

In clinical practice, VEP has been shown to be helpful in examining the integrity of the visual pathways in non-verbal children and adults. Similarly, a normal waveform can also aid in the diagnosis of the malingering patient complaining of vision loss without organic pathology. Demyelination of the optic nerve can result in increased latency, and ischemic, compressive, and toxic damage can typically reduce amplitude. Although an objective method of examining the afferent visual pathways is desirable, the use of VEP has been limited until recent years. Unfortunately, an abnormal pattern-reversal VEP may be due to nonpathologic causes such as inattention and fatigue, with long testing times increasing the likelihood of such factors. In the past, extensively trained operators were needed to perform the test, because the pattern-reversal VEP had shown poor repeatability, but recent improvements have shown potential for the use of VEP in the clinical office setting for diagnosing the...
The Diopsys Nova-LX Vision Testing System (Diopsys) uses an automated, fixed protocol. The test can be performed by an ophthalmic assistant in 10 minutes and produces a printable report. The system uses short-duration transient visual evoked potentials (SD-tVEPs) and can be thought of as a modified version of pattern-reversal VEP. The fixed protocol uses both low- and high-contrast stimuli targeting the magnocellular and parvocellular ganglion cell pathways, respectively. Tello et al showed SD-tVEPs to have strong within-session and intersession repeatability and strong intereye correlation and agreement. Prata et al used the SD-tVEPs technique in patients with asymmetric glaucoma and found that eyes with worse visual field mean deviation had more delayed latency and reduced amplitude. Pillai et al reported that the SD-tVEPs can discriminate between healthy and glaucomatous eyes. Low-contrast latency showed the highest accuracy in discriminating among patients with mild, moderate, and severe glaucoma versus controls. The sample printout (Figure 2) from the Diopsys Nova-LX is from a patient with glaucoma. The asymmetry in latency between eyes is color coded in red.

**VEP AND GLAUCOMA CARE**

Cup-to-disc measurements can vary between eye examiners and even among visits to the same examiner. Optical coherence tomography is an objective way to measure structural changes to the optic nerve and retinal nerve fiber layer versus reliance on only subjective nerve examinations.

Visual field testing results are often unreliable with poor repeatability. The Ocular Hypertension Treatment Study (OHTS) found that nearly 86% of diagnosed visual field defects seen on standard visual field testing improve with subsequent testing. In the same vein as optical coherence tomography, the SD-tVEP is an objective way of evaluating functional vision loss versus depending on only subjective standard automated perimetry.

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**TABLE. CLINICAL APPLICATIONS**

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<tr>
<th>VEP Type</th>
<th>Clinical Application</th>
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<tbody>
<tr>
<td>Pattern-Reversal VEP</td>
<td>Patients with optic neuropathy, multiple sclerosis, glaucoma, or brain injury</td>
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<tr>
<td>Flash VEP</td>
<td>Patients with poor vision, poor cooperation, or poor optics (media opacities)</td>
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Abbreviation: VEP, visual evoked potential.