VISUAL EVOKED POTENTIAL PATTERN-ELECTRORETINOGRAHAM
ASSESSMENT OF NEURO-VISUAL FUNCTION

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Lee Shettle Eye & Hearing
Overview of VEP / PERG

- Why should I Use this Test?
- How does it work?
- Clinical Indications of VEP & PERG
- Interpretation
- Case presentations
- Billing & Coding
Electrocardiogram
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ELECTROPHYSIOLOGY

- Electrocardiogram
- Electromyography
- Auditory Evoked Potential
- Electroencephalogram
Previous Ocular Electrophysiological Testing Limitations

- Test time was approximately 45 minutes
- Required highly trained operators
- Limited to large research institutions
Ophthalmic Diagnostic Tests

- Psychophysical
- VF
- GDx
- HRT
- OCT
Psychophysics of vision

Visual Acuity Test
Psychophysics of vision

Color Vision Test
Psychophysics of vision

Visual Field Test
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Psychophysics of vision

Contrast Sensitivity Test
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Current Conditions

- Test time is approximately 1 minute
- Does not require highly trained operators
- Provides valuable Objective Functional data
- Currently installed in about 700 offices
Where are we Testing?

- Low contrast testing demonstrates degradation of Magnocellular pathways
  - An early indication of glaucoma, peripheral disease

- High contrast testing demonstrates degradation of parvocellular pathways
  - An early indicator of central vision loss and issues mostly caused by problems before signal reaches optic nerve, ie central macular disease

**patient should be tested with best corrected vision**
Why Use VEP?

• Many optic nerve diseases are asymptomatic because central vision is not affected until late in the disease\(^1\)

• Diagnosis and management of optic nerve disorders are often based on structural or subjective visual field tests\(^2\)

\textbf{VEP is an objective, functional test that can help discriminate between healthy and glaucomatous eyes}\(^2\)

\(^1\) Glaucoma. American Optometric Association. \url{www.aoa.org}
After Treatment

Science Made Simple

• **Visual Evoked Potential (VEP)**
  – Visual – patient observes a visual stimulus
  – Evoked – generates electrical energy at the retina
  – Potential – measure the electrical activity in the visual cortex

• **Objectively** measure the function of the entire vision system; no verbal response or “button pushing” required
Phototransduction
Conversion of light into electricity
ANATOMY

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Photoreceptor
Bipolar
Ganglion
Ganglion cell axon
Relay neuron
Relay neurons axon
Visual cortex neuron
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NEURO-PHYSIOLOGY

Light → Photoreceptor → Bipolar → Ganglion cell axon → Relay neuron → Visual cortex neuron

Phototransduction → Electricity → Electricity → Electricity → Electricity → Electricity

VEP
Main Indications

- Glaucoma
- Multiple Sclerosis
- Ischemic Optic Neuropathy
- Traumatic Brain Injury
- Amblyopia
- Other Neuropathies
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ISCEV

International Society for Clinical Electrophysiology of Vision

http://www.iscev.org/
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VEP Stimulus

- Diffuse
- Pattern

  Reversal

  Pattern-onset

  Transient

  Steady State
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VEP TEST

VEP should be done with refractive correction for 39"

Uncorrected  Multifocal  Monofocal
VEP Testing Protocols

- **NOVA-LX** Advanced Protocol

  Testing distance of 39 “
  Alternating 32 x 32 HC & LC Checkerboard pattern

- **NOVA-TR** User Defined Protocol

  Testing distance of 39”
  16 x 16, 8 x 8, 4 x 4 HC & LC Check size
  Alternating HC & LC Checkerboard Pattern
VEP Electrode Placement

Reference  Ground  Active
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VEP

Electric signal registered at the occipital region in response to a visual stimulus.

Electrical activity of V1 occipital cortex
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VEP Components

- Amplitude usually translates to the number of axons conducting along the visual pathway.
- Latency usually translates to the myelin status of the visual pathway.
VEP LX Interpretation
32 x 32 checkerboard Standard Protocol

- Amplitude - >6 microvolts
- P 100 High Contrast Latency using 85% High contrast stimulus - 95 to 117 ms.
- P 100 Low Contrast Latency using 15% Low contrast stimulus - 95 – 125 ms
- P100 Reliability Index >70% minimum
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Diopsys® VEP Report

Diopsys® NOVA-LX
Office Based Neuro Optic Vision Assessment

First Name: [Name]
Last Name: [Name]
DOB: [DOB]
Age: [Age]
Gender: [Gender]
Exam Date: [Date]
Exam Time: [Time]
VA: [VA]

OD: S/C/Ax/Ad:///
OS: S/C/Ax/Ad:///

Amplitude Low Contrast: [Value]
Amplitude High Contrast: [Value]
Latency Low Contrast: [Value]
Latency High Contrast: [Value]

Operator: [Operator]
Signature: [Signature]

www.diopsys.com

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Diopsys® VEP Report

Signal Quality: 129dBµV 60Hz noise
Signal Quality: 133dBµV 60Hz noise
Signal Quality: 160dBµV 60Hz noise
Diopsys® VEP Report

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ASSESSMENT OF NEURO-VISUAL FUNCTION

P100 Reliability Index

Lc 92%
Hc 100%
# Diopsys® VEP Report

## ASSESSMENT OF NEURO-VISUAL FUNCTION

### Parameters

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### Remarks

[Graphical representation of results]
Diopsys® VEP Report

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VEP - Abnormal

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Remarks:
- N/A
- Both Delayed
- Delayed
VEP - Abnormal
VEP abnormal - Asymmetry