An Office-Based System for Measuring Transient Pattern Reversal Visually Evoked Potentials in Children

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Purpose:

Visual-evoked potentials (VEP) are used to quantify normal and abnormal visual function in children. However, most VEP techniques require substantial test time and a laboratory setting, making routine testing of young children with suspected visual system dysfunction extremely challenging. We have adapted this technology to produce a user and patient friendly, PC-linked system for measuring transient pattern reversal VEPs (prVEPs) in the office setting.

Methods:

Thirty children aged 2-12 years with normal visual systems (uncorrected visual acuity 20/25 OU, no significant refractive error or strabismus, normal anterior and posterior segments; n=15) or no known visual deficits from refractive error, amblyopia, or structural abnormalities were tested. Synchronized single-channel transient prVEPs were recorded with a modified Diopsys Enfant System (Diopsys, Inc., Pine Brook, New Jersey, USA), using three gold cup scalp electrodes, and the filtered N75-P100-N135 complex was analyzed. Children were tested using 5 and 10 sec stimuli at 3 checkerboard sizes (81.47, 20.59, and 10.17 min of visual arc) at 85% contrast. The stimulus was presented on an LCD monitor, optically adjusted for less than 4% residual flicker. Each eye was tested individually, and the test repeated with both eyes open.

Results:

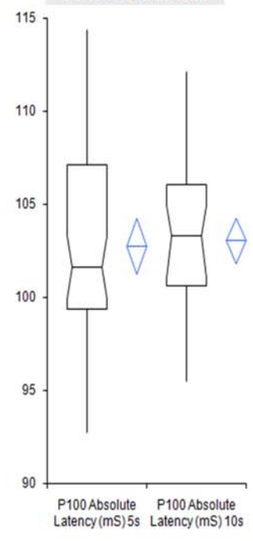
In normal children, detectable standard VEP responses with measureable N75 and P100 waveforms were produced using test protocols as short as 5 seconds. Ten-second test periods had less variability due to greater number of sweeps. Latencies increased nominally from 97 to 109 msec with smaller check sizes.

Conclusions:

Transient pattern reversal VEPs that correlate well with visual function can be reliably obtained in children in the office setting using the Enfant System and this modification. Ophthalmologic applications include office diagnosis of visual dysfunction in preverbal children, monitoring visual improvement during treatment, and screening for visual system abnormalities.

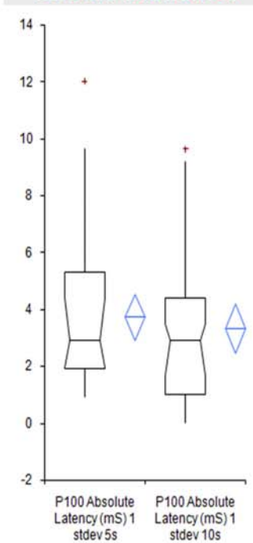
A sample of 30 normal children (ages 2 –12) underwent 3 trials each for OS, OD, OU for 5 sec and 10 sec. Two parameters were studied, the P100 latency and delta amplitude. Presented below are the mean values for each parameter and the mean for the standard deviation of each trial.

P100 Lat. Mean



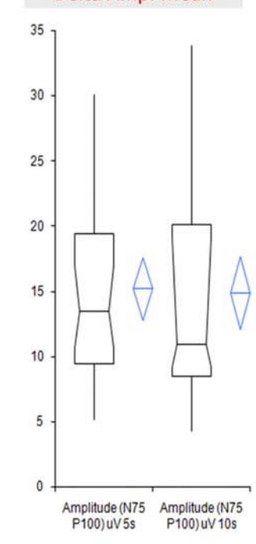
	5 sec	10 Sec
n	39	39
Mean	102.8	103.1
95% CI	101.2-104.2	101.9-104.3
SE	0.7	0.6
SD	4.6	3.7

P100 Lat. Mean St.Dev



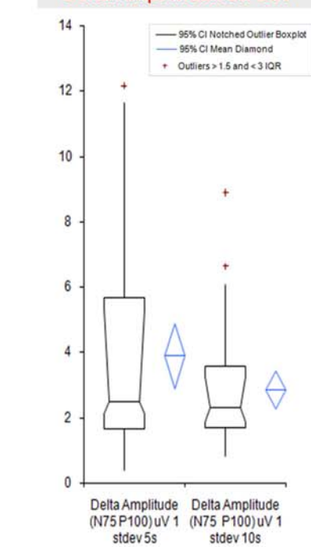
	5 sec	10 Sec
n	39	39
Mean	3.8	3.3
95% CI	2.9-4.5	2.5-4.2
SE	0.4	0.4
SD	2.5	2.7

Delta Amp. Mean



	5 sec	10 Sec
n	39	39
Mean	15.2	14.9
95% CI	12.8-17.6	12.1-17.7
SE	1.2	1.4
SD	7.4	8.6

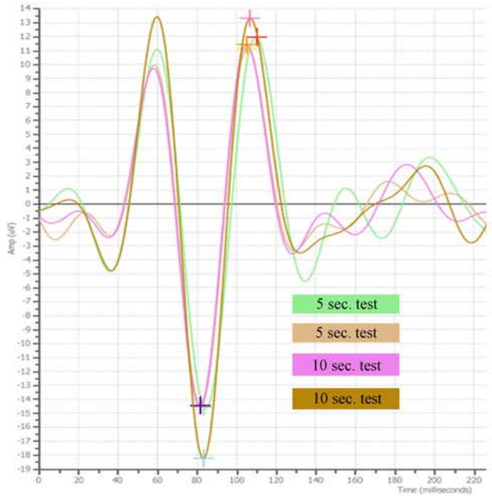
Delta Amp. Mean St. Dev



	5 sec	10 Sec
n	39	39
Mean	3.8	2.8
95% CI	2.9-4.9	2.3-3.4
SE	0.5	0.3
SD	3.0	1.8

Stimulus Pattern

An overlay of two 5 sec. and 10 sec. tests.



Tests were conducted at three check sizes for each subject in the sample. Below are statistics for the Amplitude and Latency for each 10 second trial.

Check Size (Arc min.)	Range Amp (uV)	Mean Amp (uV)	Mean Amp (uV) 95% CI	StdDev Amp (uV)
81.47`	(2.31, 24)	11.08	(8.33, 13.83)	6.82
20.59`	(3.68, 34.4)	13.77	(10.31, 17.23)	8.57
10.17`	(3.5, 28.1)	11.61	(9.00, 14.20)	6.43

Check Size (Arc min.)	Range Latency (ms)	Mean Latency (ms)	Mean Latency 95% CI (ms)	StdDev Latency (ms)
81.47`	(88.33, 115)	97.16	(94.45, 99.81)	6.73
20.59`	(95.0, 115.0)	104.2	(101.96, 106.47)	5.58
10.17`	(101.6, 128.3)	109.0	(106.64, 111.37)	5.85

Key Points

- A testing time of 5 seconds produced similar results to 10 seconds.
- While using shorter testing times, results are on par with previously published transient VEP results.
- 20.59`(64x64) pattern size produced the highest amplitude from the three check sizes.
- A reliable method to test the visual dysfunction in preverbal children
- The modified Diopsys Enfant system allows VEP technology to be used in a normal office setting without traditional VEP setups.

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