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A Comparative Study of Visual Evoked Potential between Dominant and Non-Dominant Eyes in Males.

B Sujaya*, and K Padmapriya

Department of Physiology, Kempegowda Institute of Medical Sciences, Bangalore, Karnataka, India.

Research Article

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***For Correspondence**

42-40/1, 3RD Main,
7th Block, Jayanagar,
Bangalore-560070
Mobile: +91 8762965931

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ABSTRACT

The objective was to study the P100 latency and amplitude in Visual Evoked Potentials (VEPs) with dominant and non-dominant eye individuals. VEPs were recorded in 30 dominant and non-dominant eye males using a Neuropack machine. Latency and Amplitude of VEPs (P100) were measured and analyzed statistically. The effect of eye dominance as seen in was that the latency of P100 was less in the dominant eye compared to the non-dominant eye. The results were consistent in the right and left eye dominance but were not statistically significant. The amplitude of N75-P100 was increased in the dominant eye and was statistically significant ($p<0.05$) compared to the non-dominant eye. The V E P recordings from the dominant eye showed that P100 component latency is decreased and amplitude is increased as compared to non-dominant eye. The amplitude and latency differences between dominant and non-dominant eyes provide objective electrophysiological evidence of lateralization in the central nervous system. V E P is affected in eye dominance. It should be taken into account while comparing V E P's of two eyes of the same subject.

INTRODUCTION

Optic nerve, visual pathway and visual cortices can be assessed by Visual Evoked Potentials (V E P) which are electrical potential differences recorded from the vertex in response to visual stimuli. V E P in humans is influenced by various physiological factors like age, sex, visual acuity, eye dominance and illumination. A Majority of subjects with normal visual acuity have a dominant eye [1]. Differences in the latency and amplitude on stimulation of the dominant and the non-dominating eye have been reported. Studies have revealed that eye dominance plays a role in determining the hemispheric asymmetry, in V E P recordings [2]. We would like to evaluate the effect of VEP on eye dominance electrophysiological, hence V E Ps were recorded and compared between dominant and non-dominant eyes of the normal subjects.

MATERIALS AND METHODS

30 males normal sighted males in the age group of 18 – 25 years were recruited for the study. The subjects had no history of significant neurological or ophthalmologic disease and were not on any medications. After taking their informed consent, a complete examination of the eyes was undertaken. Subjects were tested for far and near vision, dry refraction and fundus examination. Eye dominance was assessed by Seyal Test [1].

Eye Dominance for sighting was determined by having the subject binocularly align a pencil with a distant vertical line, then alternately close each eye. Closure of the dominant eye resulted in large lateral movement of the image. Eye dominance was confirmed by having the subject fixate on an object which was moved towards the nose until convergence stopped or divergence occurred in one eye, which was taken to be non-dominant [3].

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Subjects were instructed to have a head bath prior to the recording. Ethical clearance was taken from M. S Ramiah institute of Medical Sciences, Bangalore. V E P recording was done with a pattern reversal evoked potential using NIHON KOHDEN – Neuropack 2001 with upgraded software MED-2200, 3.02 version instruments. Electrode placing, nomenclature and methodology were according to Chiappa [4,5]. They were instructed about the procedure and then electrodes were placed after a scrub with gel at the following positions.

O_Z 5 cm above the inion process

F_Z 11 cm from the nasion

A_1 on the left ear lobule

The Ground electrode was placed on the left wrist.

1 Channel recording was done as recommended by the International Federation of Clinical Neurophysiology (I F C N) [6].

Channel 1 O_Z to F_Z

Background luminance was kept constant throughout the recording Electrode impedance was checked and maintained below 5 kilo – ohms for all the subjects. Patient was seated with the head elevated, 1 meter away in a dark room and the non-testing eye was lightly occluded. Each subject was presented with a 200 visual pattern reversal and evoked potential responses were recorded from the posterior electrode site. The subject had to be monitored to ensure fixation on the mid-field target. Pattern reversal consisted of checks of 16 x 16 size full locations in a checkerboard pattern over a screen the size of a television screen occupying a visual field of 12.3 degrees. The subject fixates at a central target as the pattern is reversed at 2 Hertz. Analysis time was 300 millisecs. Band pass filter was of 1 to 20 Hertz. A minimum of 2 series 200 stimuli each was averaged for each test. The P 100 latency and amplitude were measured from the recording of each subject and used for analysis.

Statistical Analysis

Two tailed independent Student t test has been used to find the significant differences of basic characteristics between the dominant and non-dominant eye. The latency and amplitude of P100 at Oz between the groups were analyzed in both the eyes.

Statistical Software

The Statistical software namely SPSS 10.0 and Systat 8.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate tables [7,8].

RESULTS

The effect of eye dominance as seen in was that the latency of P100 was less in the dominant eye compared to the non-dominant eye. The results were consistent in the right and left eye dominance but were not statistically significant. The amplitude of N75-P100 was increased in the dominant eye and was statistically significant ($p<0.05$) compared to the non-dominant eye.

The latency of P100 has been found to be lesser in the dominant eye and the amplitude is increased in the dominant eye as shown in the figure 1 ande 2 respectively. The V E P recordings from the dominant eye show that in P100 component latency is decreased and amplitude is increased as compared to non-dominant eye.

Table 1: Effect of Left eye dominance on P100

Latency with Left eye dominance		Significance by student t
Right Eye	Left Eye	
106.44 ± 4.18	105.66 ± 2.52	0.650

Table 2: Effect of Right eye dominance on P100

Right Eye	Left Eye	Significance by student t
108.21 ± 3.78	107.88 ± 3.89	0.687

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Table 3: Effect of Left eye dominance on Amplitude (N75-P100)

Right Eye	Left Eye	Significance by student t
10.96 ± 6.63	12.42 ± 6.38	0.008**

Table 4: Effect of Right eye dominance on Amplitude (N75-P100)

Right Eye	Left Eye	Significance by student t
11.85 ± 4.03	10.63 ± 4.11	0.000**

*-significant, **-highly significant

Figure 1: Mean and Standard Deviation of Latency P100 in Right Eye Dominance in Normal's

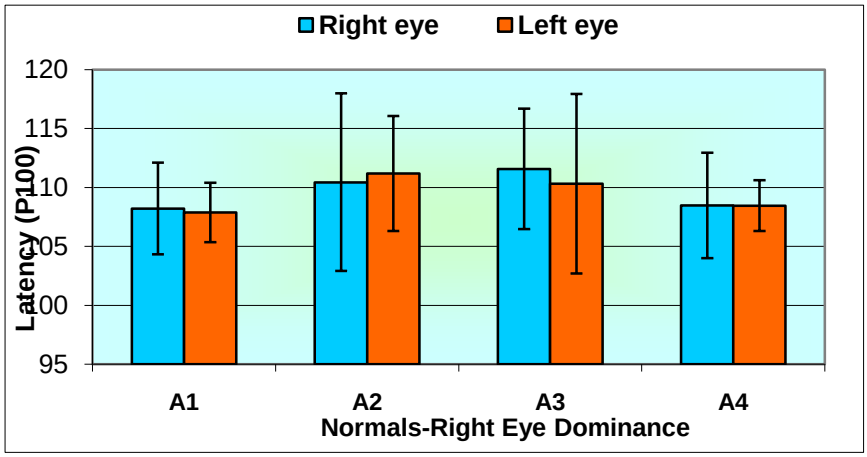
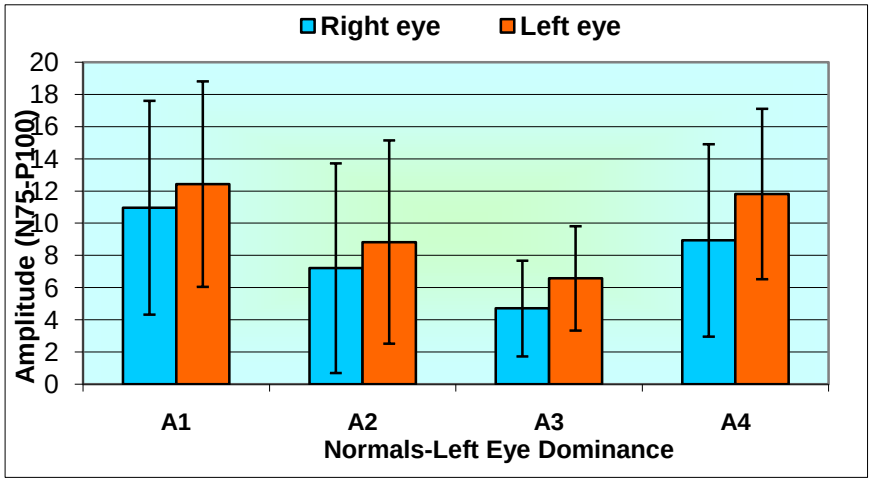


Figure 2: Mean and Standard Deviation of Amplitude (N75-P100) in Left Eye Dominance in Normal's



DISCUSSION

VEP responses were determined in young adult males. The results of the present study revealed significant decrease in the P100 latency and increase in amplitude in dominant and non-dominant eyes. It was reported earlier by Seyal M et al that the amplitude and latency differences between dominant and non-dominant eyes provide objective electrophysiological evidence of lateralization in the central nervous system and he demonstrated that there is an increase in amplitudes and decrease in latency on stimulation of dominant eye, which is similar to our study and we also have found that repeated measures of the latencies revealed a significantly shorter latency for the dominant eye [1].

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Earlier studies done by Crider with normal visual acuity have a dominant eye indicates the lateralization in the nervous system which has been confirmed by morphological, physiological and psychological evidence which is similar to our study [9].

The results of our present study are consistent with studies done by Pike J et al who has shown hemispheric differences for V E P from checkerboard stimuli [10].

Broadman and Eliot Smith and others found a strong tendency for anatomic lateralization, characterized by the left striate cortex tending to extend further laterally on the occipital lobe than does the right. Therefore they thought that it was reasonable to presume that hemisphere contributions to the generation of visual evoked potentials might be different and our study also revealed the same [11,12,]. Spinelli D et al reported that eye dominance appeared to play a role in determining the hemispheric asymmetry [13]. On the other hand, Klem et al performed a spectral analysis on steady state V. E. P obtained from dominant and non-dominant eyes found no difference in power values of VE P which is contrary to our study [14].

Hence, these amplitude and latency disparities between dominant and non-dominant eyes provide electrophysiological evidence of lateralization in the central nervous system.

CONCLUSION

The amplitude and latency differences between dominant and non-dominant eyes provide objective electrophysiological evidence of lateralization in the central nervous system. V E P is affected in eye dominance. It should be taken into account while comparing V E P's of two eyes of the same subject. Given individuals show right or left eye dominance in V E P recordings of both eyes of the same subject.

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