

Full Length Research Article

EFFECT OF OCULAR DOMINANCE ON VISUAL EVOKED POTENTIAL

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ABSTRACT

Objective: To assess effect of dominance of eye on VEP recording by using LED goggle.

Methods: We studied 300 candidates of both sex (right eye dominant N= 200, F=82, M=118 and left eye dominant N=100, F=45, M=55). The results were evaluated.

Results: Normative value for latency of P100 for LED goggle recording is 87.3ms. For right eye dominant candidates mean value of latency of N75 for right eye is 62.999ms and for left eye 65.729ms and p-value is 0.0089 and mean values for P100 for right eye was 85.393ms & left eye was 88.890ms and p-value is 0.0284. For left eye dominant candidates mean value for N75 for right eye 69.546ms & for left eye 64.936ms and p-value was 0.0024 and mean value for P100 for right eye 93.584ms & for left eye 88.484ms and p-value 0.0258.

Conclusion: Latency of N75 and P100 is lesser in dominant eye and in population ratio of right to left eye dominance is 3:1 thus dominance of eye should be determined prior to recording.

KEY WORDS: VEP, Ocular Dominance, P100, N75, Amplitude (N75-P100)

INTRODUCTION

Dominance in the broadest sense consist of any sort of physiological predominance, priority or preferential activity of one member of any bilateral pair of structures in the body. Thus to write right handed or left handed is to have a dominant hand. To start walking or climbing or putting on one's trousers always with the same foot is to have a dominant foot (Gordon *et al.*, 1950). Functional lateralization occurs in paired organs of the body, such as hands, legs and cerebral hemispheres. Ocular dominance, was first described in 1593 by Giovanni Ballista Porta. Ocular dominance, otherwise called eye dominance is the tendency to prefer visual input from one eye to the other. Individuals are not having any type of consciousness of using right or left eye as one is conscious of having right and left hand use. The eye is a sensory organ and has no conscious proprioception and vision in each eye represented bilaterally and equally in occipital lobes. An individual does not see the world from right or left eye but from a single so called cyclopean eye, which combines information from both.

Dominance wise eyes work as ones hand. They grab the image with one eye and pass on to other and start to analyze the object by refining like using fingertips or balancing objects with two hands (Jagadamba and Karthianee Kutty, 2012). Ocular dominance is extremely complex phenomenon. Sensory ocular dominance is demonstrated by the preference for one image over another when the two eyes are presented two disparate images. Sensory dominance is related to the visual mechanism of fusion, suppression and stereopsis.

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The two images are integrated or fused by a central cortical process to result in a single perception accompanied by the appreciation of depth. The phenomenon of ocular dominance tap into any of various way points along the circuitary, and also a hierarchy of dominance within the complete sensorimotor visual system (Gregory Huge Nelson, 1983). There are three sub-types of dominance in relation to eye; sighting dominance, sensory dominance & acuity dominance (Taghavy and Kugler, 1987). While playing the games in which player have to focus high speed ball like cricket, tennis it is shown that conduction in the dominant eye is very fast as they have to maintain the ability to make controlled contact with ball at high speed with bat or racquet. They have been compared with non- player subjects (Delpont *et al.*, 1991).

Functional significance of dominance of eye has not been ascertained but it have been shown to be related to a large number of perceptual, performance and clinical phenomena (Porac *et al.*, 1976). The VEP has been utilized as a research tool to investigate the processes (fusion, suppression and stereopsis) and some systematic changes which occur within the VEP in relation to these has been described. As we know that VEP has been affected by various physiological variables like age, sex, refractive error and also by ocular dominance (Mishra and Kalita, 2014). An analysis of VEP to correlate the sighting dominance with VEP changes is the focus of this study and to compare it previous studies. LED goggle has been used for stimulus which is not being used in any other study because use of LED goggle has been increased in assessing VEP by so many physicians.

MATERIALS AND METHODS

This study was carried out in Department of Physiology (Neurophysiology laboratory) in L.N. Medical College and

Research Center, Bhopal. 300 healthy candidates were enrolled for the study after approval from Institutional Ethical committee. Candidates were aged between 17yrs -21yrs of both sex. They were grouped in two after establishing the dominance of eye ie group 1 is right eye dominant and group 2 is left eye dominant, 3 candidates were excluded from the study as they were of bilateral dominant. Group 1 has N=200 (F=82 & M=118) and in Group2 N= 100 (F=45& M= 55)

Determination of ocular dominance

It is done by Miles test. In this test candidate has to extend both arms and to bring both hands together to create a small opening and then candidate has to view a distant object with both eye open through this opening. The candidate has to close the eyes alternately and has to slowly draw the opening near the eye and to tell that which eye is viewing the object. Exclusion criteria for selection of the candidates were Candidates with bilateral dominance.

- H/O eye surgery
- Color-blindness.
- H/O seizures.
- Candidates on anti-depressants.

Device used for recording of VEP was EMG Octopus by Clarity Medical Private Limited ISO9001 & ISO13485. Daily 10 candidates were called for recording between 10AM to 1PM.

All subjects were instructed for

- Washing of hairs to make hairs oil free and not to apply oil or any type of lotion before test.

- To take good sleep and normal meal.
- To remove contact lenses during procedure.

Technical setting for recording of VEP used was

Channels

- Active – Mid-Occiput - Oz.
- Reference – Mid Frontal - Fz.
- Ground – On hair line of fore-head - Cz.

Band Pass –

- Low filter = 2Hz.
- High Filter = 200 Hz.

Number of epochs given = 200.

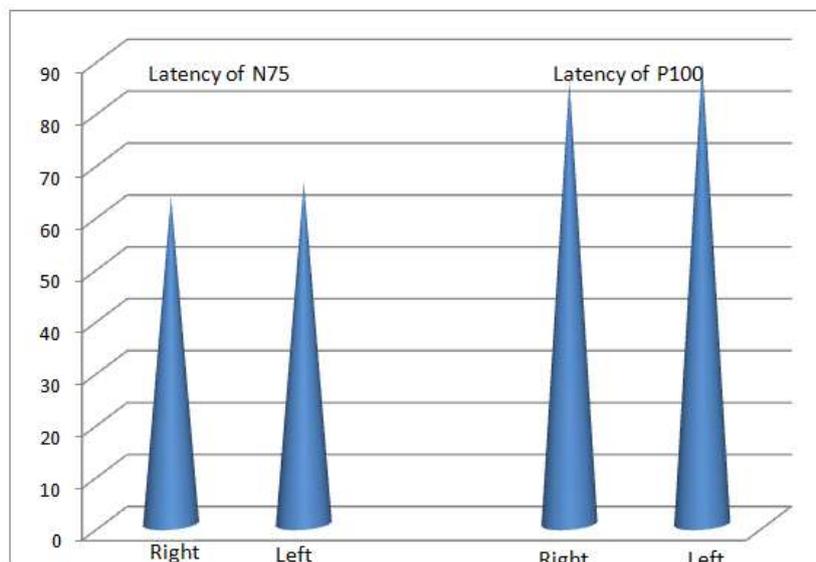
Rate of stimulation was 2Hz.

After fulfilling exclusion criteria and history and assessing the dominance of eye by Miles method along with written consent candidate was asked to sit on a comfortable chair facing in opposite direction from the recording monitor. Candidate was well informed about the procedure. Electrodes were placed with the gel over the positions mentioned above as per 10-20 system after cleaning the area before hand. LED goggle has been worn to the candidate and impedance check was done which was maintained below 5KΩ. Stimulation was given to eyes one after another at above mentioned rate and epochs. Recording done and collection of data was done according to the group.

Table 1.

Statistical analysis result for Right eye dominant candidates Group 1						
		Mean	SD	SEM	N	p- Value
Latency of N75(ms)	Right eye	62.999	10.948	0.774	200	0.0089
	Left eye	65.729	13.187	0.932	200	
Latency of P100 (ms)	Right eye	85.939	12.471	0.882	200	0.0284
	Left eye	88.890	15.045	1.064	200	
Amplitude N75-P100 (µV)	Right eye	1.008	0.754	0.053	200	0.0001
	Left eye	0.733	0.740	0.052	200	

Right Ocular dominant



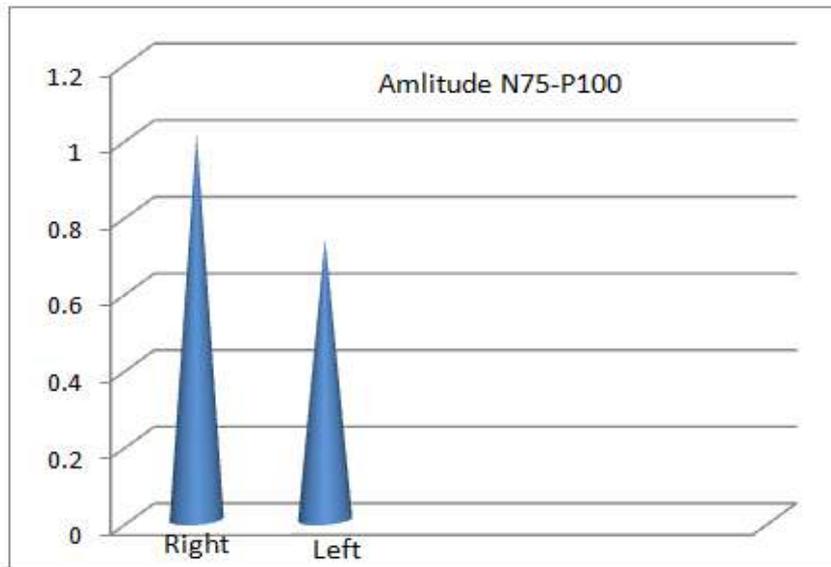
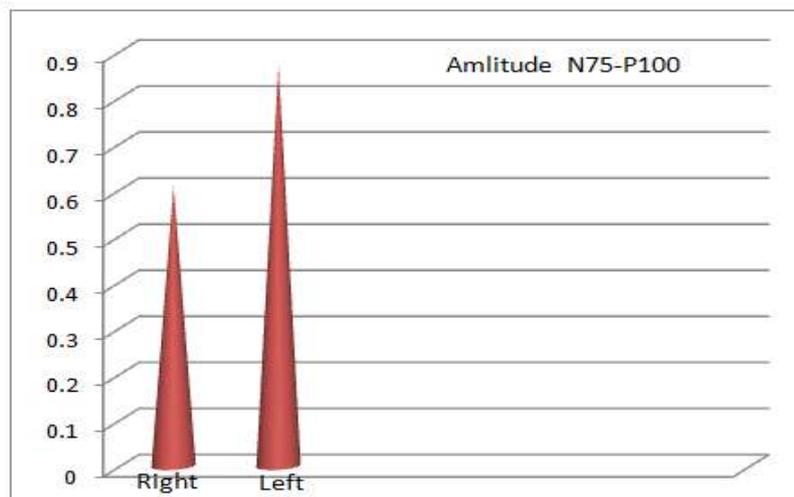
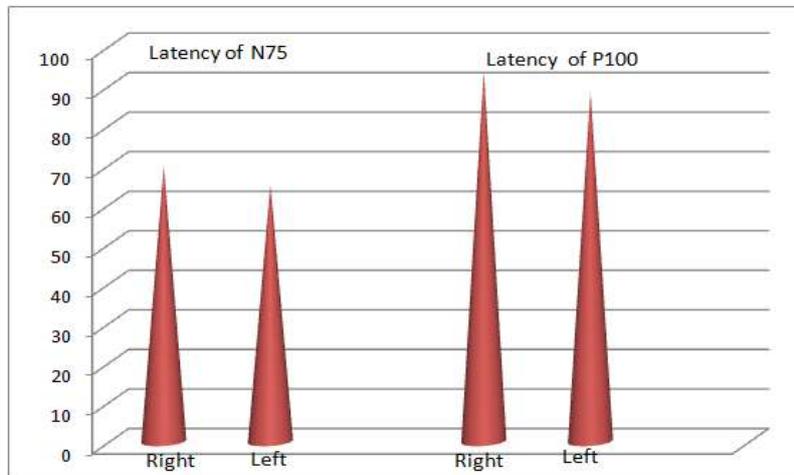


Table 2.

Statistical analysis result for left eye dominant candidates Group 2						
		Mean	SD	SEM	N	p- Value
Latency of N75 (ms)	Right eye	69.546	12.526	1.253	100	0.0024
	Left eye	64.936	11.857	1.186	100	
Latency of P100 (ms)	Right eye	93.584	16.858	1.686	100	0.0258
	Left eye	88.484	14.561	1.456	100	
Amplitude N75-P100 (μV)	Right eye	0.608	0.443	0.044	100	0.0167
	Left eye	0.871	0.657	0.066	100	

Left Ocular Dominant



RESULTS

Normative value for P100 for this device is 87.3ms (as given in manual of device) results of study was found as per the tables 1 and 2.

DISCUSSION

Dominant eye has often been defined as the eye whose input is favored in behavioral co-ordinates in which only one eye can be used. Its functional significance has not yet been established (Porac et al., 1976). Out of 300 subjects 200 were right eye dominant and 100 were found left eye dominant. In this study population approximately 33% were left eye dominant 3 candidates has been excluded from study as they have got binocular dominance. Study done by Jagadamba *et al* they had got 75% of dominance of right and only 25% of left dominant candidates. In our study we have found amplitude & latency disparities as results given by previous studies by different researchers. Disparities in amplitude and latency gives electrophysiological evidence of lateralization in the nervous system (Taghavy and Kugler, 1987; Delpont *et al.*, 1991 and Seyal *et al.*, 1981). Latency of N75 & P100 both are decreased significantly in dominant eye versus non-dominant eye in this study. There is significant difference in amplitude (N75-P100) between dominant and non-dominant eyes.

This was also found in previous studies. Latency of N75 is the time taken to stimulate fovea which is less in dominant eye as compared to non-dominant eye. It shows there is faster visual processing in the dominant eye. It was shown in a study that there is fast visual processing occur in dominant eye in skilled cricketers (Land and Mcleod, 2000). In our study latency for P100 wave is also less in dominant eye which reflects that there is less time taken for activity of visual cortex. A study by Delpont *et al* support that there is faster P100 ie decreased latency of P100 which reflects activity of visual cortex is faster in tennis player then rowers and sedentary subjects (Delpont *et al.*, 1991). One more study showed that the mean latency of P100 was less in dominant eye than non-dominant eye when stimulated separately. This is an evidence of lateralization of central nervous system.

Conclusion

In population there is approximately 70-75% of subjects are right eye dominant and 25-30% are left eye dominant. The latency of N75 & P100 is lesser in dominant eye than non-dominant eye. There is disparity in amplitude and latency in

both eyes due to dominance of eye. By this study we like to emphasize that before recording the VEP of any patient for confirmation of neuro-pathological effect on visual conduction system determination of dominance should be done. This study has been done by using LED goggle for stimulation and it gave the results in favour of previous studies thus LED goggle can also be used for stimulation in place of VEP monitor.

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