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# IMPACT OF GENDER AND HEAD SIZE ON VISUAL EVOKED POTENTIALS

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## ABSTRACT

The aim of the study is to compare head circumference in Gender and then to correlate head circumference with P100 latency, N75-P100 & P100-N145 amplitude. Visual evoked potentials are electrical potential differences recorded from scalp in response to visual stimuli. Numbers of factors that influence VEP waveforms include Age, Sex, Drugs, Head circumference. In the present study head circumference, P100 latency, N75- P100amplitude and P100 -N 145amplitude were recorded in 30 healthy males and 30 healthy females in the age group of 18-25 yrs. It is observed that head circumference is more in males. Also P100 latency is more in males as compared to females which is attributed to longer visual pathway. And amplitudes are larger in females as compared to males which is attributed to genetically determined sex differences in neuro-endocrinological systems. Present study also shows positive correlation between head circumference and latency and negative correlation between head circumference and amplitude.

When the latency and amplitude of both males and females of same head circumference (53-55cm) were compared it was found that latency does not show significant results. But amplitude is more in female which is attributed to genetically determined sex differences in neuro-endocrinological systems.

**Key Words:** Visual evoked potential, Head circumference, P100 latency, N75-P100 amplitude, P100-N145 amplitude

## INTRODUCTION

Visual evoked potentials are electrical potential differences recorded from scalp in response to visual stimuli (1). Visual evoked potentials (VEPs) are used to interrogate the visual pathway from the retina up through high-level visual cortices(2).

Numbers of factors that influence VEP waveforms include Age, Sex, Drugs, Head circumference (1). Gender is presumed to be one of the factors causing inter-individual variability in the brain's electrophysiological parameter (2). The P<sub>100</sub> latency is longer in adult males as compared to females. This has been attributed to larger head size and lower core body temperature in males (3). The mean P100 amplitude is greater in females compared to males (1).

Not many studies carried out showing how significantly these parameters affect VEP. Hence an attempt has been made, to correlate how gender has impact on VEPs, So that these factors will be considered clinically while recording VEP.

The aim of the study is to compare head circumference in Gender and then to correlate head circumference with P100 latency, N75-P100 & P100-N145 amplitude.

## MATERIALS AND METHODS

The study was conducted in a Grant Govt Medical College and J J Hospitals in Mumbai with the prior permission of the Dean of the institute and the ethical committee. 60 Healthy subjects males (n=30), females (n=30). Within in the age group of 18-25 years were subjected to a series of tests exercising utmost care in conduction so as to achieve the maximum possible accuracy with the available setup. A brief explanation to subjects regarding the procedure was given and voluntary informed consent of the subjects was taken.

The subjects selected were having no, medical, neurological and ophthalmic problems. The subjects were not on any medication likely to affect or influence VEPs or drugs affecting moods (antidepressant, tranquilizers). Prior to the study

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all subjects completed a healthy history questionnaire and a medical examination.

Visual function tests were done. Head circumference was measured in cm. Pattern reversal VEP was done on **Neuro-MEP machine**. The low cut filters (LF) are set at 2 Hz and high cut filters (HF) are set at 100 Hz. Electrode impedance set at < 5kΩ. Active electrode applied at midline 4cm above *inion* (Oz). Reference electrode applied at 12 cm above *nasion* (Fpz) and ground electrode at *vertex* (Cz). P100 latency and N75- P100 amplitude and P100 - N145 amplitude were recorded. **Pearson’s Correlation Coefficient (r)** was used for Correlation of Head circumference with VEP. **Student’s t test** –was used for analysis of VEP in Gender.

### OBSERVATIONS AND RESULTS

#### Observation

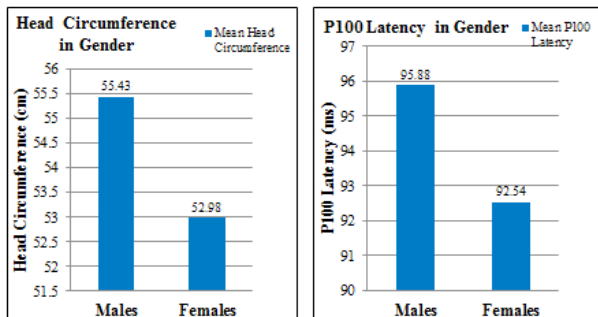
Head Circumference & VEP in gender.

	MALE (Mean ± SD)	FEMALE (Mean ± SD)	p value
Head Circumference	55.43 ± 1.73	52.98 ± 1.32	< 0.05
P100 Latency	95.88 ± 3.30	92.54 ± 1.47	<0.05
N75-P100 Amplitude	6.65 ± 1.80	9.28 ± 1.69	<0.05
P100-N145 Amplitude	6.54 ± 1.73	8.68 ± 2.15	<0.05

p value < 0.05 = Significant

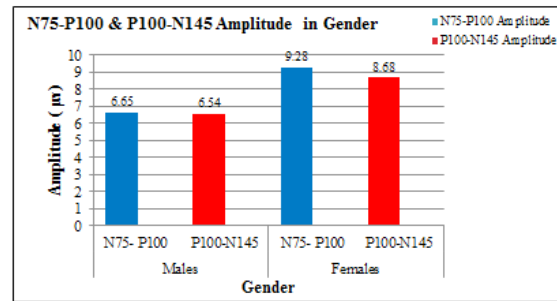
#### Result

Head Circumference & VEP Latency in gender



#### Result

VEP Amplitude in Gender



#### Observation

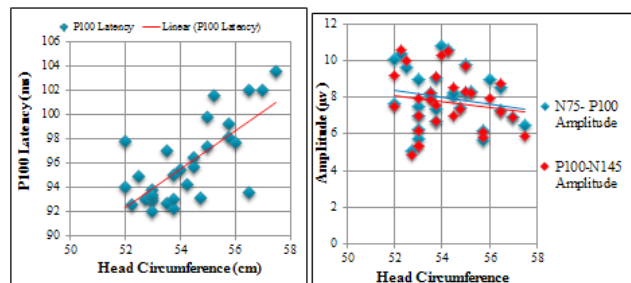
Correlation of Head circumference with VEP.

	Mean ± SD	r value	p value
Head Circumference	54.23 ± 1.95	-	-
P100 Latency	94.21 ± 3.05	0.719	< 0.05
N75-P100 Amplitude	7.96 ± 1.52	-0.198	> 0.05
P100-N145 Amplitude	7.72 ± 1.58	-0.152	> 0.05

p value < 0.05 = Significant  
p value > 0.05 = Non-significant

#### Result

Correlation of Head Circumference with VEP



Correlation of Head Circumference with Latency

Correlation of Head Circumference with Amplitude

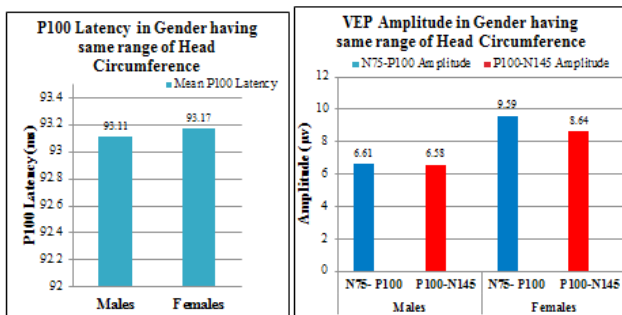
### Observation

VEP in males and females having same range of Head circumference (53-55 cm) .

	MALE (Mean ± SD)	FEMALE (Mean ± SD)	p value
P100 Latency	93.11 ± 0.77	93.17 ± 0.76	>0.05
N75-P100 Amplitude	6.61 ± 1.44	9.59 ± 1.70	<0.05
P100-N145 Amplitude	6.58 ± 1.83	8.64 ± 2.19	<0.05

### Result

VEP in Gender having same range of Head circumference



Visual Evoked Potentials Study

### DISCUSSION

It is observed that head circumference in males is significantly more than female. Also the P<sub>100</sub> latency and N<sub>75</sub>-P<sub>100</sub> amplitude and P<sub>100</sub>-N<sub>145</sub> amplitude show significant values. There is positive correlation between head circumference and latency. Increase in head circumference also increases latency. And negative correlation between head circumference and amplitude. Increase head circumference decreases amplitude.

Significant positive correlation between Head circumference and Latency is suggestive of larger the head circumference, larger is brain size and longer conduction pathway and thus prolonging VEP latencies; as per **Kothari et al** (4).

Also as per Schmidt Neilsen K, the assumption that the anatomic variation is isometric, differences in all dimensions will be proportional and any pathway in brain will vary in length as cube root of brain volume (5)

If we take the VEP in males and females of having same range of head circumference (53-55) it is observed that latency does not show significant changes but amplitude show significant changes

**Yasuhiro Kaneda et al** (3) had concluded that, the large VEP amplitude, and the tendency for increased  $\alpha$  power %

and at LP verified in their study were considered to indicate that the VEP amplitude at LP reflects the effect of estrogen more than progesterone, and that the VEP latency and EEG changes at LP reflect the effect of progesterone more than estrogen. We believe that VEP analysis is a useful tool for the study of the actions of gonadal hormones on CNS, not only in animals but also in humans. And therefore Sex differences in VEPs (more Amplitude in females) may be attributed to genetically determined sex differences in neuro-endocrinological systems.

### CONCLUSION

Head circumference is significantly larger in males. P100 Latency in male is more than female; this is attributed to longer visual pathway. Also larger amplitude in females, is attributed to genetically determined sex differences in neuro-endocrinological systems.

Head circumference has significant Positive correlation with latency and negative correlation with amplitude. Males and Females having same range of head circumference have no significant difference in Latency.

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