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# Effects of Myopia on Visual Evoked Potentials in Patients at Tertiary Care Hospital

Abdul Haleem Mirani, Amjad Ali, Ataullah Bukhari, Tehmina Imdad, Ateeq Ur Rehman Channa, Maqbool Ahmed Jamali

**ABSTRACT**

**Objective**: To determine the effects of myopia on Visual Evoked Potentials among the subjects attending the eye OPD.

**Study design and setting:** This was a cross-sectional study with non-probability convenience sampling technique carried out at Department of Ophthalmology, Peoples Medical College Hospital Nawabshah / GMMMC Sukkur from March 2021 to November 2021.

**Methodology:** Total sample size was derived to be 180. Diagnosed myopia irrespective of gender and aged 25 to 45 years were included. Optic atrophy, Extensive retinal disease, any neurological disorder like multiple sclerosis, stroke and Visual pathway disorders were excluded. SPSS version 25.0 was used for data analysis.

**Results:** The mean age of the patients was 39.14 ± 6.73 years. There were n=96 (53%) females and n=84 (47%) males. In myopic samples the mean pattern stimuli latency P100 in right eye was 92.07 ±5.1 in cases (without correction) and 82.09 ± 5.8 in controls (with correction) with significant P-value 0.023, while in left eye was 93.55 ± 6.7 in cases (without correction) and 83.6 ± 7.0 in controls (with correction) with significant P-value 0.028.

**Conclusion:** Greater the myopia; greater was the Visual Evoked Potential (VEP) changes with regards to latency and amplitude in pattern stimuli especially P100 being the most affected component in this regard. It is therefore necessary that every patient who goes for VEP test should be corrected for myopic refractive error.

**Keywords:** Amplitude, Latency, Myopia, Visual Evoked Potentials, Visual acuity

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## INTRODUCTION:

Visual Evoked Potential (VEP) is an electrical potential resulting after Visual Stimulus and is recovered from person's scalp.[1] This is a noninvasive test and is used to assess the visual function. VEPs are affected by non-pathological factors such as age, sex, pupil, and diameter, type of stimulus, electrode position and refractive states of these, the refractive error by a blur in the retina. It is a better test to identify the visual pathway than the scanning such as MRI (magnetic resonance imagining).[2] Visual pathway and visual cortex abnormalities affects the VEP results. For example, cortical blindness, demyelination due to optic neuritis, optic atrophy, hydrocephalus and tumors of the brain which compress the optic pathway. In multiple sclerosis the myelin plaque slows the speed of VEP.[3] A study reported that poor dormancy was augmented and amplitude diminished devoid of modification of refractive fault.[4] There is decreased amplitude by 25% per diopter of defocus.[5] Refractive errors blur the stimulus causes de focusing of image. That stimulated de focused image show very significant changes in latency and amplitude of VEP. It is estimated globally that one to two billion people have refractive error.[6] These refractive errors are corrected by spectacles because it is the safest and easiest method of treatment. Visually intensive occupations are also at risk factor for the progress of this refractive erros. The diagnosis of refractive error is based on clinical examination of eye

by using a retinoscope and large number of lenses of different powers. Sometimes automated refract meters used to estimate the error.[7] In our community the prevalence of myopia is greater than hypermetropia. The estimated prevalence of myopia in Pakistan is 36.1%. While that of hypermetropia is 27.1%.[8]

The different components of VEP are disturbed in different disorders for example latency of VEP is prolonged in demyelinating diseases of the visual pathway and the amplitude is reduced in the axonal damage.[9,10]

The rationale of study is to prevent the misinterpretation of the VEP results for ocular pathologies in the more prevalent myopia individuals. Present study determine effects of myopia on Visual Evoked Potentials in subjects attending tertiary care eye hospital.

**METHODOLOGY:**

A prior ethical approval was taken from the Institute Review Board (IRB) of the institute protocol number given was RP/03-2021. This was a cross-sectional study with non-probability convenience sampling technique. It was carried out at Department of Ophthalmology Peoples Medical College Hospital Nawabshah tertiary care hospital of Sindh / GMMMC Sukkur from March 2021 to November 2021. Sample size calculation was calculated using statistical formula, $n=Z^2 \times Px\ q \times N/e^2\ (N-1)+Z^2\ P \times q$ where, Z = Standardized tabulated value=1.96 at 95% confidence interval, P = Prevalence (36.1%)

e = Margin of error 5% and required sample size was found to be n = 180

Inclusion criteria were any gender, age 25 to 45 years with diagnosed with myopia. (Below the age of 25-year myopia is progressive and refractive error becomes is not static. Above 45-year myopia is rare, so researcher took the peak age). A written consent were taken from all respondents. Exclusion criteria were optic atrophy, Extensive retinal disease, any neurological disorder like multiple sclerosis and stroke, and those who did not give consent.

Patients diagnosed to have myopia by doing retinoscopy / auto refractometer (objective refraction) and manually corrected with the trial lenses that is subjective refraction were sent to Shanza Neuro Center opposite PMC hospital Nawabshah for VEP test as routine protocol and findings were recorded. The amplitude and latency of VEP waves were recorded with and without correction of visual acuity. Any change in parameters of Amplitude and latency were tabulated in data form. The data statistics was there after analyzed. The trial box were provided to the concerned doctor of the Shanza Neuro Center (where this VEP testing facility is available) who performed the VEP without (Case) and with correcting lenses (Control) already prescribed by optometrist / doctor of eye OPD. Financial expenses were beard by researcher. Statistical Analysis was done using Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive variables were used and presented as Mean, Standard deviation and frequency and percentages. Normality of data was checked prior to analysis. Variables were found to have symmetrically distributed. Inferential statistics were explored using one-way ANOVA test and Independent sample t-test. P-value = 0.05 was considered as statistically significant level.

**RESULTS:**

A total of 180 patients were included in this study. Mean age of the patients was 39.14 ± 6.73 years. There were 108 (60%) patients with =40 years of age and 72 (40%) patients with >40 years of age. Gender distribution showed that 96 (53%) females and 84 (47%) males. Best corrected visual acuity of right eye was found 6 /6 in 147 (81.66%) while left eye 162(90%) patients. Mild degree of myopia of right eye was found in 81 (45%) patients, moderate in 69 (38.33%), severe in 30 (16.67%) patients. Mild degree of myopia of left eye was found in 90 (50%) patients, moderate in 69 (38%), severe in 21 (12%) patients. (Table 1)

The mean pattern stimuli amplitude of right eye was 6.11 ± 0.7 in cases (without correction) and 6.14 ± 0.6 in controls (with correction) with not significant P-value 0.855, while in left eye was 6.13 ± 0.2 in cases (without correction) and 6.33 ± 0.8 in controls (with correction) with not significant P-value 0.766. The mean pattern stimuli latency N70 in right eye was 86.5 ± 8.1 in cases (without correction) and 83.62 ± 7.9 in controls (with correction) with not significant P-value 0.081, while in left eye was 88.62 ± 7.9 in cases (without correction) and 85.09 ± 7.0 in controls (with correction) with not significant P-value 0.087. The mean pattern stimuli latency P100 in right eye was 92.07 ±5.1 in cases (without correction) and 82.09 ± 5.8 in controls (with correction) with significant P-value 0.023, while in left eye was 93.55 ± 6.7 in cases (without correction) and 83.6 ± 7.0 in controls (with correction) with significant P-value 0.028. The mean pattern stimuli latency N155 in right eye was 85.90 ± 5.6 in cases (without correction) and 83.20 ± 6.3 in controls (with correction) with not significant P-value 0.078, while in left eye was 84.55 ± 6.6 in cases (without correction) and 82.05 ± 6.3 in controls (with correction) with not significant P-value 0.056. (Table 2)

In cases of Mild Myopia, mean pattern stimuli latency P100 in right eye was 85.68 ±7.5 and in left eye was 81.20 ± 7.9. In moderate myopia mean latency P100 in right eye was 94.21±8.1 and in left eye 93.46±6.4. Whereas in severe myopia mean latency P100 in right eye was 98.37±6.7 and in left eye was 99.28±7.35 with significant P-value < 0.001. Other parameters like amplitude, latency N 70 and Latency N 155 was found insignificant in different degree of myopia cases. (Table 3)

**DISCUSSION**

Visual evoked potential (VEP) is a tool to screen out the

Table 1: Demographic Characteristics of respondents

| **Age (years)** | Frequency | Percentage |
|---|---|---|
| =40 | 108 | 60.00 |
| >40 | 72 | 40.00 |
| **Gender** | | |
| Male | 84 | 46.67 |
| Female | 96 | 53.33 |
| **Best corrected Visual Acuity (Right Eye)** | | |
| < 6/6 | 33 | 18.33 |
| 6/6 | 147 | 81.67 |
| **Best corrected Visual Acuity (Left Eye)** | | |
| < 6/6 | 18 | 10.00 |
| 6/6 | 162 | 90.00 |
| **Degree of Myopia (Right Eye)** | | |
| Mild | 81 | 45.00 |
| Moderate | 69 | 38.33 |
| Severe | 30 | 16.67 |
| **Degree of Myopia (Left Eye)** | | |
| Mild | 90 | 50.00 |
| Moderate | 69 | 38.33 |
| Severe | 21 | 11.67 |

Table 2: Mean Visual Evoked Potential (VEP) with and without correction of Lens versus study Parameters

| **FLASH STIMULI Amplitude** | **Mean Visual Evoked Potential (VEP) without correction of Lens** | **Mean Visual Evoked Potential (VEP) with correction of Lens** | **P-value** |
|---|---|---|---|
| Right Eye | 6.11±0.7 | 6.14±0.6 | 0.855 |
| Left Eye | 6.13±0.2 | 6.33±0.8 | 0.766 |
| **LATENCY N70** | | | |
| Right Eye | 86.5±8.1 | 83.62±7.9 | 0.081 |
| Left Eye | 88.6±7.9 | 85.09±7.0 | 0.087 |
| **LATENCY P100** | | | |
| Right Eye | 92.07±5.1 | 82.09±5.8 | 0.023 |
| Left Eye | 93.55±6.7 | 83.6±7.0 | 0.028 |
| **LATENCY N155** | | | |
| Right Eye | 85.90±5.6 | 83.20±6.3 | 0.078 |
| Left Eye | 84.55±9.6 | 82.05±6.3 | 0.056 |

*Independent Sample t test was applied to see the significance
*P-value = 0.05 considered to be statistically significant

Table 3: Comparative Analysis of Study Parameters versus Degree of Myopia

| Parameters / Visual Status | Mild Myopia | | Moderate Myopia | | Severe Myopia | | P value |
|---|---|---|---|---|---|---|---|
| | RIGHT EYE | LEFT EYE | RIGHT EYE | LEFT EYE | RIGHT EYE | LEFT EYE | |
| AMPLITUDE | 5.62± 0.7 | 5.43± 0.5 | 5.07±0.6 | 5.21±0.6 | 4.90±0.8 | 5.01±0.6 | 0.124 |
| LATENCYN70 | 83.80±6.4 | 85.63±6.7 | 85.6±7.20 | 89.06±6.5 | 91.4±6.2 | 92.3±5.8 | 0.07 |
| LATENCY P100 | 85.68±7.5 | 81.20±7.9 | 94.21±8.1 | 93.64±6.4 | 98.37±6.7 | 99.28±7.3 | < 0.001 |
| LATENCY N155 | 82.89±6.3 | 83.11±5.2 | 86.51±7.1 | 86.20±8.9 | 90.20±6.9 | 89.95±7.2 | 0.11 |

*One Way ANOVA test was applied to see the significance
*P-value = 0.05 considered to be statistically significant

visual pathway defects it uses visual stimuli and measures the response in reaction to it. Myopia is a refractive error mostly prevalent in adulthood characterized by focusing of light rays behind the retina.[11] In this study we measured the changes in VEP with regard to amplitude and latencies in myopic individuals with and without correction (case/control) it was found that flash stimuli VEP do not show significant change in myopic with and without correction but N70, P100 and N155 showed noticeable change in the amplitude and latencies. A literature evaluated that the poor latency in myopia and found significant negative correlation between refractive error and poor latency and found that in high myopia the latency of uncorrected eyes was 107.99 mile seconds and after correction of high myopia 102.19 mille seconds.[12]

In present study the mean pattern stimuli latency P100 in right eye was 92.07 ±5.1 in cases (without correction) and 82.09 ± 5.8 in controls (with correction) with significant P-value 0.023, while in left eye was 93.55 ± 6.7 in cases (without correction) and 83.6 ± 7.0 in controls (with correction) with significant P-value 0.028.

Similar results showed by **Thabit MN** et al[13] with significant differences in amplitude of P100 latency increases among cases and controls. Mean value in case were presented as 132±2.2 and in control 107.7± 1.8. Another study[14] from Bhopal reported that no significant differences observed in latency P100 in the group without refractive error. However, it was highly significant found with refractive error. This is parallel to the study[15] carried out by **Agrawal A** et al who also deduced that P100 amplitude decreases and P100 latency increases with degree of myopia. The P100 being the most significant element of VEP that is effected by myopic change.

Evans AB[16] stated that it is of the same idea that P100 amplitude and latency changes are directly proportional to the refractive error.

Myopia effects on parameters like amplitude, latency N 70 and Latency N 155 was found insignificant in different degree of myopia cases. Similar results reported Hamilton R et al[17] blur in stimulus effects VEP. Another author **Zheng X** et al[18] in his study that Reduction of Visual acuity (VA) or of the contrast of the stimulus induces a prolongation of the pattern reversal visual evoked potential (PR-VEP) latencies. Literatures support that these conditions cause deterioration of the visual capacity to recognize objects and may preferentially activate the slower central retina channel.[19,20]

Present study showed that P100 amplitude decreased significantly and latency increased significantly with degree of refractive error and correction of the refractive error reduces these changes thus flash VEP is not much effected by refractive errors but pattern especially P100 significantly changes with refractive error. Henceforth it is suggested that prescribing investigation of VEP for any neuro-ophthalmic diseases the refractive error be corrected first in order to restrain from false positive results.

**CONCLUSION:**

Greater the myopia greater were the VEP changes with regards to latency and amplitude in pattern stimuli. P100 being the most affected component in this regard. It is therefore postulated that every patient sent for VEP investigation for any neuro ophthalmic disease should have refractive error myopia corrected first.

**Authors Contribution:**
**Abdul Haleem Mirani:** Conceived the study, Manuscript writing, Design of study, Literature review
**Amjad Ali:** Supervised the work and final review
**Ataullah Bukhari:** Study design & Methodology writing
**Tehmina Imdad:** Statistical Analysis and Results
**Ateeq U Rehman Channa:** Clinical work and data collection
**Maqbool Ahmed Jamali:** Help in discussion writing and Final Review

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