Original Article

Visual Evoked Potential Findings in Patients with Dyslexia

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Abstract

Purpose: The aim of this study was to compare the Visual Evoked Potential (VEP) findings in patients with dyslexia and in normal individuals.
Patients and Methods: In this case-control study, we evaluated 26 eyes from 13 dyslexic patients over the period of 2018-2022. The control group consisted of 26 eyes from 13 age- and sex-matched healthy individuals. VEP was recorded for both the case and control groups. We compared the latency (in milliseconds) and amplitude of the VEP P100 peak between the patients and the controls.
Results: The mean latency of the VEP P100 peak was significantly higher in the patient group, measuring 108.92 ± 3.84 milliseconds, compared to 97.46 ± 2.8 milliseconds in the control group ($P < 0.01$). Additionally, the mean amplitude of the VEP, P100 peak in the case group was significantly lower, at 2.96 ± 1.12 microvolts, in contrast to 6.38 ± 1.6 microvolts observed in the control group ($P < 0.01$).
Conclusion: Based on the findings of this study, it is concluded that dyslexia may influence the visual pathway of the visual system, leading to changes that could potentially be evaluated using VEP testing.

Keywords: Dyslexia; Visual Evoked Potential; Diagnosis; Visual Pathway.

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Introduction

Patients are diagnosed with dyslexia when their reading performance is significantly lower than expected for their educational level. This underperformance is not associated with sensory, neurological, or psychiatric deficits, or a low IQ [1]. The causes of dyslexia are multifactorial, with brain system dysfunction being a significant contributor [2]. One area that might be affected in these patients is the visual pathway, a crucial part of the brain [3].

Visual Evoked Potential (VEP) is a valuable technique for assessing the human visual pathway [4]. It has been demonstrated to be effective in identifying various pathological changes within the visual pathway [4].

The purpose of the current study is to compare the findings of visual evoked potential in patients with dyslexia to those in normal individuals. By comparing the VEP results of the case and control groups, we sought to identify visual pathway abnormalities associated with dyslexia. These findings could contribute to the development of more effective management and intervention strategies for preserving vision in affected individuals.

Patients and Methods

In this case-control study, we evaluated thirteen male patients (26 eyes) diagnosed with dyslexia as the case group. These patients were aged between 6 and 9 years. To assess their visual pathways, pattern-type Visual Evoked Potential (VEP) recordings were conducted using the Mangoni device. For comparison, thirteen healthy subjects of similar age and sex to the dyslexic patients were included as the control group. These individuals, having normal visual pathways, also underwent similar VEP examinations. The study protocol received approval from the institutional ethics committee board, and written consent was obtained from the parents of all individuals participating in the study. The latency and amplitude of the VEP, P100 peak, measured in milliseconds and microvolts respectively, were assessed to evaluate the patients' visual pathways. The VEP recordings were performed using three electrodes connected to the Mangoni device: the active electrode was placed on the occipital region, the reference electrode on the vertex, and the ground electrode on the forehead. This setup was designed to ensure accurate and reliable measurements during the VEP procedure.

Results

Table 1 shows the comparison of the mean age in the case and control groups. There were no statistically significant differences between the two groups in terms of age (P=0.492) and sex (all participants were male).

Table 2 presents a comparison of the latency and amplitude measurements for the VEP, P100 peak between the case and control groups. It was observed that the case group had a statistically higher latency ($P < 0.01$) and lower amplitude for the VEP, P100 peak ($P < 0.01$) compared to the control group.

Discussion

Dyslexia is a learning disability primarily affecting reading skills [5]. Developmental dyslexia is observed in almost 10 % of school-aged children, constituting a significant public health issue [6]. In these patients, the visual pathway, an integral part of the visual system, may exhibit abnormalities [7]. Visual Evoked Potential (VEP) is a well-established method for identifying deficits in the visual

Table 1: Comparison of the mean age in the case and control groups

Variable	Groups (Mean ± SD)		P value
	Control	Case	
Age	7.69 ± 0.75	7.92 ± 0.86	0.492 *

* Based on Mann-Whitney Test

Table 2: Comparison of the mean latency and amplitude of VEP, P100 Peak in case and control groups

Variable	groups (Mean ± SD)		P value *
	Control	Case	
Latency (msec)	97.46 ± 2.8	108.92 ± 3.84	< 0.01
Amplitude (μv)	6.38 ±1.6	2.96 ±1.12	< 0.01

* Based on Mann-Whitney U Test

pathway, and it is also effective for exploring unexplained visual impairments [8,9].

In our study, we observed changes in both the latency and amplitude of the VEP, P100 peak in dyslexic patients compared to normal controls. These findings suggest potential abnormalities in the visual pathways of dyslexic patients.

Shandiz et al., [10] conducted a study to investigate the role of sensory visual deficits in the pathogenesis of dyslexia using pattern visual evoked potential (PVEP). Including 36 dyslexic patients and 36 controls, matched for age, sex, and intelligence, their research revealed significantly reduced amplitude and prolonged latency in most PVEP components at low contrast levels among dyslexic patients compared to normal controls. These results align with our findings. Similarly some other studies have reported differences in VEP results between the dyslexic and normal individuals [11-13].

However, in a study by Heravian et al., [14] including 36 dyslexic and 36 normal participants aged 8-12 years, no significant differences were found in P100 latency and amplitude between the groups when comparing pattern reversal checkerboard visual evoked potentials.

This divergence in results underscores the necessity for more extensive, randomized studies with a larger number of participants to fully elucidate the role of VEP in evaluating patients with dyslexia.

Conclusion

Based on the findings of this study, it is concluded that dyslexia may influence the visual pathway of the visual system, leading to changes that could potentially be evaluated using VEP testing. Additional randomized studies with a larger number of participants are recommended to thoroughly comprehend the role of VEP in assessing patients with dyslexia.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.