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Research Article

Recording of Visual Evoked Potential in Patients Following Refractive Surgery

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Abstract:

Purpose: This study aimed to compare the visual evoked potential (VEP) findings in patients who underwent refractive surgery and normal individuals.

Patients and Methods: In this case-control study, 50 eyes of 25 patients were evaluated from 2019 to 2023. The control group consisted of 50 eyes of 25 age, sex, and visual acuity-matched healthy individuals. VEP was recorded for both the case and control groups. The latency (in milliseconds) and amplitude (in microvolts) of VEP P100 Peak were compared between the patients and the controls.

Results: The mean latency of VEP P100 Peak was measuring 100.6 ±4.61 milliseconds in the patient group compared to 99.76 ±2.16 milliseconds in the control group (P =0.876). Additionally, the mean amplitude of VEP P100, Peak in case group was 5.84 ±1.44 microvolts in contrast to 5.6 ±1.56 microvolts observed in the control group (P = 0.386). The differences for both variables were not statistically significant.

Conclusion: Based on the results, the visual pathway does not usually change in patients undergoing refractive surgery unless they have underlying diseases or drug side effects that might be missed or are silent during surgery. The authors suggest testing visual evoked potential before refractive surgery for better results.

Keywords: refractive surgery; visual evoked potential

Introduction

Refractive errors are some of the most common ophthalmic abnormalities worldwide and are associated with significant morbidity. Tremendous advances in treating refractive errors have occurred over the past years. In recent years, there has been increasing interest in refractive surgery among patients and physicians [1]. Individuals under forty years of age and females are primarily candidates for refractive surgery [2].

Refractive surgery aims to allow an individual more independence from optical devices. Technological innovations have improved the predictability and safety of surgical correction of refractive errors and revolutionized treatment. Refractive surgery is generally safe and effective, but some risks are involved. Careful patient selection, meticulous surgical techniques, and frequent follow-up can avoid most complications [3].

Electrophysiology examination of the eyes is an efficient method to check

for unexplained visual disturbances when routine eye examination is normal, or in other words, the fundus is clear.

Visual evoked potentials (VEPs) represent a valid electrophysiological tool in neurological Pathologies.

Sarzaeim F et al. 2024 measured VEP in ten male patients (20 eyes) suffering from Guillain-Barre syndrome (GBS). The patients were 25 to 56 years old. Pattern-type stimulation was used for this purpose, which resulted in a significant difference in latency and amplitude of VEP P100 Peak, between the patients and healthy groups. Finally, they concluded that GBS can affect the Visual pathway of patients, which can be measured by VEP [4].

VEP is an efficient technique for diagnosing multiple sclerosis (MS). Shushtarian SM et al. (2020) used two types of stimulation techniques, pattern reversal checkerboard, and flash, to diagnose MS. In this study, a pattern reversal checkerboard was an ideal method for recording VEP in MS patients, but in some instances, flash stimulation was inevitable for diagnosing MS [5].

VEP is a good technique for the side effects of certain drugs on the visual system, mainly visual pathways. A study was conducted on the possible impact of anti-seizure medicine on the visual pathway of the patients using these drugs for their treatment. They measured VEP on 20 Patients (ten male and ten female) aged 15-30 years. The patients were under anti-seizure treatment. There was a significant increase in latency and a decrease in amplitude of VEP P100 Peak between case and control groups, and they concluded that anti-seizure medicine can affect the visual pathway of patients, which can be diagnosed by VEP [6]. VEP is an appropriate diagnostic technique in surgical procedures where ocular complications occur.

Shushtarian S.M. et al. (2021) reported a 25-year-old female patient who suffered from far-distance blurry vision for four months after the rhinoplasty. The patient underwent different diagnostic techniques, such as visual evoked potential (VEP), to search for the reason. Magnetic resonance imaging (MRI) and other necessary methods were used, but all were normal. Finally, the authors decided to follow up with the patient in the future to find the reason for the visual disturbance created in the patient following rhinoplasty [7].

A case was reported in 2022 regarding a 75-year-old male patient presenting with a severe decline in visual acuity (light perception in both eyes). Upon reviewing the patient's medical history, it was revealed that he had undergone ozone injection surgery for spinal stenosis. Two days after the operation, he experienced a significant loss of visual acuity in both eyes. A comprehensive examination with different diagnostic techniques revealed that the patient suffers from anterior ischemic optic neuropathy following ozone therapy [8].

There are numerous studies in this regard [9-41]. Considering the above literature survey, the authors decided to record VEP in patients following refractive surgery and look for possible changes.

Patients and Methods

In this case-control study, 25 female patients (50 eyes) undergoing refractive surgery were evaluated regardless of the type as the case group. These patients were aged between 25 and 35 years, and all had full vision of 10/10. Pattern-type visual evoked potential (VEP) recordings were conducted using a Mangoni device to assess their visual pathway. For comparison, 25 healthy subjects of similar age, sex, and visual acuity to the case group were included as the control group. These individuals also underwent a VEP examination despite having normal visual pathways.

The study protocol received approval from the institutional ethics committee board, and written consent was obtained from all study participants. The latency and amplitude of VEP P100 peak, measured in milliseconds and microvolts, respectively, were assessed to evaluate the patient's 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 was placed on the vertex, and the ground electrode was placed on the forehead. This setup ensured accurate and reliable measurements during the VEP Procedure.

Results

Table 1 compares the mean age in the case and control groups. There were no statistically significant differences between the two groups in terms of age (P=0.625).

Variable	Number of participants	groups (Mean ± SD)		P value*
		Control	Case	
Age	25	28.96 ± 3.34	28.44 ± 3.02	0.625

* Based on Mann-Whitney U Test

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

Moreover no significant differences were obtained in case of sex (all participants were female), and visual acuity (all Participants had full vision).

Table 2 presents the comparison of latency and amplitude measurements for the VEP P100 Peak, between the case and control groups. As shown in Table 2, the differences for both variables i.e., mean latency and amplitude were not significant P= 0.876 and 0.386 respectively.

Variable	Number of participants	groups (Mean ± SD)		P value*
		Control	Case	
Amplitude (μv)	25	5.6 ±1.56	5.84 ±1.44	0.386
Latency (msec)	25	99.76 ±2.16	100.6 ±4.61	0.876

* Based on Mann-Whitney U Test

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

Finally, in a few cases, a delay was observed in the latency of VEP P100 Peak, which can be considered as follows.

Case 1.
A 28-year-old patient who had undergone refractive surgery had VEP P100 Peak latency of 112 msec in the right eye. The patient's medical history revealed that she was suffering from diplopia in her right eye when she was 20 years old, which might explain the latency delay. They discovered she had multiple sclerosis (MS), and after pulse therapy, her symptoms vanished.

Case 2
A 32-year-old patient with a delay in VEP P100 latency Peak of 108 msec, was checked for a possible reason for the delay. The patient's medical history showed that she had been under amiodarone treatment for her cardiac arrhythmia one year before, and the cardiologist terminated the drug when the patient's ophthalmologist observed visual abnormalities in her right eye vision.

Case3:
A 27-year-old Patient with 110 msec latency of VEP P100 Peak (left eye) was asked for the reason, but nothing could be observed in the patient's medical history. As a result of sending her to a neurologist, the neurologist ordered MRI and other diagnostic procedures to rule out MS, which subsequently revealed she was suffering from the condition that was silent till today.

Case 4
A 35-year-old patient with latencies of VEP P100 Peak equivalent to 112 and 110 msec for right and left eyes, respectively, was considered for possible delays. She explained that she had epilepsy when she was 15 years old, for which she was under polytherapy medicine, including vigabatrin.

Case 5
Finally, a 35-year-old patient with 108 msec of VEP P100 Peak latency on the left eye was investigated for a possible reason for the delay, but no reason could be obtained.

Discussion

A total of 25 patients who had undergone refractive surgery were examined for the VEP test. No statistically significant difference was observed in the case and control groups regarding latency and amplitude of VEP P100 Peak. However, in five cases, the latency of VEP P100 Peak increased due to underlying diseases or drug side effects, which were neglected or silent at the time of surgery. The results of the present work may be supported by the following research work in a related field.

A 39-year-old patient who had undergone refractive surgery was referred with a chief complaint of seeing colored rings around the lights and claimed that they had appeared after surgery. The Patient's eye was examined, and the fundoscopy was normal. VEP examination of the patient's eye showed a significant delay in VEP P100 Peak. A literature search revealed that these findings may be a side effect of amiodarone treatment in patients with heart problems. The ophthalmologist asked the patient about possible heart problems and amiodarone treatment, and the patient responded positively. The drug was discontinued with the permission of a cardiologist. One week later, only slightly dim vision remained as the only complaint of the patients [42].
Shushtarian SM et al. (2020) reported a case of a patient who complained of diplopia and blurring vision on his second refractive surgery attempt. A visual evoked potential (VEP), magnetic resonance imaging (MRI), and other necessary techniques were used to screen the visual system to determine that the patient was suffering from visual pathway disorder along with MS and that the symptom was not caused by surgery [43].

Conclusion

Refractive surgery is safe and does not affect the visual pathway unless the patient suffers from underlying diseases or needs medicine with an adverse effect on the visual pathway. Finally, the authors suggest that female patients undergoing refractive surgery should be examined for visual evoked potential for better surgery results.

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