



## Visual Evoked Potential Findings in Patients using Anti-Seizure Medicine

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### Abstract

**Aim:** Seizure is a strong shrinkage state of the skeletal muscle which is involuntary and occurs spasmodically. There are certain anti-seizure drugs such as Carbamazepine, Valproic acid and etc. used to control this illness. These drugs may affect the visual pathway, a part of the visual system. The aim of the present study is to look for probable side effects of anti-seizure medicine on visual pathway using visual evoked potential.

**Patients and Methods:** Twenty patients (10 male and 10 female) in the age range of 15 - 30 years were selected for the purpose of the present study. The patients were under anti-seizure treatment. VEP using two types of stimulators i.e., pattern reversal checkerboard and flash were tested in the total population. The VEP patterns obtained with two types of stimulators were compared between case & control groups to reach for suitable stimulation techniques to record VEP.

**Results:** There was no statistical difference regarding demographical specifications i.e., sex and age whereas the difference in the case of BCVA was significant. ( $P < 0.001$ ) There was a significant increase in latency and decrease in amplitude of VEP, P100 peak between patients and healthy groups ( $P < 0.001$ ) considering two types of stimulation techniques.

**Conclusion:** In patients using anti-seizure medicine for treatment visual pathway may be affected which can be diagnosed by VEP. For this purpose, two types of routine stimulators should be used to record VEP in patients to reach suitable and accurate results necessary for clinical purposes.

**Keywords:** Seizure, Anti-seizure drugs, Visual evoked potential, Visual stimulators

### Introduction

A seizure is a burst of uncontrolled electrical activity between brain cells that causes temporary abnormalities in muscle tone or behaviors, sensations, or states of awareness. Anti-seizure drugs are usually used to control seizures in these patients. Like any other drug anti-seizure drugs have certain side effects. The visual system among human organs may be affected by these drugs. Electrophysiological tests of the visual system mainly electrooculogram (EOG), electroretinogram (ERG), and visual evoked potential (VEP) are valuable tools for this purpose. These techniques are used for different pathological conditions of the visual system. Sanaie S et al 2014 worked on the effect of toxoplasmosis on the visual system, mainly the retina of patients suffering from toxoplasmosis. They used the EOG technique for this purpose. The result of their work was a significant difference between the Arden Index (AI) of case and control groups which shows the pathological changes of the retina mainly retinal pigment epithelium of toxoplasmosis patients. [1]

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**Citation:** Fatemeh Sarzaeim, Sanaz Abdolalizadeh, Seyed Mohammad Masoud Shushtarian, Ahmad Shojaei. Visual Evoked Potential Findings in Patients using Anti-Seizure Medicine. Journal of Ophthalmology and Research 5 (2022): 123-126.

**Received:** August 03, 2022

**Accepted:** August 12, 2022

**Published:** August 19, 2022

Recently Sarzaeim F and her colleagues published an article on the effect of hand-arm vibration on the retina of road drilling machine laborers. The authors stated that hand-arm vibration produced by road drilling machines can affect retina of the workers which can be measured by ERG [2]. In another work done by the same authors, flash VEP was measured in 10 patients following head trauma. The result was pathological changes of VEP which indicates visual pathway disturbances produced by head trauma and could be diagnosed by VEP [3]. There are quite enough related works in this connection that shows the usefulness of these techniques [4 - 12]. Electroophthalmological techniques can be used to study the side effects of different drugs on the visual system of human beings too. Allahdady F. et al 2016 worked on the toxic effect of hydroxychloroquine on the retina of arthritis rheumatoid patients using the EOG test. They concluded that EOG can be considered a suitable technique to evaluate the retinal damages caused by hydroxychloroquine in related patients [13]. Naser M. and her research team 2017 reported visual disturbances in a patient with amiodarone treatment following refractive surgery. The patient's chief complaint was seeing colored rings around the light. VEP recording in the patient showed prolongation in latency of VEP, P100 peak and reduction of the amplitude of the peak, which is proof of the toxic effect of amiodarone on the visual pathway measured by VEP.

Shushtarian S.M. and his colleagues worked on the probable toxic effect of sodium valproate (SV) on the human retina using ERG. For this purpose, 25 patients who had used SV for more than 3 years were chosen. Flash ERG was measured in these patients. The result of this work was a reduction in amplitude of ERG b wave which is an indication of pathological changes in the human retina due to SV treatment [15]. There is a large number of related other works in this connection [16 - 18]. Considering the extensive survey of the literature, the authors planned research on the probable toxic effect of anti-seizure drugs on human visual pathway using VEP by two types of stimulation techniques i.e. flash and pattern reversal checkerboard.

## Patients and Methods

In this case-control research work, 20 patients (40 eyes) suffering from seizures were selected as a case group. The patients were in the age range of 15 - 30 years. The case group was under anti-seizure drugs either monotherapy or polypharmacy for a different period longer than one year to control the illness. The patients were tested for visual acuity and brain magnetic resonance imaging (MRI). The case group had sufficient visual acuity to distinguish the fixation point on the monitor and normal MRI. Visual evoked potential test with two types of routine stimulation techniques i.e. flash and pattern reversal checkerboard was examined, the in the patient group. Latency (msec) and amplitude ( $\mu$ v) of VEP,

P100 peak was measured for the total patient group using the Mangoni machine. In summary three electrodes were used to connect the machine to patients. Active, reference, and ground electrodes were attached to the occipital, vertex, and forehead of the patient respectively. The same procedure was repeated for 20 (10 male and 10 female) age and sex-matched healthy (visual) subjects as a control group. The results obtained in two groups were compared for probable differences between the two groups.

## Results

Table 1 shows the demographical findings in the case control groups and there is no statistically significant difference between the two groups regarding age ( $P = 0.84$ ) and sex whereas the difference between BCVA is significant ( $P < 0.001$ ).

Table 2 shows the measurements of mean latency and amplitude of VEP, P100 peak in case and control groups using two types of flash and pattern reversal checkerboard stimulations. As it is clear in the table, the differences in latency and amplitude of VEP, P100 peak is significant as far as the two types of stimulation techniques are concerned ( $P < 0.001$ ).

## Discussion

Visual evoked potential with two types of stimulation techniques i.e., flash and pattern reversal checker board were recorded in patients taking anti-seizure medicine for their treatment. There was a delay in latency and fall of the amplitude of VEP, P100 peak in most of the patients compared with the same parameter of a healthy population. Moreover, the VEP pattern obtained in some patients was not reliable in the case of pattern reversal stimulation therefore, flash type of VEP was also performed in the total population i.e., case & control groups. The following discussion is an attempt to explain the findings of the present research work. Regarding the first finding i.e., significant changes in VEP, parameters i.e. latency & amplitude of VEP, P100 peak in patient group, the reason is nothing but visual pathway disturbances in case group either due to diseases itself or side effects of the anti-seizure drug which reflect itself in latency of VEP, P100 peak. It is to mention that latency of VEP, P100 peak originated from visual pathway [19]. To support the above results, Galler AM. et al 2005 measured VEP in epilepsy patients using anti-epileptic drugs and they commented that visual disruption in patients diagnosed may be attributed to either the disease itself or to anti-epileptic drugs prescribed to control the seizures [20].

Dziadkowiak E. et al 2019 worked on 81 patients with newly diagnosed epilepsy of unknown etiology before initiation of treatment VEP test was performed in the total patient group using two types of stimulation techniques i.e., flash and pattern reversal checkerboard. The result of their

work showed that VEP parameters obtained with pattern stimulation did not differ significantly between the patients and control groups, whereas in the case of flash stimulation they could find a significant delay in latency of VEP P100 peak [21] which once again support the results of present work. Regarding the side effects of anti-epileptic drugs on VEP, there exist a number of research works [22, 23]. One of the aspects of the present work was a recording of VEP in patients under anti-seizure treatment using two types of stimulation techniques i.e., flash and pattern reversal checkerboard. The reason for this attempt was the drowsiness and fatigue in a few patients which is the side effect of some anti-seizure drugs [24] and therefore lack of fixation and concentration on the monitor fixation point necessary to record VEP using pattern reversal checkerboard. In fact, the selection of stimulation technique plays a vital role in recording VEP in some cases including epilepsy. Shushtarian S.M. and his colleagues reported severe headaches initiated by flash stimulation during visual evoked potential recording in a patient with monocular optic neuritis and a history of migraine headache [25]. Selection of VEP with different stimulation techniques for better diagnosis of seizure epilepsy and other diseases is reported by different research workers [21, 26 - 28] which are proof of the advantage of recent work.

## Conclusion

Patients suffering from seizures, may have visual disruption which is either due to the disease itself or anti-seizure drugs necessary to treat the seizure. The visual evoked potential is a suitable technique for this purpose, however, two types of stimulation techniques for recording VEP are to be taken into consideration.

## Conflict of interest

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

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