Original Article

Flash and Pattern Reversal Checkerboard Visual Evoked Potential Recording in Albinism Patients

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Abstract

Purpose: Albinism includes a group of genetic disorders with decreased pigmentation. Patients with albinism experience photophobia due to the lack of pigments in the iris. Visual evoked potential (VEP) is one of the diagnostic techniques used in these patients. Flash and pattern-reversal checkerboard VEPs are two stimulation techniques to record VEP. The present work aimed to compare these two techniques in albinism patients and look for the optimum one.
Materials and Method: Flash and pattern-reversal checkerboard VEPs were recorded in 20 albinism patients. The latency (msec) and amplitude (μv) of VEP, P100 peak were measured for each patient, and the results were evaluated and compared.
Results: The patients aged between 10-20 years. The population included an approximately equal number of both sexes, and the best corrected visual acuity ranged from 1/10 to 3/10. The difference was statistically significant between the two types of stimulation regarding the latency of VEP, P100 peak. However, the peak difference was not significant between the two types of stimulation as far as amplitude was concerned.
Conclusion: The pattern-reversal checkerboard is a suitable technique to record VEP in albinism patients, although using flash VEP is inevitable in some cases.
Keywords: Albinism; Pattern Reversal Checkerboard Visual Evoked Potential; Flash Visual Evoked Potential; Stimulation Techniques.

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Introduction

Albinism may affect visual system. Various degrees of congenital nystagmus, reduced pigmentation of the retinal pigment epithelium, tall of visual acuity, refractive problems, color vision disturbances, prominent photophobia, iris hypopigmentation and translucency are among the visual system malfunction observed in these patients [1].

Aberration in the visual pathway is among the visual symptoms observed in albinism patients [2]. Visual evoked potential (VEP) is an electrophysiological technique to screen the visual pathway in human beings.

In an extensive research project, Shushtarian et al. (2017) studied the effect of the occupational vibration pathway measured by VEP. They selected fifty workers from a textile factory with machinery creating high vibration levels. They recorded VEP in the laborers and compared it with 50 age- and sex-matched controls from other departments in the factory. They finally concluded that occupational vibration might have adverse effects on the visual system, mainly the visual pathway, causing increased latency of VEP, P100 peak [3].

There are many references on the utility of VEP in different pathological conditions of the visual pathway [4-8].

Flash and pattern-reversal checkerboard stimulations are the two most common visual stimulations to record VEP. Selecting proper stimulation techniques is an essential task while recording VEP. In some cases, the improper selection of visual stimulators causes difficulties in patients. In this regard, Shushtarian et al. (2017) reported initiation of severe headache by flash stimulation during VEP recording in a patient with monocular optic neuritis and a history of migraine headache [9].

The pattern-reversal checkerboard is a common visual stimulator used in subjects with normal visual acuity [10], while flash VEP is usually used in patients with severe visual acuity impairment.

Sarzaeim et al. (2022) used the flash VEP technique to evaluate the extent of the injury on the visual pathway following head trauma [11].

In certain conditions, it is necessary to use both types of stimulation techniques to reach an ideal result.

Shushtarian (2020) used both types of visual stimulation to record VEP in migraine patients. He concluded that the pattern-reversal checkerboard was a more suitable stimulation technique in this regard unless the patient's visual acuity was so poor, making the use of flash VEP unavoidable [12].

Naser et al. (2014) conducted extensive research on 75 migraine patients. They checked the visual pathway of the patients using flash and pattern-reversal checkerboard VEPs. They commented that in connections with abnormalities of the visual pathway in migraineurs, pattern-reversal VEP should be taken into consideration, and for a more precise survey in certain cases, flash VEP could be used, requiring checking the photosensitivity of patients [13] .

Based on the above literature survey, the current research was planned to record flash and pattern-reversal checkerboard VEPs in albinism patients and decide the most suitable stimulation technique for these patients.

Methods

The study included 20 albinism patients (13 male and seven female) aged 10-20 years. The patients had reduced visual acuity, and the maximum best corrected visual acuity (BCVA) was 3/10. VEP was tested for all the patients using flash and pattern-reversal

checkboard stimulations. The ISCEV protocol was followed for recording VEP.

Three electrodes means active, reference, and earth, were fixed on subject's occipital, vertex and forehead areas, respectively. An electrophysiological unit, Mangoni enable of recording visual evoked potential was used in present work. A conducting gel was placed between the electrodes and the skin.

The latency (msec) and amplitude (μv) of VEP, P100 peak were measured in each patient. SPSS version 21 was used to compare the results obtained with the two types of stimulations between the two groups.

Result

VEP was recorded in 20 (40 eyes) albinism patients. The patients' age range was 10-20 years, with 13 of the patients being male and the rest being female. The BCVA of the patients was mostly 1/10, with the best one being 3/10.

Table 1 shows the measurement in the patients. A statistically significant difference was observed in the latency of VEP, P100 peak as far as pattern-reversal checkerboard stimulation was concerned. However, the difference in the amplitude of VEP, P100 peak obtained using both types of stimulation was insignificant.

Discussion

The visual system, mainly the visual pathway of albinism patients, was examined using flash and pattern-reversal checkerboard VEPs. The latency of VEP, P100 peak was delayed in both types of stimulation, which is the characteristic of this disease. Flash and pattern reversal checkerboard VEPs yielded significantly different latency peaks.

In the case of the amplitude of VEP, P100 peak, the difference was insignificant between the two types of stimulation. Patients with albinism have disturbances in the visual pathway that affect VEP.

Ather Sarim et al. (2019) performed a quantities assessment of visual pathway structure and function in 23 persons with albinism and 20 matched controls using different diagnostic techniques, including VEP. They concluded aberrant visual pathway development in these patients [(2)]. Several references in this regard support the results of the present work [(14-15)].

Some references in physiological and pathological conditions confirm the results regarding the statistically significant difference in the latency of VEP, P100 peak between flash and pattern-reversal checkerboard stimulation techniques.

Shushtarian and his colleagues (1999) recorded flash and pattern-reversal checkerboard VEPs in female subjects during a monthly physiological course. They reported a more significant latency of VEP, P100 peak in flash stimulation compared to pattern-reversal checkerboard stimulation [(16)].

In another work on patients with multiple sclerosis, a more delayed VEP, P100 peak was

Table 1: Measurement of mean latency and amplitude of VEP in albinism patients using flash and pattern-reversal checkerboard stimulation techniques

Variable	Number of participants	groups (Mean ± SD)		P value*
		Pattern	Flash	
Latency (msec)	20	109.62 ± 4.31	117.2 ±3.06	0
Amplitude (μv)	20	5.85 ± 2.09	5.9 ± 0.35	0.813

* Based on Wilcoxon Test

reported by flash VEP compared to pattern-reversal checkerboard VEP [17].

In the case of the amplitude of VEP, P100 peak, no difference was observed between the two types of stimulation. In this regard, certain facts are being discussed.

It is well known that albinism patients have photophobia. Thus, the suitable stimulation technique for them is pattern-reversal checkerboard VEP [12-13].

On the other hand, these patients suffer from low visual acuity and nystagmus, and thus flash VEP is ideal for them. All these factors affect the amplitude of VEP, P100 peak [18]. Therefore, albinism patients should be tested by both stimulation techniques. Also, the operator must be highly expert in deciding on the correct VEP recording technique and should report it to medical specialists so that they can take necessary actions.

Conclusion

Both types of stimulation should be used to record VEP in albinism patients, and the operator should be an expert in choosing the correct and accurate one.

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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.