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Selection of Suitable Visual Stimulator for Recording of Visual Evoked Potential in Photophobia Patients

KEYWORDS: Photophobia, Migraineurs, Visual evoked Potential, Pattern reversal checker board, flash stimulation

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ABSTRACT *Purpose: Recording of visual evoked potential (VEP) is important in diagnosis of demyelinating diseases and optic nerve atrophy. It is observed that selection of proper stimulation technique is to be taken into consideration in different pathological conditions. Photophobia is among the conditions that selection of proper stimulation technique is helpful in better diagnosis of this type of disease, therefore VEP using two routine stimulation techniques i.e. pattern reversal checker board & flash was tested in photophobia patients to search for possible changes. Migraine disease is among the one that is accompanied by photophobia. Therefore the migraine patients were taken for the purpose of present study.*

Method: Seventy five migraineurs were selected randomly. VEP was tested using pattern reversal checker board & flash stimulations in total population, VEP, P100 was measured in full population.

Result: The result shows increase delay in latency of VEP, P100 in case of flash rather than pattern stimulation.

The reason for this delay may be the visual pathway disturbances of these patients which will be discussed in detail in full paper.

Conclusion: From the result of present work one can conclude that pattern reversal checker board is a proper stimulation technique for recording VEP in migraineurs.

Introduction:
Selection of suitable stimuli is an important factor in recording of bio potential in human subject. The stimulus employed should be appropriate to the patient's individual clinical circumstances .One of the bio potential which needs appropriate stimulus technique is visual evoked potential (VEP). Visual evoked potential refer to electrical potentials, initiated by brief visual stimuli, which are recorded from the scalp overlying visual cortex. VEP waveforms are extracted from the electro-encephalogram (EEG) by signal averaging. VEP are used primarily to measure the functional integrity of the visual pathways from retina via the optic nerves to the visual cortex of the brain. VEPs better quantify functional integrity of the optic pathways than scanning techniques such as magnetic resonance imaging (MRI).Any abnormality that affects visual pathways or visual cortex in the brain can affect the VEP. Examples are cortical blindness due to meningitis or anoxia, optic neuritis as a consequence of demyelization, optic atrophy, stroke and compression the optic pathways by tumors, amblyopia and neurofibromatosis. In general, myelin plaques common in multiple sclerosis reduce the speed of VEP wave peaks. Compression of the optic pathways such as from hydrocephalus or a tumor also reduces amplitude of wave peaks [1].

For recording VEP, there are certain stimulus technique .Pattern visual stimuli elicit responses that have far less intra and inter individual variability than response to un patterned stimuli .PVEP testing will detect minor visual pathway abnormality with much greater sensitivity and accuracy than FVEP testing. Checkerboard pattern reversal is the most widely used pattern stimulus because of its relative simplicity and reliability. Grid and sinusoidal stimuli will also produce clinically reliable test results [2].

The diffuse light flash stimulus is rarely used due to high variability within and across subjects. However it is beneficial to use this type of stimulus when testing infants or individuals with poor visual acuity [3].

Present study deals with one of the pathological condition which is nothing but photophobia. Photophobia refers to a sensory disturbance provoked by light. It is a common symptom that is associated with several different conditions ranging from minor irritation to serious medical emergencies. Different pathological conditions may lead to photophobia. Migraine, corneal abrasion, encephalitis, scleritis and meningitis are among these conditions [4].

Photophobia is mostly observed in migraine disease. Migraine is a chronic neurological disorder characterized by recurrent moderate to severe headaches often in association with a number of autonomic nervous system symptoms. Typically the headache affects one half of the head, is pulsating in nature and lasts from 2 to 72 hours. Associated symptoms may include nausea, vomiting and sensitivity to light, sound or smell. Up to one third of people with migraine headaches perceive an aura: a transient visual, sensory, language or motor disturbance which signals that the headache will soon occur. Occasionally an aura can occur with little or no headache following it [5].

The aim of present work is to search for suitable stimulus

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technique in the patient suffering from photophobia and as photophobia is seen mostly in aura migraine patients; these patients are selected for the purpose of present study. The characteristic of present work is recording of flash in addition to pattern reversal visual evoked potentials in these patients which are more light sensitive and is the goal of present work.

Materials & Methods:

Seventy five aura migraineurs were selected randomly from the patients referred to Basir polyclinic for electro diagnostic examination. The patients were selected from age range of 20 to 30 years. Fifty of the patients were female and the remaining i.e. 25 patients were male. The patients were asked to come to the clinic one week after the attack. The patient's undergone VEP examination. Two types of routine stimulus i.e. pattern reversal VEP (PRVEP) and flash VEP (FVEP) was used to stimulate the eyes of the patients. As the aura migraineurs are photosensitive, the special arrangements was arranged to handle the patients if attack takes place. The patients were informed from the probable attack during FVEP examination and the agreement form was filled by the patients. Biomedica Mangoni instrument was used to record VEP from patients. Three electrodes was used to connect the patients to the machine, active on occipital, reference on vertex and ground on forehead. The parameters used to record PRVEP are listed as follow: Amplification [Gain x 1000: 200] ,Filtering [low cut freq. (Hz): 0.3, High cut freq .(Hz): 35,Rejecter (Hz):none] Averaging [Test duration (ms): 500, number of cycle: 75, artifact level (%): 100] check board [resolution : 5x5, active area EVF , contrast (%): 100 ,back color :black , active color : white , fixing color : red]

Finally the parameters selected to record FVEP are listed as below: Amplification (Gain x 1000 : 200), filtering (low cut frequency : 0.3 HZ , high cut frequency : 35 HZ). Averaging (test duration: 500 ms, numbers of cycle: 75). The specifications of flash for stimulation were delay: 0 ms, time: 10 ms, stimuli/cycle: ½, filtering color: white, Intensity: maximum Lux. Latency (msec) and amplitude (μV) of VEP, P 100 peak was measured for each patients. These patients were taken as a case group. The same number of healthy population i.e. 75 with similar age and sex of case group were selected as a control group. The same procedure was performed for control group. Mean latency and amplitude was calculated for each group. The results obtained in two groups were compared together for the possible changes in the groups. SPSS, version 13 was used to analyze the results obtained.

Results:

VEP P100 Peak Parameters / group	Latency/ S.D (msec)	Amplitude/S.D (μV)
control	95/4.23	3.2/1.12
Case (PRVER)	105/5.18	4.1/1.65
Case(FVEP)	116/6.25	3.3/1.21

Table 1 : mean latency /S.D and amplitude/S.D of VEP , P100 Peak in control , case with PRVEP stimulation and case with FVEP groups.

Table 1 indicates the mean latency/S.D. and means amplitude/S.D of VEP, P100 Peak of control and aura migraineurs with PRVEP and FVEP stimulation. According to the table 1 the different between mean latency of VEP,P100 Peak case (PRVEP) and control groups are statistically significant ($p < 0.05$).Considering the two case group i.e. PRVEP and FVEP the difference between two groups are statistically significant ($p < 0.05$) too. Finally the difference between amplitude of VEP, P100 Peak is not statistically significant as far as the two groups are concerned.

Discussion :

According to table 1, the migraine patients with aura shows delay in latency of P100 Peak as far as pattern reversal checker board stimulation is concerned. This delay is increased in patient population when flash type of stimulation was used. The reason for this delay may be given as follow. It is a well known fact that latency of VEP,P100 Peak is the projection of visual pathway. Delay in latency of VEP,P100 Peak in migraineurs in an indication of visual pathway disturbances in these patients. The result of present research shows larger delay in VEP,P100 Peak in case of flash stimulation in comparison with pattern reversal checkerboard stimulation. The reason for this difference in latency of VEP,P100 Peak for these two types of stimulation is the photophobia characteristics of such patients which produces more delay of VEP ,P100 Peak. It is observed when there is a physiological or pathological condition in the population under study the flash stimulation produces larger delay in comparison with pattern reversal checkerboard stimulation .In this regard Shushtarian S.M . etal in 1999 reported larger delay in latencies of VEP ,P100 Peak during monthly cycle which is a physiologic condition in female population .In the mentioned research work the latency of VEP,P100 Peak is more in case of flash in comparison with pattern reversal checkerboard stimulation [6].

One of the pathological condition which produces larger delay in latency of VEP,P100 Peak as far as flash stimulation is in case of multiple sclerosis which is a pathological condition [7]. These references may support the significant difference between two types of stimulations. In a research performed by Boylu E and his team on 2010, they reported the delay in latency of VEP, P100 Peak in patients suffering from aura migraine. They concluded that persisting dysfunction of precortical visual processing is the reason for VEP, P100 Peak delay which supports the result of present work [8] . Spreafico C et al in a research on migraine patients using VEP technique on 2004 found lower P100 latencies in migraineurs without therapy compared to control group. They reported the reason for these lower P100 latencies is different responsiveness of the visual system in migraineurs which is probably due to a demodulation of sensor input leading to facilitation of visual processing. This finding is in contradiction with result of present study [9].

Another somehow related study was done by Ozkul Y etal on 2001.They recorded flash VEP on migraine patients without aura. The result of their work showed no statistical difference in VEP, P100 Peak in case and control group as far as latency and amplitude was concerned. This work is common with the present work as far as flash stimulation is used in both studies but the types of migraine patients are different i.e. Ozkul used migraine without aura and we used migraine with aura [10]. Amplitude of VEP,P100 in aura migraine is of particular interest , some reference reports the higher value of amplitude in aura migraine in comparison with control group [11] and other reference report the opposite result i.e. lower value of amplitude in aura migraine [12]. These results are in contradiction with

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the result of present work but it is useful to mention that the amplitude of VEP,P100 Peak is not as reliable as latency of VEP, P100 Peak .

Conclusion:

From the result of present work one can conclude that in connection with abnormalities of visual pathway in migraineurs pattern reversal visual evoked potential should be taken into consideration however if the visual pathway was normal as far as the latency of VEP,P100 Peak is concerned for more precise survey we may record flash visual evoked potential but in this regard the photosensitivity of these patients are to be taken into consideration.

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