Research Article

Effect of Hand-Arm Vibration on Retina of Road Drilling Machine Laborers Measured by Electroretinography

Fatemeh Sarzaeim[1]; Fatemeh Ojani[2]; Tahere Sadat Hojati[3]; Ahmad Shojaei[4]; Seyed Mohammad Masoud Shushtarian*,[5]

[1]Department of Neurology, Faculty of Medicine, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

[2]Department of Ophthalmology, Faculty of Medicine, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

[3]Department of Clinical Medical Engineering, Tehran Medical Sciences, Islamic Azad University,Tehran Iran

[4]Basir Eye Health Research Center, Iran University of Medical Sciences, Tehran, Iran

[5]Department of Biophysics and Biochemistry, Faculty of Advance Science and Technology, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

***Corresponding author:** Seyed Mohammad Masoud Shushtarian, Department of Biophysics and Biochemistry, Faculty of Advance Science and Technology, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran.

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Abstract

Aim: Hand-arm vibration is vibration transmitted from a work process into worker's hands and arms. Road drilling machine laborers are exposed to heavy hand-arm vibration. Vibration may affect visual system. Retina is a part of visual system to be taken into consideration in this connection. The aim of present research is to look for possible effect of hand-arm vibration on human retina using electroretinography.

Method: Twelve male road drilling machine laborers (24 eyes) were selected for the purpose of present study. The age range of the laborers was between 25-35 years. They had normal visual acuity. The laborers were tested for electroretinography (ERG). Amplitude (µv) and latency (m sec) of ERG, b peak were recorded for all laborers and 12 age, sex and visual acuity matched control laborers not exposed to any vibration.

Result: The mean age was 30.67 ± 3.47 and 30.58±3.45 in the case and control groups respectively. The mean BCVA was 10/10 in both groups. The mean amplitude was 101.36 ± 14.29 and 109.76 ± 8.53 and in case of latency it was 43.52 ± 1.55 and 43.28 ± 1.4 in case and control groups respectively. The difference in case of amplitude of ERG, b wave was statistically significant ($p < 0.05$) whereas the difference in case of ERG, b wave latency was not statistically significant ($p = 0.612$).

Conclusion: Occupational hand-arm vibration in road drilling machine operators might have adverse effect on human retina which can be diagnosed by amplitude of ERG, b peak.

Keywords: Hand-arm-vibration, Road drilling machine laborers, human retina, electroretinography

1. Intruduction

Occupational hazard is a hazard experienced in the workplace. There are number of agents in working environment that can harms the workers in related areas. Shushtarian, S.M. et al on 2008 worked on mental stress of the workers exposed to humidity in a cheese processing factory. They found the adverse effect of humidity in working environments which reflect as mental stress in workers [1].

Visual system is among the human organs that may be affected due to occupational hazards. Electrophysiological diagnostic techniques i.e. visual evoked potential (VEP), electroretinography (ERG) and electrooculography (EOG) are among the techniques to screen the visual system diseases. Ojani F et al on 2021 worked on effect of Bardet - Biedl syndrome (BBS) on visual pathway. They found the adverse effect of BBS on visual pathway which could be diagnosed by VEP [2].

Shushtarian S.M and his colleague made a research on toxicity of Sodium Valproate (SV) on human retina. The result of their work proved that SV affects the retina which can be diagnosed by ERG [3]. There are quite number of references in this correction [4-7]. Visual system may be affected during certain occupational activities which can be diagnosed by certain electrophysiological techniques.

Intraocular foreign body (IOFB) can damage visual system in certain occupational activities. Turners are among the laborers who are mostly exposed to IOFB. It is found that ERG is a suitable technique to search for the retinal changes in the laborers exposed to IOFB [8]. Mustard gas and head trauma can damage the visual system in certain activities which can be diagnosed by VEP [9-10]. Finally, vibration is one of physical hazards that can damage the visual system.

Sarzaeim F and her research colleagues in a recent work on 2022 reported the visual pathway disturbances produced by vibration in road drilling machine laborers which can be diagnosed by VEP [11]. An earlier work on vibration done by shushtarian S.M. and his research team. They worked on fifty workers from a textile factory segment with machinery creating high levels of vibration. The result of work was adverse effect of vibration on visual system, mainly visual pathway of the laborers which could be measured by VEP [12]. Base on detailed review of literature and few research work on toxic effect of vibration on human retina, a research was planned out to look for probable toxic effect of hand-arm vibration on retina of laborers of road drilling machine using electroretinography.

2. Patients and Methods

This study was approved by Basir eye health research center ethics committee. Tehran, Iran and all subjects gave written consent before entering the study. Twelve male laborers selected as a case group. Laborers were in age range of 25-35 years. The workers had at least five years' experience of work with road drilling machine. The visual system of workers was tested using E-chart, ophthalmoscope and retinoscope by an ophthalmologist. Medical history of labors was also recorded. Twelve age, sex and visual acuity matched were selected from the laborers population with no experience of working with any hand-arm vibrating machine as control group.

All population in the study tested for electroretinography examination. Amplitude (µv) and latency (m sec) of ERG- b peak were measured for all case and control groups. Mangoni machine capable of recording ERG was used for this purpose. Conventional electrode attachments were used for attaching the electrodes to the subjects. Means and standard deviations of amplitude and latency of ERG-b peak in the case and control groups were compared. We performed the statistical analysis using spss software version 22 (IBM, Armok, NY, USA). P value less than 0.05 were considered statistically significant.

3. Results

The demographic findings in the case and control groups does not shows statistically significant differences between two groups, regarding the sex (all male) age (p=0.954) and visual acuity (the mean BCVA in two groups was 10/10).

Table 1: Measurements of mean amplitude and latency of ERG, b peak in case and control groups

Variable	groups (Mean ± SD)		P value*
	Control	Case	
Latency (msec)	43.28 ± 1.4	43.52 ± 1.55	0.612
Amplitude (µv)	109.76 ± 8.53	101.36 ± 14.29	0.048

* Based on Mann-Whitney Test

Table 1, shows the measurement results for amplitude and latency of ERG, b peak in the case and control groups. There was a statistically significant lower amplitude of ERG, b peak in the case group compared to control group ($p < 0.05$). No significant regarding the latency of ERG, b peak was observed between two groups (p =0.612).

4. Discussion

Research was designed to check the probable toxic effect of hand-arm vibration on retina of road drilling machine operators. In case of demographic finding of population i.e. case and control no statistically significant difference was observed as far as age, sex and visual acuity were concerned. In case of ERG finding, a significant difference ($p < 0.05$) was observed in case of amplitude of ERG, b peak between case and control groups whereas the differences between latency of b wave was not

significant. From the findings of present work one can understand that retina of the laborers of road drilling machine undergoes pathological changes. The authors despite their extensive search regarding the effect of hand arm vibration on human could not find the reference to either support or reject the result of present work but there are certain related references that may supports the findings of this study.

Shushtarian S.M et al on 2018 worked on fifty workers from a segment of a textile factory with machinery creating excessive levels of vibration. ERG was tested in total laborers population. The result was decrease in amplitude and increase in latency of ERG b wave peak measured using ERG. In present study we observed decrease in amplitude of ERG, b peak which is similar to results of present work, and hence supports the result of present study [13]. Bertschinger et al in 2008 reported a 43-year-old man who presented 2 weeks after starting whole body vibration training with a spontaneous vitreous hemorrhage [14]. Another case report was done by Gillan et al, He reported a 52-year-old man with spontaneous vitreous hemorrhage after a session of whole-body vibration training [15].

5. Conclusion

Hand-arm vibration might have adverse effects on retina of road drilling machine laborers causing a decrease in amplitude of ERG, b wave measured using electroretinography.

Conflict of interest: The authors have no conflict of interest with the subject matter of this manuscript

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