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Original Research Article

EFFECT OF SLEEP DEPRIVATION ON VISUAL EVOKED POTENTIALS IN NIGHT SHIFT WORKERS: A HOSPITAL BASED PROSPECTIVE STUDY

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ABSTRACT

Background: Night shift workers are required to stay awake when their circadian rhythm is preparing them for sleep, and to sleep when it is preparing them for wakefulness. Disruptions to the circadian rhythm due to sleep deprivation can lead to deleterious effects on normal neurophysiological functioning. Abnormalities in visual evoked potentials (VEP) can reflect subclinical involvement of visual pathway functioning.
Materials and Methods: Sixty healthy female shift workers at SMIMS, aged 20-40 years, were divided into two groups: Group I - Day shift workers and Group II - Night shift workers. The amplitude and latency of the P100 wave of VEP were recorded. Results were expressed as Mean±SD. Statistical significance between study groups was determined using SPSS version 16.0 software, applying the unpaired student 't' test.
Results: A statistically significant increase in the latency of the P100 wave was observed in female night shift workers compared to day shift workers. No significant reduction was observed in the amplitude of the P100 wave between the groups.
Conclusion: The study concluded that night shifts significantly affect sleep patterns, which can lead to the development of various diseases.
Keywords: Sleep, Night shifts, Visual evoked potentials, P100 wave, Visual pathway, Insomnia.

INTRODUCTION

The internal biological clock regulates sleep and wakefulness in all living organisms and is a key regulator of sleep intensity and duration. Melatonin, another crucial factor, helps maintain normal sleep patterns.[1-3] The body's metabolism is regulated according to the day and night cycle. Various factors can disrupt this cycle, leading to the development of multiple diseases. Studies have shown that the body reactivates during sleep, making it essential for overall health.[4] In today's world, many jobs require day and night shifts, which can disturb worker's internal biological clocks. This disruption can lead to changes in sleep quality and duration. Night shift workers perform their tasks under artificial light, causing the circadian rhythm to become highly unstable and potentially leading to metabolic and psychological disorders.[5,6] Sleep deprivation significantly impacts cognitive functions, including reaction time, cognitive thinking, problem analysis, procedural processing, and thought processes. There are numerous methods to analyze the effects of shift work on daily activities.[7] One such method is evaluating visual evoked potentials (VEP), which are electrical potential differences recorded from the scalp in response to visual stimuli. Pupil diameter, an indicator of changes in the circadian pattern, is also measured. In night shift workers, the affected circadian pattern indirectly influences pupil size.[8,9] With this background, the present study aimed to evaluate the effect of sleep deprivation on visual evoked potentials in night shift workers.

MATERIALS AND METHODS

Study Settings: The study was conducted in the department of Physiology, Sree Mookambika

Institute of Medical Sciences, Kulasekharam, Kanyakumari (Dist), Tamil Nadu.

Study design: Cross sectional observational study.

Study period: The study was conducted for two months June-August 2016.

The inclusion criteria for this study are individuals aged above 18 years, who are either night shift or day shift workers, and are employed in the healthcare system. The exclusion criteria include males, pregnant women, nursing mothers, individuals with duties exceeding 18 hours, those suffering from insomnia, and those on hormonal medication.

Study groups

Group-I: Night shift (n=30)

Group-II: Day shift (n=30)

Procedure

The study protocol was approved by the Institutional Research Committee and the Institutional Human Ethics Committee. After receiving ethical clearance, a total of 30 day-shift and 30 night-shift workers who met the inclusion and exclusion criteria were included in the study. The study procedure was explained to all subjects, and informed consent was obtained. Both groups were asked to come to the experimental area, where each subject was further briefed on the procedure. All participants underwent simple visual reaction time tests and visual evoked potential measurements. Following the standard procedure suggested by Nikam LH et al., the tests were conducted using reaction time machines for both the right and left eyes. The reaction time, latency, and amplitude were measured and recorded.

Statistical Analysis

The data was expressed in number, percentage, mean and standard deviation. Statistical Package for Social Sciences (SPSS 20.0) version used for analysis. Unpaired t test applied to find the statistically significant between the groups. P value less than 0.05 considered statistically significant at 95% confidence interval.

RESULTS

The study included 60 subjects and divided into two groups each of 30 members. The mean age of group-I is 28 and group-II is 29 years. Comparison of age between the groups did not show any significant effect. BMI and height were compared between the groups did not show any significant effect (Table-1). Group-I subjects had visual reaction time high compared to group-II. The difference between the mean visual reaction time showed significant difference compared group-I with group-II with p value less than 0.05. (Table-2). Group-I right eye showed high latency compared to group-II. The mean of latency of visual evoked potential showed significant compared group-I with group-II. In the left eye of group-I had latency 116.29 and group-II 111.34. The mean difference showed significant difference. Amplitude of left and right eye compared between the group-I and II not showed any significant difference. Group-II right and left eye had higher amplitude compared to group-I. (Table-3)

Table 1: Comparison of mean demographic data between the groups

Demographic data	Group-I (MEAN±SD)	Group-II (MEAN±SD)
Age (years)	28.76±1.45	29.34±1.41
BMI	22.19±1.07	23.85±1.04
Height (cm)	53.42±1.53	55.34±1.92

Table 2: Comparison of mean visual reaction time between the groups

Groups	Visual reaction time (MEAN±SD)	p value
Group-I	276.83±28.43	0.02
Group-II	167.94±19.34*	

*(*p<0.05 significant compared group-I with group-II)*

Table 3: Comparison of mean latency and amplitude between the groups

Observation	Eye	Group-I (MEAN±SD)	Group-II (MEAN±SD)	p value
Latency of visual evoked potential	Right	119.45±5.94	115.29±3.24*	0.05
	Left	116.29±4.29	111.34±5.17*	0.04
Amplitude of visual evoked potential	Right	5.12±3.76	6.31±4.02	0.16
	Left	4.83±2.18	5.62±2.16	0.21

*(*p<0.05 significant compared group-I with group-II)*

DISCUSSIONS

The present study included 30-night shift and 30-day shift workers. Demographic and clinical data for all subjects were collected and analyzed. The mean age of participants in both groups ranged between 23 and 28 years, with similar BMI and height. Significant differences were observed in visual reaction time between Group I (day shift workers) and Group II (night shift workers), with day shift workers showing shorter reaction times compared to night shift workers. This finding aligns with the study by Hemamalini RV et al., which also reported prolonged visual reaction times in night shift workers.[10] Similarly, McCarthy et al. revealed that sleep deprivation significantly affects reaction time and amplitude, indicating that changes in sleep patterns reduce attentional responsiveness and efficiency in performing known tasks.[11] Pilcher et al. further concluded that sleep deprivation or altered sleep patterns significantly impact daily activities, particularly psychological functions more than physical ones.[12] Bings PG et al. found that short-term sleep deprivation did not show significant changes, suggesting that long-term deprivation may be the cause of observed symptoms.[13] Additionally, some studies showed minimal differences in visual scale duration and amplitude, possibly due to adaptation to shift work. Various factors, including age, gender, type of work, light intensity, exposure duration, time of measurement, comorbidities, existing diseases, and stress, can affect visual evoked potential (VEP) scale readings. It was noted that VEP amplitude and latency can be influenced by head circumference and time of measurement.[14] A study showed a significant correlation between latency and head circumference. The results of the present study are consistent with previous research, suggesting that long-term night duties significantly affect reaction time and amplitude.

Limitation of the study

The study done in a smaller number of samples and all are females.

CONCLUSION

The study results concluded that there is a significant increase in the latency of visual evoked potentials in night shift workers compared to day shift workers. These changes may lead to visual problems. It is essential for night shift workers to take proper rest to avoid such issues.

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