International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Effects of Duration of Sleep on Visual Reaction Time in First Year Dental Students

Dr Sharda Singh[1], Dr Anu Khera[2], Dr Gitanjali Gupta[3], Dr Etisha Sharma[4], Dr. Hansika Rastogi[5], Dr Isra Gulzar[4], Dr Dikshya Shivam[6]

[1]Associate Professor, Dept of Physiology, Autonomous State Medical College, Kaushambi, Uttar Pradesh
[2]Assistant Professor, Dept of Anatomy, Pacific Institute of Medical Science, Udaipur, Rajasthan
[3]Associate Professor, Dept of Biochemistry, Pacific Institute of Medical Science, Udaipur, Rajasthan
[4]Postgraduate Student (MDS), Dept of Pediatric and Preventive Dentistry, ITS Dental College, Hospital and Research Centre, Greater Noida, Uttar Pradesh
[5]Postgraduate Student (MDS), Dept of Pediatric & Preventive Dentistry, Kothiwal Dental College & Research Centre, Moradabad, Uttar Pradesh
[6]General Dentist, ITS Dental College, Hospital and Research Centre, Greater Noida, Uttar Pradesh

OPEN ACCESS

Corresponding Author:

Dr Sharda Singh
Associate Professor, Dept of Physiology, ASMC Kaushambi, Uttar Pradesh;
Email: shardarya@gmail.com

Received: 03-04-2026
Accepted: 30-04-2026
Available online: 18-06-2026

ABSTRACT

Introduction: The recommended duration of sleep is 7-9 hours for adults as per The National Sleep Foundation, US. Sleep of shorter duration (< 7 hours per night) in adults causes Sleep Deprivation (SD). Reaction Time (RT) is the interval between the onset of a stimulus and the commencement of a movement response. Reaction time has been most frequently used to assess the effects of sleep deprivation on psychomotor ability. Visual reaction time (VRT) is the time a person takes to respond after presenting a visual stimulus.
Objective: To find out the association of duration of sleep with visual reaction time.
Materials and methods: The current study was done on first year dental students. For Visual Reaction Time (VRT) red color picture is used and the duration of time to press the spacebar is recorded.
Results: VRT in students who slept less than 7 hours is more than the students who slept for 7-8 hours. The difference between the two groups is statistically significant that is p value < 0.05. Conclusion: Present study confirms that lack of sleep increases Visual Reaction time due to lack of concentration and cognitive slowing.
Conclusion: Present study confirms that lack of sleep increases Visual Reaction time due to lack of concentration and cognitive slowing.

Keywords: Sleep duration; Visual reaction time (VRT); Dental students.

INTRODUCTION

Increasing public awareness of the positive effects of adequate sleep and increasing the proportion of adults to obtain enough sleep for improvement of health, quality of life, and public safety is a national health objective.[1,2] The National Sleep Foundation in the US announced revised (2015) recommendation of sleep as 7-9 hours for adults.[3] Sleep of shorter duration that is less than 7 hours per night in adults causes Sleep Deprivation (SD).[4] Sleep deprivation has detrimental effect on human performance and is associated with deterioration of neurobehavioral performance. Prolonged wakefulness can be due to acute total sleep deprivation or due to chronic partial sleep restriction. Although the latter is more common in everyday life, the effects of total SD have been examined more thoroughly. Both total and partial SD induce adverse changes in cognitive performance.[5] So, present study focused on the effects of chronic sleep deprivation in college students.

Reaction Time (RT) is the interval between the onset of a stimulus and the commencement of a movement response (Magill, 1998).[6] Reaction time have been most frequently used to assess the effects of sleep deprivation on psychomotor ability. It is an indirect index of the processing ability of Central Nervous System and simple means of determining sensory motor association and performance of an individual (Das et al., 1997).[7] Sleep deprivation has been associated with longer reaction

times and there are significant linear correlations of hours of wakefulness with EEG and RT.[8] Sleep deprivation has deleterious effects on task performance in the form of audio-visual reaction time because it causes mental fatigue. The human brain needs adequate sleep to recover from fatigue.

Students of different education levels (from school to university) are chronically sleep deprived or suffer from poor sleep quality and consequent daytime sleepiness. Sleep quality and quantity are closely related to student learning capacity and academic performance.[9] Visual reaction time (VRT) is the time a person takes to respond after presenting a visual stimulus. In the present study we have taken VRT as a tool to assess the effect of chronic sleep deprivation in 1st year dental students.

OBJECTIVE

To find out the association of duration of sleep with visual reaction time.

MATERIALS AND METHODS

The study was conducted in the department of Physiology, ITS Dental College, Greater Noida, Uttar Pradesh during 2018-2019. The protocol was presented, and prior permission was taken from the Institutional Ethical Committee before beginning the research.

A total of 53 students were enrolled in the study. The subjects underwent a careful interview and filled out questionnaires on sleep habits and health. They were required to refrain from alcohol and caffeine intake during the study. Hours of sleep the student had previous night was recorded before recording VRT. Visual stimuli consisted of a video display of collections of pictures of objects in various shapes, size, and colours on a computer.

One picture was displayed for 50 milliseconds on the screen with the interval between two pictures kept around 5-7 seconds. Preceding the task, one specific picture of red colour was shown to each subject and the subject was asked to press the "spacebar" button on the keyboard as soon as the selected picture appeared. The timer on the screen started at the beginning of the video and stopped at pressing the spacebar button. Reaction time, omissions and errors were computed.

RESULTS

Visual Reaction Time (VRT) was recorded and the data was divided into 2 groups:

Group 1: composed of those who slept for < 7 hours and

Group 2: those who slept for 7-8 hours at night previous to the day of recording.

Table 1: Mean reaction time (sec) to visual stimulus

S. No.	Duration of Sleep	Visual Reaction Time (sec)
1.	less than 7 hours (n = 30)	12.05 ± 0.17
2.	7-8 hours (n= 23)	11.44 ± 0.26

Table 2: Comparative analysis between <7 hours and 7-8 hours findings

	VRT (<7hrs)	*VRT (7-8 hrs)*
Mean	12.05533333	11.46304348
Variance	0.031142989	0.071913043
Observations	30	23
Hypothesized Mean Difference	0	
Df	36	
t Stat	9.177822066	
P(T<=t) one-tail	2.91951E-11	
t Critical one-tail	1.688297714	
P(T<=t) two-tail	5.83901E-11	
t Critical two-tail	2.028094001	

VRT in students who slept less than 7 hours is more than the students who slept for 7-8 hours. The difference between the two groups is highly significant that is p value < 0.05.

DISCUSSION

Singer et al., (1993) defined reaction time as being composed of four stages, namely: the start of Eye movements, eye movement time, decision time and muscle contraction time.[10] Yoo et al demonstrated that a single night of shortened sleep duration resulted in decreased memory encoding, which led to less knowledge retention, an effect suggesting the

hippocampus was affected.[11] Choudhary AK et.al reported that loss of sleep has major impact in dynamic changes of mental attention and prolongation of reaction time among watchmen employed in night shift.[12] Cain SW et.al reported that one night of sleep loss slows down reaction time and increases error in Stroop performance but appears to have no significant impact on Stroop interference or facilitation in healthy, young, well-rested individuals.[13] Yogi J et.al reported that SD significantly increases the reaction time to various stimuli, leading to a decrease in the task performance, lapses in concentration and cognitive slowing.[14] Lowry M et.al have shown that amount of sleep and academic success (GPA) are positively correlated.[15] Jalali R et al states that poor sleep, characterized by short duration and irregularity, reduces cognitive functions like attention and information processing, leading to lower GPAs and increased risk of academic failure.[16]

Present study confirms that lack of sleep increases Visual Reaction time due to lack of concentration and cognitive slowing. Therefore, attention span of students reduced during didactic lectures and DOAP sessions. In occupations such as health care, such a decrease in performance can be detrimental and a cause of concern to patient safety. Further study is required to use both auditory-visual reaction time to associate SD with performance of students during formative assessment. Adequate sleep quantity (7-9 hours) and consistent sleep are critical for optimal student learning, memory consolidation, and academic performance.

ACKNOWLEDGEMENT

The authors thank the first year dental students of ITS Dental College, Greater Noida, Uttar Pradesh for their active participation. The authors also wish to acknowledge Dr. Shailendra Vashistha (Assistant Professor, Transplant Immunology-HLA Lab, Dept of IHTM, GMC, Kota) and the VAssist Research team (www.thevassist.com) for their contribution in manuscript editing and submission process.

Conflict of Interest: None

Source of Funding: Nil

REFERENCES

1. Colrain IM, Nicholas CL, Baker FC. Alcohol and the sleeping brain. Handbook Clin Neurol. 2014;125:415–31.
2. Gupta S, Singh S, Maheshwari D, Sardana V, Bhushan B. Analysis of various sleep architecture parameters using polysomnography among patients with recurrent stroke: A cross-sectional study at a tertiary care hospital in Rajasthan. Int J Med Pharm Res. 2025 Sep;6(5):1958-66.
3. Hirshkowitz M, Whiton K , Albert S, Alessi C, Bruni O, DonCarlos L, et al. National sleep foundation's sleep time duration recommendations: Methodology and results summary. Sleep Health. 2015 Mar;1(1):40-3.
4. Colten HR, Altevogt BM, editors. Sleep disorders and sleep deprivation: An unmet public health problem. Washington (DC): National Academies Press (US); 2006. 3, Extent and Health Consequences of Chronic Sleep Loss and Sleep Disorders.
5. Alhola P, Polo-Kantola P. Sleep deprivation: impact on cognitive performance. Neuropsychiatr Dis Treat. 2007;3(5):553–67.
6. Magill RA (1998). Motor Learning Concepts and Applications. 5e, McGraw-Hill, Boston, USA 19.
7. Das S, Gandhi A, Modal S. Effect of pre-menstrual stress on audiovisual reaction time & audiogram. Indian J Physiol Pharmacol. 1997;41:67-70.
8. Home JA. A review of the biological effects of total sleep deprivation in man. BioI Psychol. 1978;7:55-102.
9. Curcio G, Ferrara M, De Gennaro L. Sleep loss, learning capacity and academic performance. Sleep Med Rev. 2006;10(5):323–37.
10. Singer RN, Murphey M & Tennant LK (1993). Handbook of research on sport psychology. Macmillan Publishing, New York, USA 54.
11. Yoo SS, Hu PT, Gujar N, Jolesz FA, Walker MP. A deficit in the ability to form new human memories without sleep. Nat Neurosci. 2007;10(3):385–92.
12. Choudhary AK, Kishanrao SS, Kumar A, Dhanvijay D, Alam T. Sleep restriction may lead to disruption in physiological attention and reaction time. Sleep Sci. 2016 Jul-Sep;9(3):207-11.
13. Cain SW, Silva EJ, Chang AM, Ronda JM, Duffy JF. One night of sleep deprivation affects reaction time, but not interference or facilitation in a Stroop task. Elsevier Brain Cognit. 2011 Jun;76(1):37-42.
14. Yogi J, Hirkani M. Effect of sleep deprivation on audio-visual reaction time in resident doctors: A measure of task performance. Indian J Basic Applied Med Res. 2016 Mar;5(2):29-35.
15. Lowry M, Dean K, Manders K. The link between sleep quantity and academic performance for the college student. 2010;3. www.psych.umn.edu/sentience © 2010 Regents of the University of Minnesota
16. Jalali R, Khazaei H, Paveh BK, Hayrani Z, Menati L. The effect of sleep quality on students' academic achievement. Adv Med Educ Pract. 2020 Jul 17;11:497–502.