10.5958/2320-608X.2019.00180.X

Digital Screens Accelerates Visual Fatigue in Young Females than Young Males

T. Sahithi Deepthi[1], K.N. Maruthy[2]

[1]Tutor, [2]Professor& HOD, Department of Physiology, Narayana Medical College, Chintharedypalem, Nellore

Abstract

Younger populations of this modern age are highly exposed to digital screens of different kinds of electronic gadgets. Continuous exposure to digital screens leads to eye strains/ visual fatigue which may impact poor orientation and reduction in efficiency.

Aim: To assess the visual fatigue among young male and female subjects by using critical flickering fusion frequency (CFFF).

Material and Method: A total of 60 young healthy adults of age 17-19 years were invited to participate .Of them 30 were males and 30 were females. The CFFF and visual fatigue protocol consists of the subject has to observe flickering light emitting from red LED module. The changes in light flickering were recognized and report by the subjects. The resulting data was statistically analyzed.

Results: Mean CFFF values for male participants are 45.7 ±23.5 Hertz, female participants is 41.4 ±13.9 Hertz with highly significant p value =0.000. The result of our study appears to be reflecting sex differences in visual fatigue. A statistically significant difference between male and females CFFF data was observed.

Conclusion: CFFF can be considered to be a non-invasive tool, useful for screening of diseases of the optic nerve and also an effective indicator of visual fatigue**.** Occurrence of visual fatigue is seems to be more common in young females than young males which may impact their work performance. This might be reduced by proper guidance; simple changes and precautions such as maintain distance between the screens and eye, regular blinking while seeing the devices.

Keywords: *Critical Flickering Fusion Frequency, Visual Fatigue, Digital Screens, Young Females, Young Males.*

Introduction

Performance of many tasks mainly depends up on visual system .Like the other muscles of the body, eyes can also get fatigued. Prolonged visual activity leads to visual fatigue. Visual fatigue is referred to as eyestrain. Visual Fatigue is associated with decreased arousal that may impair the ability to perform a task which may also impact concentration ability and decrease in efficiency.

Corresponding Author:
Miss T. Sahithi Deepthi
Tutor/Demonstrator, Department of Physiology,
Narayan Medical College, Nellore, Andhra Pradesh
Mobile: 8500539217
e-mail ID: sahithtdeepthi@gmail.com

Now a day's many people without gender variation are suffering from visual fatigue. Work and lifestyle changes increased the demand for viewing digital screens of electronic gadgets such as computers, video gaming, cell phones and TV etc. Eye strains because of flickering lights can trigger occurrence of ocular migraine[1].

In the past, visual fatigue has most often been examined in specific work related tasks like reading[2]. Recent studies reported that 3D, stereoscopic displays are the major causes for visual fatigue[3]. The association between eyestrain with alcoholism, crime, and melancholia is highlighted in 20th century[4]. Poor academic performance, social isolation, headaches, and general psychological malaise are the consequences of eyestrains. Many activities are impaired in association with visual fatigue such as bicycling[5] typing[6],

driving[7]etc. It is typical to recognize difference between general and visual fatigue. Spatial frequency adaptation may be associated with visual fatigue[8].

Along with visual activity, visual fatigue is also influenced by environmental as well as individual factors. The symptoms of visual fatigue classified into ocular-surface related, oculomotor related and monocular effects[10]. Monocular effects of visual fatigue are evaluated by self-reporting method[11] and Critical flicker fusion frequency threshold (CFF). In research of fatigue, Cfff has been used since the 1940s and still continues till today [12, 13].

The present study has been done on younger population who were living in the world of digital screens and also to make them aware of related diseases.

Materials and Method

After obtained approval from ethical committee, the study was carried out in the Department of Physiology in Narayana Medical College, Nellore. CFFF was done on 60 volunteers. Of them 30 were young male and 30 were young adult female. All participates were between the age of 17 to 19 years who were in good health at the time of data collection. Participants with old age, Psychiatric disease, history of epilepsy, habit of alcohol and smoking were excluded from the study. The critical flicker fusion (CFFF) frequency was measured with a standard electronic module i.e., CFFF test apparatus was build by Professor - Dr.K.N.Maruthy, in the Exercise Physiology Laboratory in the Department of Physiology at Narayana Medical College Nellore, to assess the subject's visual fatigue and visual sensory sensitivity.

CFFF test can measured the minimal number of flashes per second where an intermittent light stimulus can no longer be stimulates as a continuous sensation. Written consent form is given to all the volunteers. The test was conducted in dusky room with a single 40-w bulb fixed behind the participant. The module contains a board of white background with a central flickering red light emitting diode with a wave length of 160 nm .The frequency of red light diode can be changed at different frequencies ranging from 10 to 80 Hz with the help of SweepGen software.

The subject was made to sit comfortably infront of the red light emitting module from recommended distance i.e.80 cms. While the subject to be tested is looking straight at the LED, the frequency of flicker was slowly changed with the help of software until the participants reported that they have perceived the light from LED is flickered or constant. The data regarding the procedure was obtained from SweepGen software.

Statistical analysis comprised comparison, using unpaired Student's t-test of visual fatigue between the healthy young male and female groups.

Results

The results are given in Table 1. Comparison of visual fatigue by using critical flickering fusion frequency (CFFF) among young male and young female subjects showed statistically highly significant with p value of 0.000. Data showed that there was a reduction in the CFFF value in young female subjects than young male.

Table 1: CFFF values between young male and young female subjects.

S.No.	Status	Mean	Standard Deviation	P Value
1.	Male group	45.72	23.527	0.000
2.	Female group	41.46	13.912	

Discussion

Now a day electronic gadgets are the essential equipments in everywhere as a result the young population is exposed to a variety of digital screens that rise hazards related to continuous usage. Visual fatigue is rarely becoming as a serious condition. Commonest cause for eye fatigue are continuous driving, reading, exposure to bright light and staring for long periods at digital devices. The symptoms related to eye strain includes tired, itching and burning eyes .Reduced critical fusion frequency has been used as an index of central fatigue[14].The problems raised by visual fatigue adversely affect the user quality of life, efficiency and reduced their productivity[15]. The prevalence of visual fatigue is higher in VDT operators[16]. Studies done on Indian information technology professionals showed that prevalence of visual symptoms is high in the IT professionals [17].

Critical flickering fusion frequency (CFFF) is one of the cognitive function tests used to measure the time resolving ability of eye. It is expressed in Hz, which is referred as threshold frequency[18].The ability to distinguish discrete sensory events is measured by threshold. Threshold frequency is related to persistence

of vision. Since the quick and easy administrative method of CFFF, it can be used widely in human population to study the human performance, behavior, fatigue, central nervous system activity and arousal. An increase in CFF threshold indicates an increase in visual sensory sensitivity. On the contrary, a decrease in CFF threshold indicates an increase of visual fatigue [19].

In our study, young male subjects showed high CFFF value than young female subjects (Table 1). Diffusion of flickering light initiates metabolic activities in the retina. An increased sensory threshold leads to arousal of cortical visual system [20]. Normal CFFF ranges from 35- 40 Hz [21]. CFFF value is slightly more than normal range in female participants but it is less when compared to male participants. Reduction in flicker sensitivity in females showed delays in the impulse response function. That implies the sensory thresholds, cortical arousal and alertness mechanism are inhibited in females which are influenced by eyestrains. Retina and left cerebral cortex are involving in perception of flickering of light [22].

CFFF is accepted and used as an indicator of the cortex arousal level and as an indicator of physical human fatigue and mental workload. It was reported previously that the females are fatigued more than males when exposed to same type of work [23]. However there is no gender variation in fatigue related to the mental work [24]. .Flickering lights are one of the causes for ocular migraine headaches commonly founded in females than males. Prevalence of visual fatigue in female population is more than males which is reflected in our study CFFF.

CFFF parameter is significantly less in female when compared to male group. Many studies stated that the CFFF was wide implication in the study of arousal and fatigue. Any electronic equipment when used properly and purposefully does not cause adverse affects for the users. In another study, CFFFR threshold values are slightly higher in males when compared to females and these values are statistically not significant[25]. Consequences related to visual fatigue like migraine is most common in females. And also there is a variation in the performance of task between male and female. Females are exhibiting different fatigue characters than males. Visual fatigue may relive after taking rest or a change in task. However some studies have reported that subjects are not complaining about visual discomfort even with visual fatigue [26].

Conclusion

The data of our study found significant changes in CFFF between male and female subjects. It is appears to be reflecting that there is a variation in visual fatigue among young male and females. Occurrence of visual fatigue is seems to be more common in young females than young males. This may suggest that proper guidance and education about the usage of gadgets may prevent the prevalence of hazards related to continuous usage. Taking precautions like maintaining specific distance between digital gadgets and regular gaps between the works and also eye blink often while using digital devices may help to reduce visual fatigue. The results may also suggest that CFFF could be treated as an indicator for visual fatigue.

Source of Support: Nil

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: The Study Was Approved By Institutional Ethical Committee of Narayana Medical College, Nellore.

References

1. Think about Your Eyes. American optometric association, 2019.
2. Griffing H, Franz, S. I. On the conditions of fatigue in reading. Psychological Review. 1896; 3(5):513-530.
3. Emoto, M, Nojiri, Y, Okano, F. Changes In Fusion Vergence limit and its Hysteresis after Viewing Stereoscopic TV .Displays, 25 (2-3), 67-76.
4. Anon. Eye strain and its effect on health. [Electronic Version]. The New York Times. Retrieved August 1, 2008 database.
5. Anon. Say bicycle eye is a reality: Erect posture riding, a careless glance at the landscape, and protection against glare the remedy. [Electronic Version]. The Chicago Tribune, 2008; pg. 46. Retrieved August 1.
6. Anon. Typewriter and the eye: It aids the vision and the oculist likewise. The contradiction explained. New York practitioner gives instances where the machine is invaluable to many classes of workers. [Electronic Version]. ProQuest Historical Newspapers the New York Times, 2008; pg. 2. Retrieved August 1.

7. Anon. Eyes Can't Stand the Pace of Auto Speeding and Moving Pictures [Electronic Version]. The Washington Post (1877-1954), SM4. Retrieved August 4, 2008 from ProQuest Historical Newspapers the Washington Post, 1877 – 1992.
8. Watten, R. G, Lie, I, Magnussen, S.VDU work, contrast adaptation, and visual fatigue. Behaviour & Information Technology, 1992;11(5):262-267.
9. John M. Sullivanv, Fatigue and the Driver, UMTRI -50 -2008.
10. Dillon, T. W, Emurian, H. H. Reports of visual fatigue resulting from use of a video display unit. Computers in Human Behavior, 1995; 11(1): 77-84.
11. Simonson, E, Brozek, J. Effects of illumination level on visual performance and fatigue. Journal of the Optical Society of America, 1948; 38(4): 384-397.
12. Luczak, A, Sobolewski, A. Longitudinal changes in critical flicker fusion Frequency: An indicator of human workload. Ergonomics, 2005; 48(15): 1770-1792.
13. Ernst Simonson and Norbert Enzer, Measurement of fusion frequency of flicker as a test for fatigue of the central nervous system, Journal of Indus. Hyg. Tox, 23,1941; 83-89.
14. Subratty AH, Korumtollee F, Occupational overuse syndrome among keyboard users in Maurittus. Indian journal on occupation and environment.2005; 9(2): 71-9.
15. De Seneviratne , G K K Sewwandi, S Sharmilee. Visual and musculoskeletal problem among video display operators and their ergonomic and working condition [Internet]. 2001; Page 204-9. Available from http:// www.med.cmb.ac.lk.
16. Sharma AK, Khera S, Khandekar J. Computer related health problems among Information Technology Professionals in Delhi. Indian visual symptoms and stress were found to be more common in software field. Journal of Community Medicine, 2006; 32(1): 36-8.
17. Dr.R.N.Roy," A Text Book of Biophysics", 2009; page: 421. 2009.
18. Li, Z, Jiao, K, Chen,et al, "Reducing the effects of driving fatigue with magnitopuncture stimulation," Accident Analysis and Prevention, 2004; 36 (4): 501-505.
19. Wells EF, Bernstein GM, Scott BW, et al, CFFF responses in visual cortex, Journal of Ophthalmology.2006; 90 (30): 342 346.
20. S. Yadav, R. Boddula , G.Genitta , et al, Prevelance and risk factors of prehypertensive and hypertensive in an affluent north Indian population , Journal of Medical Respiration , 2008; 128: 712-720.
21. Iwasaki, Kurimoto, S, Noro, K. The change in colour Critical Flicker Fusion (CFFF) values and accommodation times during experimental repetitive tasks with CRT display screens. Ergonomics, 1989; 32(3), 293-305.
22. Maclaren D, Gibson H, Parry-Billings M et.al. A review of metabolic and physiological factors in fatigue. Exercise Sports Scientific Review, 1989; 17:29-66.
23. Åhsberg, Gamberale, F.Perceived fatigue during physical work: An Experimental Evaluation of a Fatigue Inventory, IJIE, 1998; 21, 117-131.
24. Wells EF, Bernstein GM, Scott BW,et al, CFFF responses in visual cortex, Journal of Ophthalmology, 2006; 90 (30): 342 346..
25. Wolska, Switula, M. Luminance of the surround and visual fatigue of VDT operators. International Journal of Occupational Safety and Ergonomics, 1999; 5(4): 553-581.
26. John M. Sullivan, A Study of Critical Flickering Fusion Frequency Rate in Media Players, Fatigue and the Driver, UMTRI -50 -2008.