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Original Research Article

Visually Stressful Activities and Associated Symptoms amongst Medical Students

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Abstract

This complete enumeration, cross-sectional, descriptive study was conducted at Rajiv Gandhi Medical College, Thane, Maharashtra State, India, to determine the frequency of visually stressful activities and associated symptoms among undergraduate medical students of either gender. After approval from the Institutional Ethics Committee, the purpose and procedure of the study was explained to participants and written informed consent was obtained. Primary data related to visually stressful activities, presence of refractive errors in the participants or their family members and associated self-reported symptoms were recorded on a proforma. The mean age for males (n=32; 52.46%) was 19.33 ± 1.04 years (95% CI: 18.97 – 19.69 years), while that for females (n=29; 47.54%) was 18.74 ± 0.73 years (95% CI: 18.48 – 19.01 years). The Smart phone was the predominantly used electronic display device and though the daily mean duration of use was higher for males, the gender differences were not significant. The results revealed a moderate prevalence of computer vision syndrome with no significant gender difference among the symptomatics, except for backache which was significantly (Z=2.465; p=0.013) self-reported by female participants. Since electronic display devices, such as, computers, laptops and Smart phones are universally used both at work and for recreation; users ought to be made aware of measures for prevention of computer vision syndrome.

Keywords: Computer vision syndrome, Medical students, Smart phone, Visual stress.

INTRODUCTION

Medical students function in a time-constrained setting and are expected to multi-task academic and clinical responsibilities, as well as cope with their own personal issues. Current undergraduate medical students have grown up with online technology and owing to the availability of online medical literature and databases they give preference to online learning, which is accessible at any time of the day or night [1-3]. Electronic screens, which require focussed vision, are found everywhere in desktop computers, laptops, tablets and mobile phones. Extended reading, writing or other intensive "near work" can cause eye strain due to increased work of accommodation muscles. The normal human blinking rate of about 15 times a minute is reduced while using electronic digital display devices and this increases risk of harmful effects [4].

Computer vision syndrome (CVS) is a repetitive strain disorder that manifests as a complex of eye and vision problems resulting from focusing the eyes on electronic digital display devices for protracted, uninterrupted periods of time [5]. Working on computer screen requires the eye to focus on near object for which, accommodation of eye occurs. During accommodation, the anterior part of lens protrudes and its diameter changes from 10 mm to 6 mm, which pushes the iris forward, which may cause temporary hindrance to trabecular meshwork due to which, the intra-ocular pressure may increase [5]. According to the National Institute of Occupational Safety and Health, United States, CVS affects about 90% of those who spend three hours or more per day at a computer or similar electronic display device [6]. Symptoms of CVS include headache, tiredness and burning sensation, excessive lacrimation, red eyes, blurred vision, neck pain, eye strain (asthenopia), double vision, sensitivity to light or glare, changes in colour perception and difficulty refocusing the eyes. These symptoms can be further aggravated by inappropriate ambient lighting conditions, wrong posture or wrong distance [7-9].

Healthy human eyes can easily focus on most printed material, which is represented by contrasted

black images with well-defined edges. Since the images on a computer screen (pixels) do not have well-defined edges but are brightest at the centre and diminish in intensity toward their edges, it is difficult for the eyes to maintain focus onto these images [10]. The normal blink rate (20-22 times per minute) is reduced to 4-6 times per minute, causing evaporative dry eye, which is worsened by air conditioning. Prolonged viewing strain the ocular muscles and also causes dry eye. Awkward or unnatural posturing while using computer or similar display devices causes backache and pain in the neck and shoulder [11].

The risk factors responsible for CVS include prolonged viewing, uncorrected refractive error, use of unsuitable glasses while working on computers and similar electronic display devices, dry eye, glare and reflections from the monitor, strain on the ocular muscles, awkward or unnatural posture while using computers and similar display devices, non-ergonomic workstation [12], pre-existing eye disease, female gender, prolonged viewing, absence of visual display terminal (VDT) filter and use of contact lenses [13].

The objective of the present study was to determine the frequency of visually stressful activities and associated symptoms among undergraduate medical students so that appropriate interventions can be initiated.

Materials and Methods

This complete enumeration, cross-sectional, descriptive study was conducted at Rajiv Gandhi Medical College, Kalwa, Thane, Maharashtra, India after obtaining approval from the Institutional Ethics Committee. After explaining the purpose and procedure of the study, written informed consent was obtained from the participants (medical students of either gender). Primary data related to visually stressful activities, presence of refractive errors (if any) in the participants or their family members and associated self-reported symptoms were recorded on a proforma.

The data were statistically analyzed using EpiInfo Version 7.0 (public domain software package from the Centers for Disease Control and Prevention, Atlanta, GA, USA). Continuous data were presented as Mean and Standard Deviation (SD). 95% Confidence interval (CI) was stated as: [Mean-(1.96)*Standard Error)] - [Mean+(1.96)*Standard Error)]. The standard error of difference between two means and standard error of difference between two proportions were calculated. A "p" value of <0.05 was considered as statistically significant.

Results and Discussion

Age Distribution

The mean age for males (n=32; 52.46%) was 19.33 ± 1.04 years (95% CI: 18.97 – 19.69 years), while that for females (n=29; 47.54%) was 18.74 ± 0.73 years (95% CI: 18.48 – 19.01 years). The gender difference in the age of participants was statistically significant (Z=2.565; p=0.010). The maximum age was 21.5 years and 20.5 years for males and females, respectively, while the minimum age of participants was 18 years for both sexes (Fig-1).

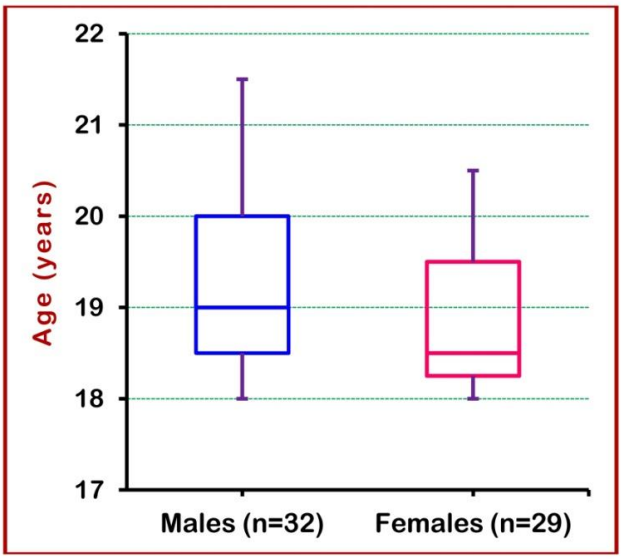

Fig-1: Boxplot of age distribution of participants

Visually Stressful Activities

Though the mean duration (hours/day) of visually stressful activities was higher for males (Fig-2), the mean duration of Smart phone use was almost similar in males and females and the gender differences were not significant (Table-1). Smart phone ownership was 100% among the medical students in the present study, which was conducted in 2018, while an Iranian

study (2014) reported that Smart phone ownership was 61.6% among medical students [14]. Studies from other developing countries have reported varying frequencies of Internet use by medical students – Bangladesh (35.7%) [15] and Sudan (78.9%) [16].

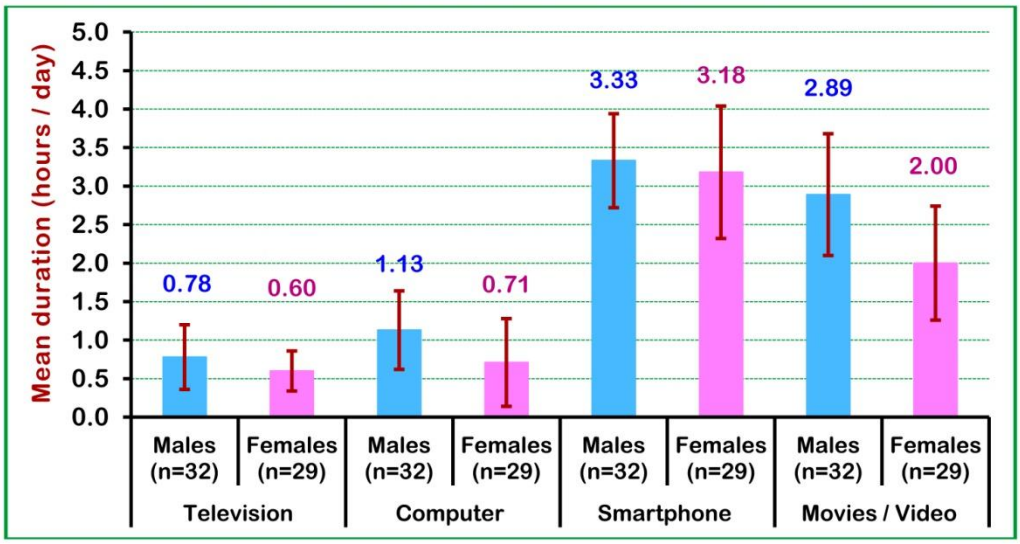

Fig-2: Gender-wise mean duration of visually stressful activities Vertical bars indicate 95% confidence intervals

Table-1: Gender distribution of visually stressful activities

Activity (hours/day)	Mean (SD)		Z value #	p value
	Males (n=32)	Females (n=29)		
Television	0.78 (1.22)	0.60 (0.72)	0.701	0.483
Computer	1.13 (1.45)	0.71 (1.83)	0.981	0.326
Smart phone	3.33 (1.75)	3.18 (2.35)	0.278	0.781
Movies & Video	2.89 (2.27)	2.00 (2.04)	1.615	0.106

Standard error of difference between two means; SD = Standard deviation

A Telengana-based study on young computer professionals revealed significant increase in intra-ocular pressure in both eyes (with a greater rise in the left eye) after exposure to computer screens [4]. In a Malaysian study, 89.9% of the surveyed students reported experiencing at least one symptom of CVS [17]. A female preponderance for asthenopia has been reported and the occurrence was significantly associated with early age of starting use of computer, pre-existing of refractive error, distance from the VDT, level of top of the computer screen with respect to eyes, use of antiglare screen and adjustment of contrast and brightness of monitor screen [18].

Refractive Errors

The frequency of self-reported refractive errors was 22 (68.75%) and 19 (65.52%) for males (n=32) and females (n=29), respectively, with non-significant (Z=0.268; p=0.788) gender difference. 14 (43.75%) males and 22 (75.86%) females reported family history of refractive errors and the gender difference was statistically significant (Z=2.714; p=0.006).

Symptoms

The gender difference among the asymptomatics was statistically significant (Z=2.248; p=0.024). The remaining participants reported multiple symptoms. The gender difference among the symptomatics was not significant except for backache, which exhibited significant (Z=2.465; p=0.013) gender difference (Table-2).

The measures for prophylaxis against CVS include ergonomic work station, using anti-glare screen filter, correction of refractive errors, periodic eye exercise and maintaining good sitting posture to avoid neck pain and backache [19]. Eye strain is diminished when the computer monitor is at a distance of 35-40 inches [20]. Adjusting the computer monitor to a viewing angle of 15 degrees lower than horizontal level may reduce the musculoskeletal discomfort (neck pain and back pain) and visual discomfort [21]. The luminance of the room should not exceed three times than the mean luminance of the screen [22]. Anti-reflective coating in spectacle glasses prevents glare and reflections on the front and the back of the lenses and will remove the continuous refocusing exertion by the eyes when viewing the monitor. For focussing on a near vision test card and for focussing on a computer screen or similar electronic display devices, different types of spectacle glasses are required [23].

Table-2: Gender distribution of self-reported symptoms†

Symptoms	Males (n=32)	Females (n=29)	Z value #	p value
Asymptomatics	11 (34.37%)	18 (62.06%)	2.248	0.024 *
Eye strain	08 (25.00%)	10 (34.48%)	0.812	0.417
Eye irritation	05 (15.63%)	06 (20.69%)	0.512	0.608
Focussing problem	03 (09.38%)	06 (20.69%)	1.241	0.214
Blurred vision	02 (06.25%)	05 (17.24%)	1.338	0.180
Double vision	01 (03.13%)	02 (06.90%)	0.672	0.501
Dry / red eyes	08 (25.00%)	03 (10.34%)	1.540	0.123
Watering of eyes	07 (21.88%)	10 (34.48%)	1.100	0.271
Headache	07 (21.88%)	08 (27.59%)	0.516	0.516
Backache	01 (03.13%)	07 (24.13%)	2.465	0.013 *
Neck & shoulder pain	04 (12.50%)	09 (31.03%)	1.784	0.074
Dizziness	01 (03.13%)	02 (03.45%)	0.070	0.944

Standard error of difference between two proportions *Significant
† Multiple symptoms were reported by symptomatic participants

Presbyopic persons reportedly prefer using progressive lenses over bifocals while working on a computer since these lenses integrate an area in the top half of the lens for mid-distance viewing of the monitor and a bottom half of the lens for viewing the keyboard [24]. Asthenopia is linked to prolonged work on computers without periodic interruptions [25]. Eye strain can be forestalled by taking regular small breaks to relax the accommodation muscles. It is beneficial to abide by the "20/20/20" rule – after 20 minutes of using electronic display devices, the user should look at an object about 20 feet away for 20 seconds [26-28].

Limitations

Extrapolation of the findings of this cross-sectional study would be encumbered since this study was limited to 62 medical students and ophthalmic examination was not done. It was not possible to verify the students' self-reported history. Though the participants were medical students, it is likely that some participants would not have recognized and reported some symptoms. Uncorrected refractive errors or non-use of prescription glasses may also cause CVS-like symptoms, such as, blurring of vision and asthenopia. A larger study that incorporates ophthalmic examination that is specifically custom-made for users of electronic display devices would be required in order to generalize the results.

CONCLUSION

The predominantly used electronic display device among participants in this study was the Smart phone. The results revealed a moderate prevalence of CVS with no significant gender difference among the symptomatics, except for backache which was significantly self-reported by female participants. Since electronic display devices including Smart phones are universally used both at work and for recreation, users ought to be made aware of measures for prevention of CVS.

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