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Visual Implications Following Online Classes in Medical Students during Covid Times

Amogh V Harsoor[1], Sheshank V Sajjanshetty[2], Komala V[3]
[1]*Senior resident, Department of ophthalmology,* [2]*Assistant professor, Department of ophthalmology,*
[3]*Junior resident ,Department of ophthalmology*
Navodaya medical college hospital and research centre Raichur ,Karnataka ,584101
Corresponding author: Dr.Sheshank v sajjanshetty
Assistant professor, Department of ophthalmology,NMCHRC Raichur,Karnataka 584101

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ABSTRACT
Purpose :
To evaluate the use of digital devices, reading habits and the prevalence of eyestrain among medical students , aged 22-25 years.
Methods:
The study included 157 medical students attending online classes by electronic device usage via the questionnaire. Additional information on the factors that may have an effect on ocular symptoms was collected.
Results :
15 questionnaires were given to students for which for they opted answers. There were significant number of students who were facing difficulties to cope up with higher screen time due to transition of classroom lectures to online lectures during COVID-19 pandemic. Almost 58% in the study population of medical students use digital devices on daily basis. In addition to using these devices for reading, 52.86 % use for college projects and 45.22% for gaming. The majority of medical students preferred sitting on the chair while reading (79.61% 125 students) with only 21.65% (34 students)preferred to lie on the bed. The study revealed that 77.70% used smartphones as their primary devices for online classes and 62.42% used overall screen time of 2-3 hours. About 32% complained of burning sensation, 24.20% experienced watering of eye and 19.74% blurring of vision. Systemic complaints include headache in 45.85% , tiredness in 38.85%. Out of 157 students at the end of the day , 58.59% (92 students) experience eye strain after working in digital devices.
Conclusion:
The increased use of digital devices by medical students brings a new challenge of digital eyestrain at an early age. Our study reports the patterns of electronic device usage by medical students , evaluates factors associated with eyestrain and highlights the need for further investigation of these issues.
Keywords: Digital device,Eye strain,posture

I. INTRODUCTION

The COVID-19 pandemic, which has swept the globe, has had a notable impact on the lives of students with unpredictable developments unfolding everyday as there's been lockdown in multiple countries on an unimaginable scale.

Educational institutions in the country have been closed since March, 2020 to halt the spread of the novel coronavirus disease (COVID). However,there is uncertainty as to when these colleges will reopen. Since there is no immediate solution to stop the spread of the COVID pandemic, the closure of colleges will continue, having a large effect on the learning of students. The outbreak has changed the traditional teaching method of using black boards to digital device-assisted online classes.[1]

Technology has changed the ways people operate to a large extent. Our generation is highly tech savvy, we use electronic devices for practically all aspects of our life ranging from reading news, to study, work and even for entertainment and communication with family and colleagues.

The reason behind the slow progression of myopia due to outdoor activities has not been brought out , it's probably assumed to be related to daylight exposure.

Asthenopia is clinically defined as a subjective sensation of visual fatigue, eye weakness or eyestrain. It results from imbalance of extraocular muscles, uncorrected refractive errors, accommodative impairment and improper lighting [1].

Individuals who spend long periods looking at computer displays have intense accommodation and extraocular muscle strains, and often exhibit asthenopia[2].

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In the current era, children (even toddlers) are growing up with touchscreen technology at their fingertips. It is reasonable to speculate that the increased use of mobile phones, tablets etc., may contribute toward the rising prevalence of asthenopia in the young.However, our knowledge of eyestrain in the young is currently limited by a scarcity of data investigating the association of asthenopia with behavioral risk factors. In view of the sparse literature on the subject of digital eyestrain in college students, the present study was conducted to assess the prevalence of eyestrain and its relation to digital device use in students.

Although a positive impact on cognitive development and academic skills have been found with negative influence on psychological and social skills . We are aiming to find out ways on how the risk attached with higher screen time on devices on the student's eye can be mitigated and reduced.

II. MATERIALS AND METHODS :

We conducted a study to understand the data on the screen time of students in 22-25 age group via questionnaire in March 2020 - December2020.

The questionnaire was formed by a ophthalmologist of the institution and the institutional survey board approval has been done.

We compiled the data on age groups, presence of refractive error, frequent usage of particular device and comparison of screen time before and after lockdown. The questionnaire was prepared and given to the students batchwise of 20-25 who appeared for the examinations.

The questionnaire included the following questions:

QUESTIONNAIRE

NAME AGE/SEX

DATE YEAR

1) Total time you spend in a day reading a paper, book or writing.
a) Less than 2 hours
b) 2-4 hours
c) 4-6 hours
d) More than 6 hour

2) In addition to reading paper, textbooks what other reading formats do you prefer?
a) Reading from desktop computer
b) Reading from ipone/smartphone
c) Reading from a tablet/ipad
d) Don't use a digital device

3) How often do you use these digital devices?
a) 1-2 times/week
b) 3-4 times/week
c) 5-6 times/week
d) 8-9 times/week
e) Everyday

4) How much time do you send on them?
a) <2 hrs
b) 2-4 hrs
c) 4-6 hrs
d) >6 hrs

5) What is your distance from the book / electronic devices while reading?
a) <25 cm
b) 25-40 cm
c) At an arm's distance

6) What is your posture while reading?
a) Sitting on a chair
b) Lying on bed

7) Which of the following electronic devices do you use?
a) Laptop
b) Desktop computer
c) Smartphone
d) Tablet/ipad
e) E-book reader

8) For what all purposes do you use the devices?
a) Social networking
b) College projects
c) Reading books
d) Watching movies /videos
e) Gaming
f) Others : specify

9) Do you experience eye strain at the end of the day after working on digital devices?
a) Yes
b) No

10) Do you wear glasses?
a) Yes
b) No

11) Have you noticed a frequent change in your glass prescription after usingdigital devices?
a) Yes
b) No

12) Do you use smartphones at bed time with lights switched off?
a) Yes

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b) No

13) What is the power of glasses you wear?
a) Doesn't wear glasses
b) Do not know
c) <1D/ very low power
d) 1-2D/ spherocylindrical
e) 2-4D/ spherocylindrical
f) >4D/ spherocylindrical

14) How much time do you spend on digital devices for online classes?
a) 2-3 hrs
b) 4-6 hrs
c) 8-10 hrs
d) 11-12 hrs

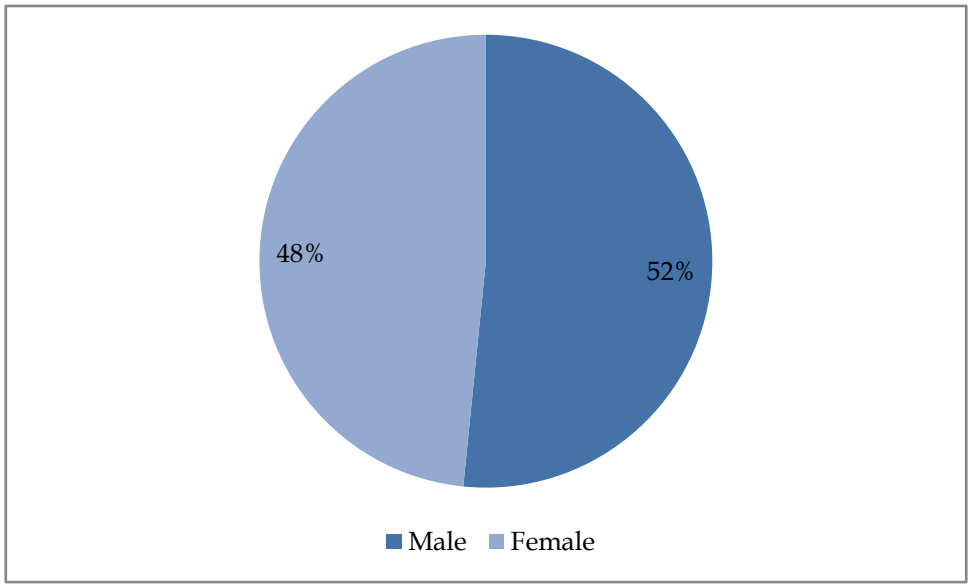
15) Are you experiencing any of the symptoms?
1) OCULAR
a) Not sure
b) Redness
c) Watering
d) Blurring of vision
e) Burning sensation

2) SYSTEMIC
a) Depression
b) Headache
c) Irritable
d) Not sure
e) Sleep disturbance
f) Tired

III. OBSERVATIONS AND RESULTS :

The study included 157 students,81 males and 76 females. The mean age of the participants was 23.6 years and median age was 23.5 years.

Figure-1- Gender distribution



Type of digital devices used:

Among different electronic devices, 77.70% (122 students) used a smartphone, 12.73% (20 students) used a tablet/ phablet/ iPad, 13.37% students (21 students) used a laptop, 23.8% (137) used a desktop computer and 8.91% (14 students) used an eBook Reader device for reading.

Purpose of the digital device used:

52.86% students (83) used it for college projects, 45.22% (71) used it for gaming purposes, 56.68% students (89) used it for social networking, 15.92% (25) used it for reading eBooks and 34.39%(54) used it for watching movies/videos.

Reading habits

: a) Reading habits on a digital device: 61.14% (96) used an iPhone/ Smartphone, 17.83% (28) used an iPad/Tablet and 15.28% students (24) used a desktop/laptop as preferred reading device.

Reading distance:

(108; 68.78%) kept their books/electronic devices at a distance of 25 cms-40cms, 12.10% (19) kept it at an arm's length while reading and 18.47% (29) kept their books at a distance of less than 25 cms.

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Distance (in cm)	No. (In %)
<25 cm	29 (18.47)
Within 25.40 cm	108(68.78)
At arm's distance	19(12.10)

Table-1-Comparision of reading distance in the study group

c) **Reading positions:**

The majority of students preferred sitting on a chair while reading (78.61%; 125) and only 21.39% (32)

Posture	No (in %)
Sitting in chair	125 (78.61)
Lying on bed	32 (21.39)

Table-2-Comparision of reading posture in the study group

d) **Time Spent on reading a book and paper using a digital device:**

Time spent on book/ paper text reading:

Out of 157 students, 29.29% (46) spent 2–4 h a day, 17.19% (27) spent less than 2 h a day either reading or writing, 39.49% (62) spent 4–6 h a day and only 15.28% (24) spent more than 6 h in a day reading a "paper book" or writing in addition to time in college.

Time spent on digital device reading:

However, in terms of time spent on digital devices 62.42% (98) spent 2–4 h in a day, 30.57%(48) spent 4–6 h and 4.45% (7) spent 8-10 h, 1.27% (2) spent 11-12 h each day using digital devices.

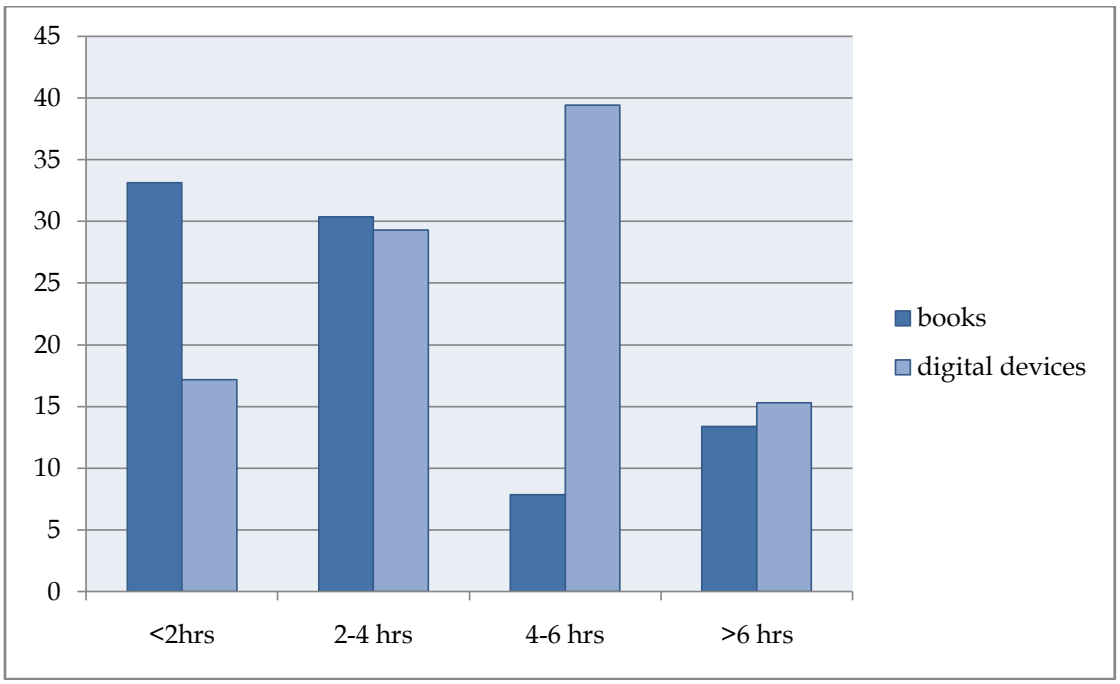

Figure -2-Time spent in hours in reading books / digital devices

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Frequency of digital device usage:

13.37% (21) of students used them 1-2 times/week, 10.82% (17) used them 3–4 times a week, 17.83% (28) used them 5-6 times a week, and 2.54% (4) used these digital devices 8-9 times a week and 57.96 (91) used them everyday.

DIGITAL DEVICE USAGE	NUMBER(IN %)
1-2 times a week	21 (13.37)
3-4 times a week	17 (10.82)
5-6 times a week	28(17.83)
8-9 times a week	4 (2.54)
Everyday	91 (57.96)

Table-3-Time spent on digital device while reading

e)Eyestrain and smartphone addiction

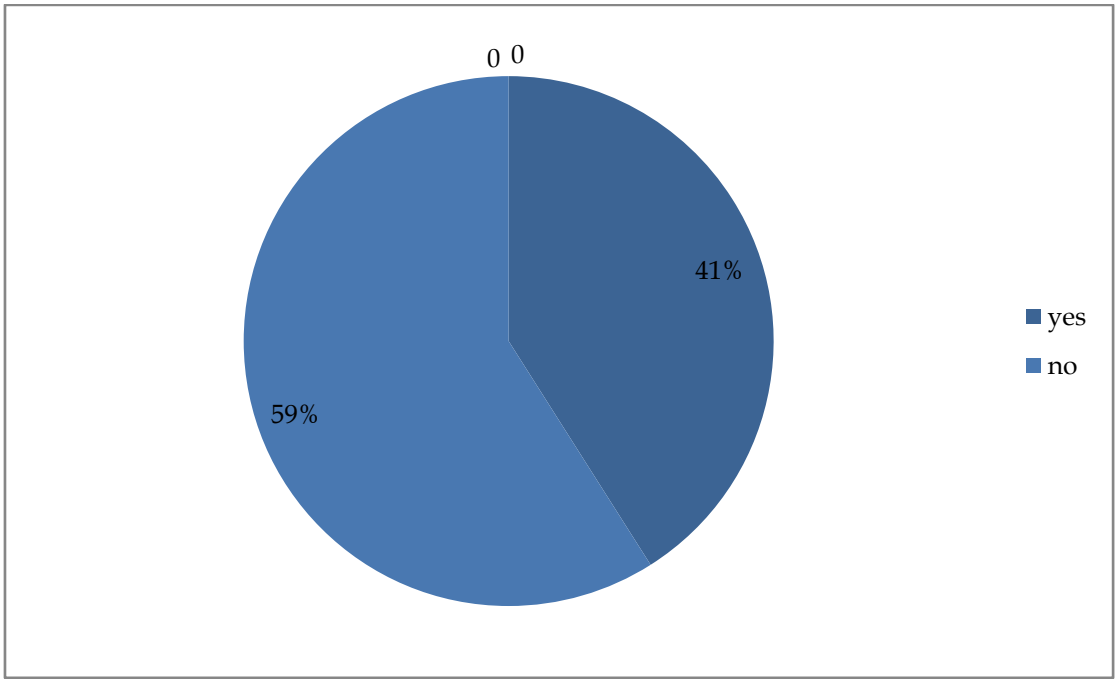

Figure-3-Experience of eye strain at the end of the day after working on digital device

Out of 157 students, 58.59% (92 students) experienced eyestrain at the end of the day after working on the digital devices (fig 3). Although 54.14% students (35) wore glasses, only 33.75% (53) reported a change in their glass prescription after using these electronic devices. The question regarding eyestrain with paper books was asked to the students as an extended question to Question No 9. The difference in eyestrain between the students who chose to read on paper compared to those who read on digital devices cannot be clearly delineated by our study, as students who read on paper also use digital devices for playing games, surfing the internet or social media; therefore the influence of digital device use as a potential confounding factors cannot be totally negated.

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f)symptoms following usage of digital devices

Ocular symptoms		
symptoms	Number of students	% incidence
Not sure	97	61.70%
Redness	15	9.55%
watering	28	17.83%
Blurring of vision	31	19.73%
Burning sensation	20	12.73%

Systemic symptoms		
Symptom	Number of students	% incidence
Depression	26	16.56%
Headache	72	45.85%
Irritable	30	19.10%
Not sure	43	27.38%
Sleep disturbance	39	24.84%
Tired	61	38.85%

Table-4-symptoms following usage of digital devices

IV. DISCUSSION:

The current study have reported the incidence of eyestrain in college students. 59% of the children presenting with typicaleye fatigue symptoms had normal ocular examination. ages of 20 and 28 year. The students had symptoms related to refractive errors,low visual acuity, and accommodative insufficiency[3].

Reading distance

Reading distance influences the magnitude of symptomsexperienced by those using digital devices. The optimumfocus distance for reading and writing is 30–40 cm fromthe eyes. Ideal focus distance is greater for computerviewing, as compared to reading and writing. It is suggestedthat there is lesser eyestrain when the computermonitor is 50–70 cm away from one's eyes [4]. Smallerdigital devices such as mobile phones are usually held at
a distance of 20–30 cm from the eyes, fostering conditionsfor digital eyestrain. Long et al. recently reportedthat viewing distances are closer and the resulting eyestrainsymptoms are greater after reading for 60 minfrom a smartphone [5]. In the present study, however,more than half of the students (68%) maintained an idealreading distance.

Postural variations and musculoskeletal symptoms

Improper posture leads to excessive straining of eyes and hunching of the back leading to pain in the neckand back muscles. Previous authors have attributed this to incorrect posture and excessive usage of digitaldevices [6–8]. In our study, we didn't find any relationship between eyestrain and posture. Of note,most students (79%) preferred sitting on a chair, while the remaining students preferred to lie down whilereading or using digital devices.

Time spent using digital devices

The present study also found that the time spent by students on digital devices each day consistently increasesas age increases. It is advised that adolescents should not have screen time for more than two hours a day[8]. This guidance can be challenging for teenagers to follow, particularly since homework frequently requirescomputer time. Previous studies suggest that the total weekly time spent by adolescents working on computersranges from 80 to 840 min [8–14]. The present study showed that approximately more than half of the 20-28year old students 58% spent every day using digital devices. This observation is notable, given that previous studies have documented the association of a wide array of health complaints with excessive use ofsuch devices [8, 10, 15]. Accelerated myopia is just one of a plethora of health complaints associated with excessivescreen time [16].

Previous studies have reported the prevalence of eyestrain in children. Ip et al. conducted a comprehen-sive study evaluating 1448 children, aged 6 years [5]. The investigators estimated 12.6% prevalence of asthenopia in the group. 82% of the children presenting with typical eye fatigue symptoms had normal ocular

examination [5]. A study by Abdi evaluated 216 children between the ages of 6 and 16 years, and found 23.1% to be asthenopic [6]. The children had symptoms related to refractive er-rors, low visual acuity, and accommodative insufficiency [6]. Another study evaluated 72 children, aged 5–9 years,reporting an estimated asthenopia prevalence of 26.4% [7]. Tiwari et al. evaluated children working in the stone polishing and shoe-making industries in India, in order to evaluate the prevalence of asthenopia in minor workers [8, 9]. The control groups used in both studies did not comprise working children, and prevalence of 24.1 and 12.4% were reported respectively [8, 9]. Vilela et al. subsequently reported a 24.7% prevalence of asthenopia in 964 Brazilian school children [10]. The prevalence reported by our study (17.9%) closely matches the pooled prevalence figure of 19.7% deter-mined by a recent meta-analysis of the available studies [3]. However, none of the studies included in the meta-analysis investigated the effect of the use of digital devices by school children, and the possibility that these devices may be contributing towards the ocular symp-toms [5–9].

Reading distance

Reading distance influences the magnitude of symptoms experienced by those using digital devices. The optimum focus distance for reading and writing is 30–40 cm from the eyes. Ideal focus distance is greater for computer viewing, as compared to reading and writing. It is sug- gested that there is lesser eyestrain when the computer monitor is 50–70 cm away from one's eyes [11]. Smaller digital devices such as mobile phones are usually held at a distance of 20–30 cm from the eyes, fostering condi- tions for digital eyestrain. Long et al. recently reported that viewing distances are closer and the resulting eye- strain symptoms are greater after reading for 60 min from a smartphone [12]. In the present study, however, more than half of the students (56%) maintained an ideal reading distance.

Range and purpose of digital device use

The use of digital devices is now an essential part ofadolescent life style. Adolescents regularly use computersto perform both scholastic as well as leisure activities[17]. In Korea, 60% of the population was reportedas using smartphones in August 2012, only a few yearsafter their introduction [18]. In the present study, whileanalyzing the different types of electronic devices usedand the purpose for which they are used, almost 89%students used a smartphone for social networking. 17% of children usesmartphones for gaming. Although excessive gaming hasbeen shown to have detrimental health effects [6, 9].

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Digital device usage at night

The crispness of high-definition television screens, laptops and tablets can feel easier on the eyes as comparedto older, less defined screens. Most digital screens are backlit and emit blue light or high-energy visible (HEV)light wavelengths. There is evidence that the eye is susceptible to blue light exposure, and that over a periodof time the cumulative damage may increase the likelihood and severity of eye disorders (e.g. age-relatedmacular degeneration and cataracts) [19]. Studies are also reporting the negative impact of smartphone usageon sleep . In our study, 73.24% (115) used their smartphones at bedtimewith lights switched off. We also observed that as age increased, the use of smartphones at bedtime with lights switched off also increased.

V. CONCLUSION:

As we have noticed that the need of the hour lies in the use of the electronic devices and not in eliminating their usage followingmeasures can be taken to prevent their impact and limit the screen time.Avoid the usage of electronic devices outside and in bright environments as glare can produce unnecessary eye strain, remind the college students to blink frequently amid prolonged usage of electronic devices, setting a timer to remind students of their allowed screen time, looking out of the window or at distance for at least 20 seconds after completing a task, using digital bookmarks in e-readers to remind kids to look at distance after a few pages , Encourage the reading of real books as an alternative to e-books, Ensuring good posture while reading or using electronic devices and holding the digital media at least 18-24 inches farther away.

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