

Eye Sight - A Bull's Eye Target of COVID-19

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ABSTRACT

Aim: To determine the effect of COVID-19 on eye sight due to increase screen time in undergraduate students of medical school.

Study design: Cross-sectional study.

Place and duration of study: This survey was carried out from October 2022 to December 2022 in Army Medical College Rawalpindi. Questionnaires were filled in person and also online-based platform was used to distribute the e-questionnaire, developed using the Google Form. The participants were asked to share the e-questionnaire with their friends using Facebook and Messenger.

Methods: Participants were selected for the study using non-probability consecutive sampling. College students of 20-25 years were included in the study. Sample size was 400 according to a study done internationally. Participants with comorbidities (cataract, glaucoma) were excluded from study. Participants having (trouble concentrating on things such as reading the newspaper, books or watching television) were included in the study. Digital eye strain was calculated using validated computer vision syndrome (CVS-Q) questionnaire to measure the symptoms such as eye fatigue, headache, blurred vision, double vision, itching eyes, dryness, tears, eye redness and pain, excessive blinking, feeling of a foreign body, burning or irritation, difficulty in focusing for near vision, feeling of sight worsening, and sensitivity to light. Qualitative data was analyzed using Chi square test.

Results A total number of 470 responses were recorded, out of which 257 (54.7%) were males and 213(45.3%) were females. In our study, the most common symptom was headache, affecting 58.1% of the population before COVID 19 which has increased to 83.2% and the P value is less than 0.001. The other symptoms which also showed P value less than 0.001 were blurred vision while using digital device, irritated or burning eyes, dry eyes and sensitivity to bright light.

Conclusion The practical implication of the study is to create awareness among general population about COVID, that eye sight is Bull's Target to be affected by it and simple preventing measures can be taken. The purpose of this study is to limelight the importance that during COVID 19 lockdown the excessive use of digital devices and their cons on the ocular health among future health care workers.

Key words: Eye sight, Undergraduate students, computer vision syndrome, video display terminals

INTRODUCTION

Over the past decades, great advancements in information technology had been achieved. Increase usage of digital devices, computers, laptops, cell phones, tablets, e-readers and other digital devices, which are collectively called as the devices with Video Display Terminals (VDT), is leading to a complex of eye and vision related problems¹. By the end of year 2019, there was an emergence of Novel Severe Acute Respiratory Syndrome Corona Virus (SARS-CoV-2) from Wuhan, China leading to a global pandemic as declared by WHO on March 11, 2020. With these pandemic, individuals and countries faced huge challenges². Developed countries saw a slowing down of their economy while for the developing nations, it was a horrifying collapse. SARS-CoV-2 killed more people than HIV did in a decade³.

During COVID 19, the frequent usage of VDT devices has given rise to a complex of ocular and non-ocular symptoms, termed Computer Vision Syndrome (CVS), which occurred in individuals who used them with more frequency and intensity⁴. There can be different variables which can be the risk factors for Computer vision syndrome like prolonged duration of computer use, abnormal seating position and viewing distances and lastly, lack of protective practice. Using digital devices more frequently and for longer times have also been shown to be associated with CVS⁵. The diagnosis of computer vision syndrome is caused by excess usage of these devices which not only a annoyance on the visual system but also lead to musculoskeletal strain and circadian disturbances⁶.

These digital devices should be used by keeping them at a distance which is intermediate between near and at distance which is comfortable for near and distant vision⁷. As in the start of COVID-19 pandemic the lockdowns world widely was followed by a surge in the amount of time spent on these gadgets. According to the American Optometric Association, per day minimum of two

hours of continuous digital device usage is enough to bring about the development of an array of vision related problems and is known as digital eyestrain⁸.

The pathogenesis behind the excess usage of digital devices causes the blink rate to fall significantly which effects the meibomian glands they are not mechanically stimulated as often to release a proper lipid layer causing a decrease rate of replenishment of the tear film⁹. The gaze angle is also affected by excess computer use it becomes higher than what normal near work usually demands and the palpebral aperture is vertically larger, leading to faster evaporation and less blinking.

The blue light which is continuously emitted by these devices, is not only proven to be hazardous, but has also raised concerns regarding cumulative phototoxicity¹¹. As with the excess light exposure causes problems in the secretion of melanin by melanocytes in the pineal gland which are controlled by melatonin-containing photosensitive ganglion cells of the retina¹². These cells are highly sensitive to light in the wavelength of 482 nm. It is specifically falling within the blue light spectrum¹³.

There are a very few studies who have measured the prevalence and population-specific CVS-associated risk factors. This study has been conducted to evaluate the impact of the worldwide lockdown on the duration of usage of these devices, and consequently, its effect on ocular health. In this study we have subjected to deal with the student population, specifically the future health care professionals.

MATERIAL AND METHODS

Study design: Cross-sectional study.

Time and Duration of study: This survey was carried out from October 2022 to December 2022. Questionnaire was filled in person and also online-based platform was used to distribute the e-questionnaire, developed using the Google Form. The participants were asked to share the e-questionnaire with their friends using Facebook and Messenger.

Sampling and sample size: Participants were selected for the study using non-probability consecutive sampling. Students of

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medical college, age between 20-25 years were included in the study. Sample size was 400 according to a study reference is given.¹⁴ Participants with comorbidities (cataract, glaucoma) were excluded from the study. Participants having (trouble concentrating on things such as reading the newspaper, books or watching television) were included in the study.

Data collection procedure: Digital eye strain was calculated using validated computer vision syndrome (CVS-Q) questionnaire to measure the symptoms such as eye fatigue, headache, blurred vision, double vision, itching eyes, dryness, tears, eye redness and pain, excessive blinking, feeling of a foreign body, burning or irritation, difficulty in focusing for near vision, feeling of sight worsening, and sensitivity to light.

Data analysis: The CVS-Q questionnaire measured the frequency of the above-mentioned symptoms with the response options of “never,” “sometimes,” and “often” or “always.” If the total score was ≥ 6 , then the student was considered to have CVS. All results were compared with the results of pre COVID-19 era. Descriptive statistics of the baseline characteristics of students were provided as mean and SD for quantitative variables and frequency and percentages was calculated for qualitative variables. Qualitative data was analyzed using Chi square test. All statistical analyses were performed by using SPSS version 22 and statistical significance was declared if p- value is less than 0.05.

RESULTS

A total number of 470 responses were recorded, out of which 257 (54.7%) were males and 213(45.3%) were females. Participants were of age from 20 to 25 years specifically the future health care professionals from medical college. Majority of the people were aware of computer vision syndrome but only few people knew that breaks need to be taken every 20 minutes while working on digital devices. The findings of study have been illustrated in the tables given below

Table-I: Descriptive Statistics (n=470)

Study parameters	n(%)
Age (years)	
Mean \pm SD	22.5 \pm 1.49
Range (min-max)	(20 25) years
Life Styles Group	
Pre COVID 19	124 (26.4%)
Repercussions of COVID 19	346 (73.6%)
Gender	
Male	257 (54.7%)
Female	213 (45.3%)
Digital Device Use	
Desktop	1 (2.0%)
Laptop	45 (9.6%)
Mobile	214 (45.5%)
Tablet	13 (2.8%)
All	30 (6.4%)
Laptop & Mobile	134 (28.5%)
Laptop & Tablet	12 (2.6%)
Tablet & Mobile	8 (1.7%)
Laptop, Tablet & Mobile	13 (2.8%)
Hours of Digital Devices Use	
1 – 2	29 (6.2%)
2 – 4	120 (25.5%)
4 – 6	165 (35.1%)
6 – 8	84 (17.9%)
More than 8 Hour	72 (15.3%)

A total of 470 students were included, 124(26.4%) students were pre covid-19 Students and 346(73.6%) students were repercussions of Covid-19. Mean age was 22.50 \pm 1.49 years range from 20 to 25 years, 257(54.7%) students were Male and 213(45.3%) students were females. 273(58.1%) students used one digital device, 154(32.8%) students used two digital devices and 43(9.1%) three digital devices. 165(35.1%) students used digital device for 4-6 hours followed by 1-2 hour 29(6.2%), 2-4 hours

120(25.5%), 6-8 hours 84(17.9%) and 7(1.5%) students used more than 8 hours shown in Table-I.

Table-II: Comparison of Pre COVID 19 and Repercussions of COVID 19 with respect to Digital Device Use, Hours of Digital Devices Use

Parameters	Study Group		P value
	Pre COVID 19 (n=124)	Repercussions of COVID 19 (n=346)	
Digital Device Use			
One	43 (34.7%)	230 (66.5%)	0.001
Two	45 (36.3%)	109 (31.5%)	
More than Two	36 (29.0%)	7 (2.0%)	
Hours of Digital Devices Use			
1 – 2	5 (4.0%)	24 (6.9%)	0.074
2 – 4	32 (25.8%)	88 (25.4%)	
4 – 6	48 (38.7%)	117 (33.8%)	
6 – 8	14 (11.3%)	70 (20.2%)	
More than 8 Hour	25 (20.2%)	47 (13.6%)	

In Repercussions of COVID 19 majority 109(31.5%) of students used two digital devices 109(31.5%) as compare to Pre COVID 19 439(34.7%) p value = 0.001. There are not significant was found hour of Digital Devices Use between pre COVID 19 and Repercussions of COVID 19 as p value =0.074. Most of the students used digital device at least 4 to 6 in both situation Pre COVID 19 and Repercussions of COVID 19 shown in Table-II.

Table III: comparison of symptoms experienced pre and Repercussions of COVID 19

Eye Sight Problems	Study Group		p value
	Pre COVID 19 (n=124)	Repercussions of COVID 19 (n=346)	
Blurred Vision While using Digital Device	66 (53.2%)	243 (70.2%)	0.001
Blurred Vision when looking into the distance	76 (61.3%)	245 (70.8%)	0.009
Difficulty or slowness in refocusing eyes from one to another	57 (46.0%)	215 (62.1%)	0.002
Irritated or burning eyes	65 (52.4%)	247 (71.4%)	0.001
Dry eyes	42 (33.9%)	211 (61.0%)	0.001
Eye Strain	76 (61.3%)	258 (74.6%)	0.016
Headache	72 (58.1%)	288 (83.2%)	0.001
Tried Eyes	90 (72.6%)	298 (86.1%)	0.006
Sensitivity to bright lights	61 (49.2%)	255 (73.7%)	0.001

There was statistically significant difference of eye sight problems between Pre COVID 19 and Repercussions of COVID 19 (p < 0.05) shown in Table-III. Of the total, 53.2% students had Blurred Vision While using Digital Device in pre covid while in Repercussions of COVID 19 70.2% students had Blurred Vision While using Digital Device. 61.3% had students Blurred Vision when looking into the distance in Pre COVID-19 while in Repercussions of COVID 19 70.8% students had Blurred Vision While using Digital Device. 46% students felt Difficulty or slowness in refocusing eyes from one to another in Pre COVID-19 while in Repercussions of COVID 19. 62.1% students felt, 52.4% students felt Irritated or burning eyes in Pre COVID-19 while in Repercussions of COVID 19 71.4% students felt Irritated or burning eyes, 33.9% students had dry eyes in Pre COVID-19 while in Repercussions of COVID 19 61.0% students had dry eyes, 61.3% students had Eye Strain in Pre COVID-19 while in Repercussions of COVID 19, 74.6% students had Eye Strain. 58.1% had Headache in Pre COVID-19 while in Repercussions of COVID 19 83.2% had Headache. 72.6% felt Tried eyes in Pre COVID-19 while in Repercussions of COVID 19, 86.1% felt tried eyes. 49.2% students felt Sensitivity to bright lights in pre COVID-19 while 73.37% felt Sensitivity to bright lights Repercussions of COVID 19.

Of the total, 53.2% students had Blurred Vision While using Digital Device in pre covid while in Repercussions of COVID 19 70.2% students had Blurred Vision While using Digital Device. 61.3% had students Blurred Vision when looking into the distance

in Pre COVID-19 while in Repercussions of COVID 19 70.8% students had Blurred Vision While using Digital Device. 46.0% students felt Difficulty or slowness in refocusing eyes from one to another in Pre COVID-19 while in Repercussions of COVID 19. 62.1% students felt, 52.4% students felt Irritated or burning eyes in Pre COVID-19 while in Repercussions of COVID 19 71.4% students felt Irritated or burning eyes, 33.9% students had dry eyes in Pre COVID-19 while in Repercussions of COVID 19 61.0% students had dry eyes, 61.3% students had Eye Strain in Pre COVID-19 while in Repercussions of COVID 19, 74.6% students had Eye Strain. 58.1% had Headache in Pre COVID-19 while in Repercussions of COVID 19 83.2% had Headache. 72.6% felt Tried eyes in Pre COVID-19 while in Repercussions of COVID 19, 86.1% felt tried eyes. 49.2% students felt Sensitivity to bright lights in pre COVID-19 while 73.37% felt Sensitivity to bright lights Repercussions of COVID 19 shown in Figure.

The comparison between symptom score and hours of digital device pre and Repercussions of COVID 19 shown in Table-IV. In pre COVID-19, Dry eyes ($p = 0.029$) and Sensitivity to bright

lights ($p = 0.04$) were statistically significant. In Repercussions of COVID 19 Eye Sight Problems were increased, Eye sight symptom score, Blurred Vision While using Digital Device ($p = 0.001$), Blurred Vision when looking into the distance ($p = 0.002$), Irritated or burning eyes ($p = 0.002$), Eye Strain ($p = 0.02$), Headache ($p = 0.049$) and Sensitivity to bright lights ($p = 0.036$) were statistically significant Shown in Table-IV.

The comparison between symptom score and number of digital device pre and Repercussions of COVID 19 shown in Table-V. In pre COVID-19, Difficulty or slowness in refocusing eyes from one to another ($p = 0.005$) was statistically significant. In Repercussions of COVID 19 Eye Sight Problems were increased, Eye sight symptom score, Blurred Vision While using Digital Device ($p = 0.047$), Difficulty or slowness in refocusing eyes from one to another ($p = 0.044$), Irritated or burning eyes ($p = 0.033$), Headache ($p = 0.049$) and Sensitivity to bright lights ($p = 0.034$) were statistically significant Shown in Table-IV.

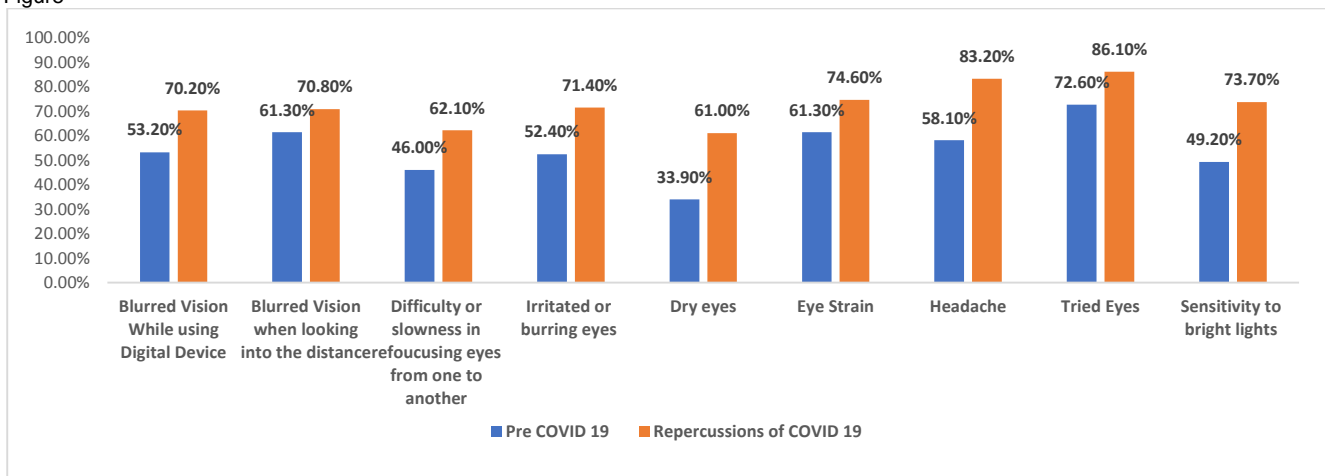
Table - IV: comparison between symptom score and hours of digital device pre and Repercussions of COVID 19

Eye Sight Problems	Hours of Digital Devices Use	Pre COVID 19 (n=124) Mean±SD	p value	Repercussions of COVID 19 (n=346) Mean±SD	p value
Blurred Vision While using Digital Device	1 – 2	0.80±0.83	0.883	1.10±0.78	0.001
	2 – 4	0.88±0.87		1.39±0.89	
	4 – 6	0.81±0.79		1.38±0.85	
	6 – 8	1.00±0.22		1.92±0.92	
	More than 8 Hour	0.72±0.67		2.01±0.22	
Blurred Vision when looking into the distance	1 – 2	1.00±0.44	0.528	0.79±0.18	0.002
	2 – 4	1.03±0.81		1.27±1.03	
	4 – 6	1.15±0.14		1.54±0.87	
	6 – 8	1.29±0.99		1.34±0.94	
	More than 8 Hour	1.20±0.23		1.62±0.92	
Difficulty or slowness in refocusing eyes from one to another	1 – 2	0.40±0.24	0.485	0.75±0.71	0.065
	2 – 4	0.87±0.15		1.17±0.11	
	4 – 6	0.93±0.13		1.26±0.95	
	6 – 8	1.20±0.32		1.21±0.13	
	More than 8 Hour	1.05±0.21		1.99±0.13	
Irritated or burring eyes	1 – 2	1.00±0.44	0.563	0.83±0.16	0.002
	2 – 4	0.96±0.17		0.94±0.10	
	4 – 6	0.82±0.11		0.89±0.08	
	6 – 8	0.97±0.26		1.04±0.12	
	More than 8 Hour	1.16±0.23		0.95±0.13	
Dry eyes	1 – 2	1.60±1.14	0.029	0.92±0.88	0.40
	2 – 4	0.38±0.70		1.06±1.03	
	4 – 6	0.46±0.72		1.32±1.00	
	6 – 8	0.43±0.64		1.23±0.99	
	More than 8 Hour	0.64±0.20		1.53±0.99	
Eye Strain	1 – 2	1.60±1.14	0.525	1.00±0.83	0.02
	2 – 4	0.94±1.01		1.26±0.988	
	4 – 6	0.96±0.92		1.48±0.91	
	6 – 8	1.29±1.06		1.17±0.94	
	More than 8 Hour	0.96±1.02		1.60±0.14	
Headache	1 – 2	1.60±1.14	0.691	0.92±0.72	0.049
	2 – 4	1.28±0.77		1.33±0.85	
	4 – 6	1.10±0.88		1.32±0.72	
	6 – 8	1.36±0.84		1.40±0.93	
	More than 8 Hour	1.32±1.18		1.53±0.74	
Tried Eyes	1 – 2	1.60±1.14	0.771	0.69±0.14	0.124
	2 – 4	1.34±1.00		0.83±0.08	
	4 – 6	1.17±0.97		0.70±0.06	
	6 – 8	1.07±0.829		0.92±0.11	
	More than 8 Hour	1.28±0.93		0.74±0.11	
Sensitivity to bright lights	1 – 2	1.80±0.83	0.04	0.92±0.88	0.036
	2 – 4	0.81±1.03		1.44±1.02	
	4 – 6	0.88±0.98		2.39±0.94	
	6 – 8	1.29±1.13		1.21±1.04	
	More than 8 Hour	0.52±0.82		1.55±1.03	

Table V: Comparison between symptom score and number of digital device pre and Repercussions of COVID 19

Eye Sight Problems	Number of Digital Devices Use	Pre COVID 19 (n=124) Mean±SD	p value	Repercussions of COVID 19 (n=346) Mean±SD	p value
Blurred Vision While using Digital Device	1	0.84±0.12	0.359	0.99±0.56	0.047
	2	0.72±0.12		1.21±0.88	
	>2	0.97±0.77		1.71±0.77	
Blurred Vision when looking into the distance	1	1.09±0.15	0.880	1.42±0.06	0.376
	2	1.02±0.60		1.30±0.09	
	>2	1.14±0.09		1.71±0.42	
Difficulty or slowness in refocusing eyes from one to another	1	1.14±0.16	0.005	0.96±0.97	0.044
	2	0.51±0.81		0.92±0.10	
	>2	0.61±0.83		1.43±0.36	
Irritated or burring eyes	1	0.88±1.02	0.332	0.94±0.06	0.039
	2	0.69±0.79		1.34±0.09	
	>2	1.00±1.04		2.14±0.45	
Dry eyes	1	0.53±0.12	0.981	0.92±0.97	0.033
	2	0.51±0.22		1.12±0.10	
	>2	0.52±0.07		2.22±0.45	
Eye Strain	1	1.12±0.17	0.667	1.30±0.94	0.667
	2	1.00±0.90		1.41±0.97	
	>2	0.92±0.15		1.57±0.48	
Headache	1	1.47±0.93	0.137	0.93±0.79	0.049
	2	1.16±0.95		1.36±0.85	
	>2	1.08±0.84		2.00±0.57	
Tried Eyes	1	1.37±1.00	0.261	1.39±0.78	0.643
	2	1.29±0.94		1.46±0.80	
	>2	1.03±0.91		1.57±0.366	
Sensitivity to bright lights	1	1.09±0.15	0.195	0.78±0.62	0.034
	2	0.78±0.99		1.57±0.09	
	>2	0.97±0.72		2.01±0.05	

Figure



DISCUSSION

In the era of novel coronavirus, the more advancement in information technology and sudden increase in usage of digital devices globally, the overall number of hours of screen time recorded per day have been due to a shift of professional and social activities to a web-based platform¹⁵. Digital devices are actively used for online conference calls, meetings, webinars, online classes, assignments, work from home, personal and social video calls, online shopping, leisure, and entertainment¹⁶.

As eyes are the main target to be affected by screen. In our study in which target participants were students from medical college, predominantly males as compared to the females. The usage of mobile and laptops for 4 to 6 hours was significantly increased in COVID, as before there was decreased screen time. The placarded symptom was blurred vision while using digital device and looking into distance, irritated or burring eyes, dry tied eyes, sensitivity to bright light and the most important headache.

In present study 33.8% students used digital devices for more than 4 hours a day. Similar results were reported by a study conducted by Abusamak et al.¹⁷ This study showed that 45.5% students used mobile phones. A study conducted by Richa et al

showed that 90% of participants used smart phones.¹⁸The less use of mobiles may be attributed to more use of tablets and laptops for online classes.

In our study, the most common symptom was headache, affecting 58.1% of the population before COVID 19 which has increased to 83.2% and the P value is less than 0.001. Headache could be a presentation of eye strain, undiagnosed refractive errors, or could be a result of exposure to continuous bright light for unnatural periods of time. The other symptoms which also showed P value less than 0.001 were blurred vision while using digital device, irritated or burring eyes, dry eyes and sensitivity to bright light.

We concluded that dry eyes were present in 61% students and irritated eyes in 71.4%. This is quite high as compared to another study conducted in Spain which reported 31.1% dry eyes and 24.1% irritation in eyes¹⁹. Furthermore, in comparison to few other studies we observed dry eyes in 61% students and eye strain in 74.6%. These numbers were less than a study conducted in Saudi Arabia which showed eye strain in 50% students and dryness in 48% during the pandemic²⁰. The increased frequency of eyestrain and dryness may be due to more usage of digital devices by undergraduate students.

The explanation of the eye pain is explained by the excessive strain on the intrinsic muscles of accommodation, which are unable fully relax under the viewing distances of digital devices.²¹ Another possible option could be the paucity of breaks in an office environment as compared to work on these devices at home during the lockdown. Other problems which are also associated with it are sleep disturbances, sleep pattern disruption and heavy eyelids due to longer screen time more digital device usage²².

When the comparison between symptom score and number of digital devices pre and Repercussions of COVID 19 was done P value was highly significant in the symptoms, as compared to the studies done internationally¹⁴. As prevention is the only cure so these symptoms can be prevented by changing our lifestyle and by adapting a few habits. Some of these are to voluntarily blink at certain intervals. Forcefully excess blinking during screen time can be encouraged, since this will lead to squeezes the Meibomian glands, and the lipid layer of the tear film is well formed, which can prevent the evaporation from the dry eye²³. With the use of proper placement of digital devices as 4–5 inches below eye level, ensures that most of the eyeball is protected by the eyelids, and only a small inferior portion is exposed to environmental drying forces. As by focusing on distant objects at intervals decreases the accommodative effort of the eyes for a while and prevents eye pain and headache.²⁴ The other problems related to circadian rhythm disturbances can be controlled by using in-built blue light filters in the devices themselves or by wearing plain glasses with a slight yellow tint, called “blue light filter glasses.” Furthermore a warm fomentation followed by a gentle eyelid massage once or twice daily, which can help in healthy functioning of the tarsal glands²⁵. A artificial tear preparation can be recommended. People who wear contact lenses can be asked to wear glasses while working on screens as much as possible²⁶. To incorporate these measures in our life’s would need months of training to result in a conditioned reflex, but considering the need of time and plethora of silent sufferers with digital eye strain will increase in the near future.

CONCLUSION

The practical implication of the study is to create awareness among general population about COVID, that eye sight is Bull’s Target to be affected by it and simple preventing measures can be taken. The purpose of this study is to limelight the importance that during COVID 19 lockdown the excessive use of digital devices and their cons on the ocular health among future health care workers. It is foremost to take measures to spread awareness to reduce the adverse effects and take preventive measures.

Conflict of interest: Nothing to declare

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