International Journal of Medical Ophthalmology

E-ISSN: 2663-8274
P-ISSN: 2663-8266
www.ophthalmoljournal.com
IJMO 2020; 2(2): 33-36
Received: 01-11-2020
Accepted: 30-11-2020

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Ocular symptoms survey among undergraduate students in this COVID-19 era

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DOI: https://doi.org/10.33545/26638266.2020.v2.i2a.39

Abstract
AIM: To find out ocular symptoms in Visual Display Terminals (VDTs) users, among undergraduate students who adopted new education system in this COVID-19 era.
Methods: A cross-sectional, observational survey carried out in the month of September 2020, which included undergraduate students from Ahmedabad, who were using Visual Display Terminals (VDTs) for educational activities for more than 6 to 8 months. A total of fourteen validated questionnaires were selected, webpage survey form was created and the link was sent via various social media platform. Responses were assessed in the scale of 0 to 4 (0= never, 1=infrequently, 2=sometimes, 3= often, 4=always). The percentage of symptoms was calculated in terms of subjects, also in the scale of 0 to 4.
Results: A total of 103 undergraduate students responded with mean age of 19±1.5 years. Highest number (40: 4-6 hours, 36: 7-9 hours) of students had a screen time of 4 to 9 hours per day. The burning sensation (69.8%), redness (51.4%), itching (47.6%) were the most common symptoms, followed by irritation (34.6%), and scratchiness (25.5%) related to dry eyes. However, majority of the patients had those symptoms on infrequent duration.
A loss of the concentration (73.8%), tired eyes (69.6%), discomfort (61.2%), headache (60.7%), reduced reading speed (56.3%), fluctuation in vision (44.7%), blurring (43.7%), were the most common symptoms related to the near work. Majority of participants felt these complain for the duration of infrequent to often basis. The double vision (25.2%) and floating of objects (11.7%) were the least common symptoms related to near work.
Conclusion: The VDTs related symptoms are increasing in the students in this COVID-19 era. Increasing awareness, proper counselling regarding algorithm of VDTs, taking regular breaks, avoiding unnecessary web searching and social media can help to relieve or minizine symptoms related to VDTs work in this COVID-19 era.

Keywords: Ocular Symptoms, VDT users, screen time, COVID-19

Introduction
The 2019 Coronavirus disease (COVID-19) pandemic has resulted in legislation and regulations that included laws on the closing, lockout or shelter-in-place of the national schools and social distance guidelines [1]. In response to the closure of schools, UNESCO has recommended the use of distance learning programmes and open educational applicants and platforms that can be used by schools and teachers to reach students remotely and to reduce educational disruption [2]. India has entered a new era of online education which can result in higher overall screen time among students [3, 4]. This new online education system needed to be periodically reinstated to control future COVID-19 emergencies [5, 6]. This leads to a rapid transition of students from paper to computers and the eye has not adapted to the new role to function for long hours in demanding conditions in a new visual world.
The complex of eye and vision problems related to near work which experienced during computer work referred as computer vision syndrome (CVS) [7, 8]. This near work relates to the use of all visual display terminals (VDTs) that are self-illuminating PCs, cell phones and the new devices that have helped to introduce our hands to a network environment and quick computation [7, 8]. This advancement in science has made a big difference in our lives, so we wonder what life would have been without it. With these benefits, there are several health-related problems, knowledge of which is limited. The initial concern about use of electronic gadgets was centered on radiation, which included X-rays, optical radio frequency, very low frequency and extreme low frequency radiation [9]. Many studies have found no strong evidence of any adverse effects of these on VDTs users [10, 11].

Symptoms related to orthopedics, psychiatry and ophthalmology have been documented in previous studies [12, 13]. The ocular symptoms experience by VDTs users typically include eyestrain, eye fatigue, burning sensations, irritation, redness, blurred vision and dry eyes [7, 14, 15]. The aim of study was to find out ocular symptoms in VDTs users, among undergraduate students who adopted new education system in this COVID-19 era.

Materials and Methods

A cross-sectional, observational survey carried out in the month of September 2020, which included undergraduate students from Ahmedabad, who were using VDTs for educational and other activities more than 6 to 8 months.

A total of fourteen questionnaires were selected to determine the ocular symptoms associated with dry eye and close work among the included participants. The demographic data, history of refractive error, screen time duration was also noted. The participants who were not using any glasses for uncorrected refractive errors or were a diagnosed case of dry eyes, infections or with any systemic diseases that may affect ocular surface and near work were excluded. Questionnaire survey form was created on the webpage and the link was sent to the included participants using various social media platform. All participants were prior informed about the survey and the confidentiality of all participants were also maintained.

Symptoms related to dry eyes (Scratchiness, irritation, burning, itching and redness) questionnaires were adopted from standard patient evaluation of eye dryness (SPEED) questionnaires [16], and symptoms related to near work (fluctuation in vision, tired eyes, discomfort, headache, loss of concentration, double vision, floating of objects, reduced reading speed, blurring of vision) questionnaires were taken from convergence insufficiency symptoms score [17]. They were assessed in the scale of 0 to 4 (0= never, 1=infrequently, 2=sometimes, 3= often, 4=always). Descriptive statistics was calculated in Microsoft Excel 2019 and, the percentage of symptoms was calculated in terms of subjects, also in the scale of 0 to 4.

Results

A total of 103 undergraduate students were responded on the online survey. The mean age of the participants was 19±1.5 years. Among them 58% were female and 42% were male. Of these, 66 % had refractive error and were using glasses or contact lenses for vision correction, rest were emmetropes.

Of these 103 students, highest numbers of students spent 4 to 9 hours (40: 4-6 hour, 36: 7-9 hour) screen time per day (Figure 1). The burning sensation (69.8%), redness (51.4%), itching (47.6%) were the most common, followed by irritation (34.6%), and scratchiness (25.5%) in the symptoms related to dry eyes. However, majority of patients had those symptoms for infrequent duration.

A loss of the concentration (73.8%), tired eyes (69.6%), discomfort (61.2%), headache (60.7%) and reduced reading speed (56.3%) were the most common symptoms related to the near work. Majority of the participants felt those complain for the duration of infrequent to often basis (Table 2). The fluctuation in vision (44.7%), blurring (43.7%), double vision (25.2%) and floating of objects (11.7%) were the least common symptoms in this survey.

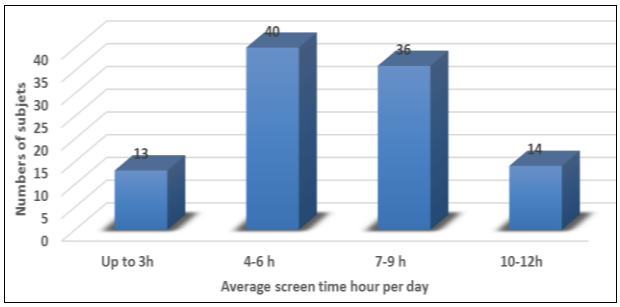

Fig 1: Average Screen time per day of the included subjects.

Table 1: Ocular symptoms related to dry eyes among undergraduate students in this COVID-19 era.

Symptoms	None N (%)	YES (%)	Symptoms Scale frequency			
			Infrequently N (%)	Sometimes N (%)	Often N (%)	Always N (%)
Scratchiness	76 (74.5)	25.5%	21(20.6)	4(3.9)	1(1)	0
Irritation	66 (65.3)	34.6%	27(26.7)	6(5.9)	2(2)	0
Burning	31(30.1)	69.8%	44(42.7)	19(18.4)	7(6.8)	2(1.9)
Itching	54(52.4)	47.6%	30(29.1)	11(10.7)	8(7.8)	0(0)
Redness	50(48.5)	51.4%	40(38.8)	10(9.7)	2(1.9)	1(1)

N= number of students
%= Percentage

Table 2: Ocular symptoms related to near work among undergraduate students in this COVID-19 era.

Symptoms	None N (%)	YES (%)	Symptoms Scale frequency			
			Infrequently N (%)	Sometimes N (%)	Often N (%)	Always N (%)
Fluctuation in vision	57(55.3)	44.7%	28(27.2)	13(12.6)	4(3.9)	1(1)
Tired eyes	31(30.4)	69.6%	26(25.5)	28(27.5)	13(12.7)	4(3.9)
Discomfort	40(38.8)	61.2%	34(33)	20(19.4)	8(7.8)	1(1)
Headache	41(39.8)	60.7%	27(26.6)	21(20.4)	11(10.7)	3(2.9)
Loss of concentration	27(26.2)	73.8%	20(19.4)	35(34)	17(16.5)	4(3.9)
Double Vision	77(74.8)	25.2%	20(19.4)	2(1.9)	3(2.9)	1(1)
Floating of objects	91(88.3)	11.7%	8(7.8)	2(1.9)	1(1)	1(1)
Reduced reading speed	45(43.7)	56.3%	28(27.2)	17(16.5)	10(9.7)	3(2.9)
Blurring	58(56.3)	43.7%	29(28.2)	13(12.6)	2(1.9)	1(1)

N= number of students
%= Percentage

Discussion

Previous study from India has shown that in recent years, the use of screen time has increased rapidly [7, 18]. In 2018, Indian adolescents' estimated average screen time was 2 hours/day [18], while in present study it was found 4 to 9 hours/day in the maximum numbers of students, which was three to four times higher than 2018 data due to the COVID-19 pandemic that implemented a new online education system.

This shifting from paper to computers has been so rapid and strong that the eyes haven't got adapted to the new demands of the work at the new reduced distance environment for extensive hours. Our eyes and brain react differently to the characters on the screen than they do to printed characters.

Healthy eyes can easily maintain focus on the printed page, but characters on a computer screen however do not have this contrast or well-defined edges. These characters (pixels) are brightest at the center and diminish in intensity towards their edges. This makes it very difficult for our eyes to maintain focus and remain fixed on these images. Instead, our eyes tend to drift out to a point called "Resting point of Accommodation" which is approximately 30 inches and grows as we get older. Prolonged viewing of the monitor 12 inches away than it does to focus at 30 inches. When the demand for near work exceeds the normal ability of the eye to perform the job comfortably, one develops discomfort and prolonged exposure, leads to a cascade of reactions that can be put together as CVS [7]. Portello *et al.* [19] identified a clear split of CVS related symptoms in two categories: those seemed linked to dry eye and those associated with accommodation. In our study, we selected 14 questionnaires related to dry eyes and near work or accommodation.

A study by Sheppard *et al*. [20] reported 31.5% VDTs users had symptoms of dry eyes. In our study, 69.8% had burning sensation, redness (51.4%) and itching sensation (47.6%) in the symptoms related to dry eyes. However, most of them had complain on infrequent basis. These symptoms prevalence was higher in our study because of higher screen time in our study population, that can cause reduced blink rate leading to tear film instability and significantly increased burning sensation and tearing to a large extent than a reading a printed book. Previous studies also reported that dry eye was the most frequently reported ocular complain among VDTs users [14, 20, 21]. Many studies describe how performance of all visual tasks lead to reduction in blink rate and blink amplitude commensurate with attention and congestive demands from central neural mechanism [22].

The ocular fatigue is common complain among VDTs users [15, 23]. In our study, 73.8% had a loss of the concentration, 69.6% had tired eyes, 61.2% had discomfort, 60.7% had headache, and 56.3 % had reduced reading speed related symptoms. The higher percentage of near work-related symptoms because of VDTs that produces images when the liquid crystal molecules change their alignment to allow light through pass through [7, 13]. This creates small spots called pixel that, when accompanied by a high level of luminance and contrast can induce asthenopic symptoms. A study by Kim *et al*. [24] also stated that visual fatigue and discomfort were significantly induced even though devices were equipped with state of art display technology.

Conclusion

The VDTs related symptoms are increasing in the students in this COVID-19 era. Proper counselling, increasing awareness, regular yearly complete eye examination, proper lighting, minimizing glare, adjusting brightness of computer screen, taking frequent blinks, refocusing eyes, blinking more often, modified workstation, exercising even while sitting, taking regular breaks, avoiding unnecessary web searching and social media can help to relive or minizine symptoms related to VDTs work.

Limitations:

There are several factors that cause eye dryness and near work related problems or symptoms including dry environment and air contaminants, increased ocular surface exposure, hormonal changes in elderly, contact lens wear, uncorrected refractive errors, certain systemic disease and medication. A hospital based cross-sectional study on large sample size and duration of VDTs usage with their relation to symptoms frequency can give better outcome of the study.

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