

The distribution of eye symptoms related to the use of digital devices among university students in Istanbul, Türkiye

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ABSTRACT

BACKGROUND: This study was designed to describe the distribution of digital eye strain and accompanying variables among students studying at a health campus of a governmental university in Istanbul.

MATERIAL AND METHODS: This is a descriptive study conducted among students at a health campus in Istanbul between February and May 2022. Researchers visited the campus at various times and collected data face-to-face using a convenient sampling technique. The questionnaire included socio-demographic questions, questions on digital device use and eye disorders, and a 17-item Computer Vision Symptom Scale (CVSS17). Categorical data are shown as percentages and frequencies. Mann-Whitney U and Kruskal-Wallis tests were applied. The statistical significance level was accepted as 0.05.

RESULT: A total of 416 participants (69.5% females) with a median age of 23.00 (18–31) included. The main goal of using technological devices was social media (92.5%) and education (87.7%). Among participants, 47.8% declared that they use technological devices more than 6 hours a day. Among students who had an eye disorder prior to the pandemic (n = 257), 50.2% reported an increase in their vision problems. Furthermore, 16.4% of students who did not have an eye disorder before the pandemic (n = 159) reported having a newly diagnosed eye disorder. While using digital devices, 98.6% of students experienced at least one of the ocular symptoms, and 91.3% experienced three or more. The most common symptoms students reported were heavy eyes, pain, and burning sensation.

CONCLUSION: Eye problems related to digital device usage are seen frequently among university students of health disciplines. Although digital eye strain is a temporary condition it can decrease productivity which is important for students. With the pandemic, the role of digital devices in students' daily lives has grown and continues to increase. We believe this topic will require considerable clinical attention in the future.

KEY WORDS: digital eye strain; university students; COVID-19 pandemic

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INTRODUCTION

Digital eye strain is a collection of eye and vision disorders caused by extended use of digital devices such as computers, tablets, e-readers, and mobile

phones [1]. Eye strain, tiredness, burning sensations, irritation, redness, blurred vision, and dry eyes are common ocular problems among computer users [2]. Many people endure eye strain and vision

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difficulties when looking at digital screens for long periods. The level of discomfort tends to rise with the amount of time spent on digital screens [1].

Universally, digital eye strain is the leading occupational hazard of the 21st century and one of the leading public health problems [3]. Global data shows that 60 million people are suffering from digital eye strain and one million new cases occur each year [4]. Also, its symptoms are reported to affect almost 70.0% of all computer customers [3]. It is a growing public health concern and significantly reduces the quality of life and efficiency at the workplace. However, digital eye strain may have a significant impact not only on visual comfort but also on occupational productivity since between 64.0% and 90.0% of computer users experience visual symptoms and ocular discomfort either at near or when looking into the distance after prolonged computer use [2, 5].

Previous research among youths, particularly university students, has revealed that most students suffer from ocular symptoms related to using technological devices. A study conducted in 2021 in Ethiopia among university students showed that the prevalence of digital eye strain is 70.4% [6]. According to a survey study conducted in 2021, in a sample of 228 medical students from Paraguay, digital eye strain was present in 82.5% of participants [7]. Other studies also showed similar ratios of university students having ocular symptoms related to technological device usage [8–10].

During the pandemic, the academic, professional, and social use of computers increased significantly worldwide [11]. So, it is unavoidable that university students' use of digital technologies will rise. COVID-19 spreads quickly in university settings owing to the difficulties in enforcing social distance regulations among students. As a result, education has changed from physical to online teaching, and the frequency of ocular symptoms associated with technological devices has considerably increased among university students [12]. Special attention should be paid to university students due

to the growing extent of online classes, excessive use of electronic devices, and an increased prevalence of digital eye strain symptoms [7].

To our knowledge, the magnitude of digital eye strain and its associated factors among university students in Türkiye was not well studied. Therefore, the aim of this study was designed to describe the distribution of digital eye strain and accompanying variables among students studying at a health campus of a governmental university in Istanbul.

MATERIAL AND METHODS

Study design and sampling

This descriptive study was conducted among students in a health campus that includes medicine, dentistry, pharmacy, and health sciences faculties in Istanbul between February and May 2022, a stable phase of the COVID-19 pandemic. The minimum sample size was calculated as 237 using Piface version 1.76 with a population of 5884, anticipated frequency 0.8 [7, 8], and margin of error 0.05. Researchers visited the campus at different times and collected data face-to-face. A convenient sampling technique was used to collect the data, and all students who were willing to participate were included. Data collection was completed with a total of 416 participants.

The study included 416 students in total, and nearly half of the students were from the medical faculty (47.4%). The sample size does not reflect the faculties individually, which is a limitation of this study (Tab. 1).

Data collection tool

The questionnaire consists of three parts. The first part consists of 4 socio-demographic questions. The second part consists of 13 questions prepared by the researchers in light of the literature on the use of digital devices and eye disorders. The third part consists of the 17-item Computer Vision Symptom Scale (CVSS17) questionnaire, which consists of

Schools	Population (N)	Sample (n) (%*)	%**
Faculty of Medicine	1572	197 (47.4)	12.5
Faculty of Health Sciences	2762	72 (17.3)	3.5
Faculty of Dentistry	818	51 (12.3)	8.8
Faculty of Pharmacy	732	96 (23.0)	6.3
Total	5884	416 (100.0)	7.1

*Column percentage; **Row percentage

17 questions about symptoms related to digital eye strain. The scale was used with the author's permission [13].

CVSS17 was developed by González-Pérez et al. in 2014 to measure digital screen-related ocular and visual symptoms (Cronbach's $\alpha = 0.92$) [13]. The scale is based on the severity and frequency of a symptom and the individual's complaints for 15 different symptoms. It consists of 17 items with different scores giving information about the symptoms. Two items have two response categories, eleven items have three response categories, and four have four. The minimum score that can be obtained from the scale is 17, and the maximum score is 53 (as the CVSS17 score increases, the severity of digital eye strain increases).

Statistical analysis

Analysis was done using statistical packet programs. Data cleanup and cross-checking were done before analysis. Categorical data are shown as percentages and frequencies. Normality tests (Kolmogorov-Smirnov) were applied to continuous variables. For distributions not complying with parametric assumptions, Mann-Whitney U tests were applied when comparing the medians of the two groups, and Kruskal-Wallis tests were applied when comparing the medians of more than two groups. The statistical significance level was accepted as 0.05.

Ethical approval

This study was designed by the principles of the Helsinki Declaration and with the approval of the local ethics committee (03.12.2021.1388). Data were collected after the dean's approval of the related faculties with the assurance that each participant had the full right to participate, refuse, or withdraw at any time. After explaining the purpose of the study, written consent was obtained from each participant.

RESULTS

The study included a total of 416 students, 47.4% being from the faculty of medicine, 17.3% being from the faculty of dentistry, 12.3% being from the faculty of pharmacy and 23.1% being from the faculty of health sciences. The median age of the participants was 20.00 with a range of 18 to 31. Among participants 69.5% ($n = 289$) were females.

The most commonly used device was the mobile phone (99.5%), with the primary goal of using that device was social media (92.5%). On the other hand, 87.7% of the students were using technological devices for the purpose of education, and 73.8% of them played games. Among participants, 47.8% ($n = 199$) of the students declared that they use technological devices more than 6 hours a day, and 53.3% spent more than an hour using the devices without taking breaks. Among students, 60.1% kept less than 40 cm distance while using the devices, and 68.0% stated that they used them in a dark/shady environment.

When asked about present eye disorders, 68.0% ($n = 283$) of students stated that they had an eye disorder, while 61.5% ($n = 256$) used glasses or contact lenses. Among students with an eye disorder before the pandemic ($n = 257$), 50.2% ($n = 129$) declared an increase in their vision problems. Furthermore, among students who did not have an eye disorder before the pandemic ($n = 159$), 16.4% ($n = 26$) said that they had a newly diagnosed eye disorder during or after the pandemic.

Among students, 98.6% of them ($n = 410$) had at least one of the ocular symptoms given in Table 2 while using digital devices, and 91.3% of the students had 3 or more ocular symptoms. The most common symptoms students had while using the devices were feeling their eyes heavy, hurt, or burning, as seen in Table 2.

Statistically significant differences between CVSS17 scores and individual characteristics of

Table 2. Ocular symptoms related to digital eye strain while using the technological devices

Symptoms	n	%
Feeling eyes heavy	378	90.9
Feeling eyes hurt	359	86.3
Burning eyes	322	77.4
Blinking a lot	310	74.5
Stinging in the eyes	306	73.6
Cross vision	282	67.8
Straining to see well	238	57.2
Eye redness	235	56.5
Watery eyes	197	47.4
Dryness	178	42.8
Tired eyes	159	38.2
Lights bothering eyes	159	38.2
Blurry letters	147	35.3
Double image	44	10.6

Table 3. Distribution of 17-item Computer Vision Symptom Scale (CVSS17) scores according to individual characteristics of the participants

Characteristics of the participants		n (%)	CVSS17 Score		p-value
			Median	IQR	
Gender*	Male	119 (29.2)	28.00	24.00–33.00	< 0.001**
	Female	289 (70.8)	31.00	27.00–36.00	
Faculty	Medicine	197 (47.4)	30.00	25.00–34.00	0.003***
	Dentistry	72 (17.3)	29.50	24.50–33.00	
	Pharmacy	51 (12.3)	31.00	26.00–35.00	
	Health Sciences	96 (23.1)	32.50	27.50–38.00	
Duration of daily digital device usage	< 4 hours	67 (16.1)	31.00	26.00–35.00	0.484***
	4–6 hours	150 (36.1)	29.00	25.00–34.00	
	> 6 hours	199 (57.8)	31.00	26.00–36.00	
Daily digital device usage without taking breaks	≤ 1 hour	194 (46.6)	30.00	26.00–34.00	0.113**
	> 1 hour	222 (53.4)	31.00	26.00–36.00	
Distance with the screen	< 40 cm	250 (60.1)	31.00	27.00–36.00	0.029**
	≤ 40 cm	166 (39.9)	29.00	25.00–34.00	
Digital device usage at a dark/shady environment	Yes	80 (19.2)	33.00	27.00–37.00	0.044**
	No	336 (80.8)	30.00	26.00–34.00	
Present eye disorder	Yes	283 (68.0)	32.00	28.00–36.00	< 0.001**
	No	133 (32.0)	27.00	24.00–31.00	
Usage of eye-glasses or lens	Yes	256 (61.5)	32.00	28.00–36.00	< 0.001**
	No	160 (38.5)	28.00	24.00–32.50	

IQR — interquartile range; *8 students were excluded from the analysis because they did not want to reveal their genders; **Mann-Whitney U test; ***Kruskal Wallis test

the participants were observed as far as gender, faculties, distance with the screen and individual, digital device usage at a dark/shady environment present eye disorder and usage of eyeglasses or contact lens were concerned (Tab. 3).

DISCUSSION

This study aimed to determine the habits of students using digital devices and the frequency of ocular symptoms while using those devices at a health campus containing different faculties of a university in Istanbul, Türkiye.

This survey found that students use digital devices quite often, with mobile phones ranking first and computers ranking second. When asked what they used it for, the most common responses were social media, education, and gaming. A study conducted in 2019 showed similar results in terms of telephone and main goal is being entertainment [14]. In our study, emerging use of digital devices for the educational purposes could be explained by distance education practices during pandemic.

Nearly half of the students spent more than 6 hours in a day for using digital devices and more than half were using the device for more than one hour without interruption. The majority of the students used digital devices for more than six hours per day in a study conducted in 2020 in Jordan [15]. Increased screen time has been shown to be one of the risk factors for developing ocular symptoms related to digital devices, according to some studies [7, 16, 17].

Another important finding of this study was that students did not follow ergonomic practices while using digital devices, such as keeping a distance between them and the screen or adjusting the environmental lighting properly. According to a study conducted in 2020 in India, increased average screen time per day, decreased screen distance, and using digital devices in the dark were found to be associated with increased digital eye strain [17].

Our study found that 98.6% of the students have at least one ocular symptom related to digital device usage. When literature was searched about the prevalence of computer vision syndrome or digital eye strain, different results emerged ranging from 70%

to 90% [6–10, 14]. This high percentage can be linked to increased screen time exposure due to distance education conducted during the COVID-19 pandemic [18]. Furthermore, in our study, students claimed that eye disorders or vision problems increased during or after the pandemic. A study in India revealed that the proportion of participants exposed to screen time of six or more hours was more significant during the pandemic (57.0%) than before (10.9%). The results of that particular study indicate increased screen time during the pandemic, especially among the students attending online classes [17].

The most common ocular symptoms students had while using the devices were feeling eyes heavy, hurt, and burning sensation. According to studies, affected eyesight, itchy eyes, tears, eye pain, and dry eyes were among the most common symptoms [7, 14, 15]. In this study, almost all symptoms were seen more frequently among female students than males. In a study carried out by Cartes et al., it was found that being of female sex increased the risk of severe computer vision symptoms [12]. Another study confirms that the female gender is a risk factor for symptomatic digital eye strain and that women generally report a higher impact of those symptoms on daily activities [18]. Generally, it could be merely due to females expressing themselves more easily than males. In addition to this, ocular symptoms due to digital device use were frequent among students who had a present eye condition and wore glasses or contact lenses as in previous studies [12, 17] as in line with our study's findings.

There are at least three limitations of this study. Firstly, non-ocular symptoms such as headaches and musculoskeletal issues like neck or shoulder discomfort should have been investigated because they are frequent symptoms associated with digital device use. Secondly, since this study relies on the participants' responses, there might be recall bias. Finally, because convenient sampling was used, this study may not reflect the entire university student population; students who experienced eye difficulties due to digital device usage may have participated more in our study.

CONCLUSION

It can be concluded that eye problems related to digital device usage are seen frequently among university students of health disciplines. Although dig-

ital eye strain is temporary, it can decrease productivity, which is important for university students. The use of digital devices in students' daily lives has increased with the pandemic and is continuing to accelerate. Therefore, training about ergonomic usage of digital devices should be integrated into lectures and online lectures, such as not exceeding 40 minutes or uninterrupted usage, in order to prevent or minimize particular ocular problems related to devices.

It is necessary to consider it as an emerging public health problem that is probably related to the recent changes in lifestyle. We believe this topic will require considerable clinical attention in the future. Therefore, further research is needed on this issue, particularly momentary investigations to detect abrupt visual alterations is recommended.

Conflict of interests

The authors declare no conflict interests.

List of abbreviations

CVS: Computer vision syndrome

CVSS17: The 17-item Computer Vision Symptom Scale

Data availability statement

Yes.

Ethics statement

This study was designed in accordance with the principles of the Helsinki Declaration and with the approval of the local ethics committee (03.12.2021.1388).

Author contributions

Data collection: C.H.K.Y., F.E., Ç.T., statistical analysis: C.H.K.Y.; preparing the manuscript: C.H.K.Y.; final review: C.H.K.Y., S.H., F.E., Ç.T., M.K.

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