

## OCULAR AND VISUAL DISCOMFORT EPIDEMIC AMID COVID-19 PANDEMIC: A SAMPLE OF MEDICAL STUDENTS IN BULGARIA

**Vesela I. Lubenova,  
Zehra B. Gay,  
Snezhana V. Murgova**

*Department of Ophthalmology,  
Medical University - Pleven*

### Summary

The purpose of our research was to evaluate the effect of remote education on ocular health among medical students during the current COVID-19 pandemic. The students included in the study were 219 in total, all from Medical Universities in Bulgaria. They were asked about their eye health and comfort during the distance-learning semester. They were interviewed anonymously, with an online questionnaire, between April 1-30, 2021. The findings of the study highlighted that digital learning increases screen time, at potentially dangerous for eye health levels. The most common presenting complaints were eye fatigue (83.1%), tearing (epiphora) (58.9%), dry eyes (58.4%), blurred vision (40.2%), photophobia (37.4%), itchiness (34.7%) etc. Regarding the longest uninterrupted time spent working on a computer, 32% of the students reported 1-2 hours without a break, 57.1% - more than 2 hours, and only 3.7% spent less than 20 min before taking a break. As the conclusion of this study, it was observed that distance learning during the pandemic and social isolation during the pandemic adversely affected eye health and eye fatigue among medical students. Increased screen time during online semester causes digital eye strain, which interferes with the quality of life and is an emerging public health issue.

**Keywords:** eye strain, ocular health, remote education, COVID-19 pandemic

### Introduction

The COVID-19 pandemic profoundly affected all societies worldwide and had various health, social, economic, and psychological results. Social isolation measures were taken to slow the disease; among them was closing all the universities in Bulgaria since October 2020 and switching to a hybrid or entirely distance learning process. Although remote learning system was proven to reduce transmission rate, it may adversely affect ocular health. Digital eye strain, or computer visual syndrome, is an emerging occupational and public health

### Corresponding author:

Vesela Ivancheva  
e-mail: [vesela.lyubenova@gmail.com](mailto:vesela.lyubenova@gmail.com)

**Received:** December 22, 2021

**Revision received:** July 31, 2023

**Accepted:** November 16, 2023

problem. It is a condition of visual disturbance and ocular discomfort associated with using electronic devices and monitors (computers, tablets, smartphones) resulting from a spectrum of stresses on the visual environment [1, 2].

It is known that around 90% of electronic monitor users are experiencing digital eye strain signs. There are studies that prove that the listed factors are associated with eye digital strain: not proper working distance (more often closer), uncorrected refractive errors, vergence or accommodation anomalies, altered blinking pattern (incomplete blinking, reduced rate of blinking), intense light exposure, and smaller font size [2-4].

This research aims to study the effect of electronic education on the eye health and comfort of medical students during the COVID-19 pandemic.

## Materials and Methods

A total of 219 students from different Medical Universities in Bulgaria were asked about their eye health and comfort of the anterior ocular surface during the distance-learning semester. The majority of responses were received from Medical University in Pleven with 51.1% (n=112), followed by Varna Medical University with 21.9% (n=48), Sofia Medical University with 18.3% (n=40), Plovdiv Medical University with 7.8% (n=17) and Trakia University Stara Zagora with 0.9% (n=2).

Most respondents were 21-24 years old (68.5%). Respondents aged 18-20 accounted

for 18.3%, while those aged 25-28 – 10%. The rest of the respondents were either 29-32 years old (1.8%) or older than 33 (1.4%). All our participants (n=219; 100%) answered the questionnaire in the English language. The majority of the students were in the 3th and 4rd year (n=69; 31.5%; n=49; 22.4%, respectively). Other respondents were: year 1 (n=30; 13.7%), year 5 (n=24; 11%), year 2 (n=23.5; 10.5%), and year 6 (n=21, 9.6%). The graduated cohort included 3 respondents (1.4%).

All students were interviewed anonymously, using an online questionnaire Google Docs, partially based on the Standardized Patient Evaluation of Eye Dryness (SPEED) Questionnaire, between April 1-30, 2021. The eye fatigue questionnaire focused on the sensation of ocular discomfort and its severity and lasting during remote education: usual screen time, complaints of eye fatigue or tearing, a feeling of blurred vision, dryness, photophobia, scratchiness, etc.

## Results

The findings of the study highlighted that digital and online learning increases screen time, at potentially dangerous for eye health levels. One hundred twenty-five 5 participants (57.1%) worked for more than 2 hours before taking a break from the PC screen; 70 participants (32%) reported working around 1-2 hours without a break. Only 8 participants (3.7%) spent less than 20 min before taking a break. An additional 16 participants (7.3%) answered this question as “unsure” (Figure 1).

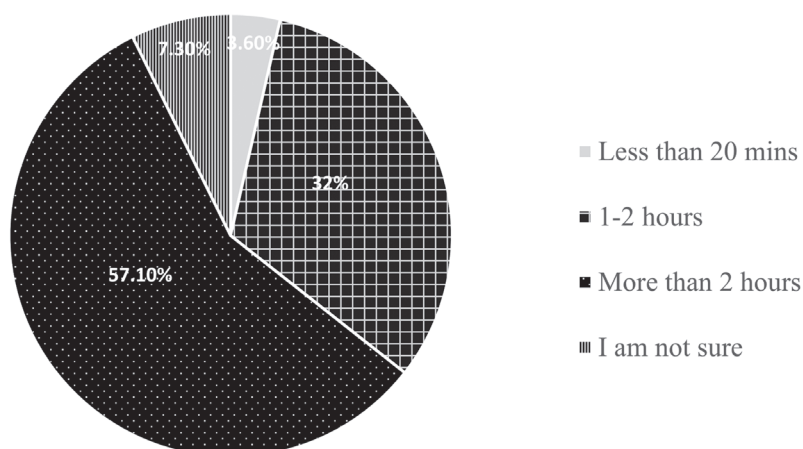
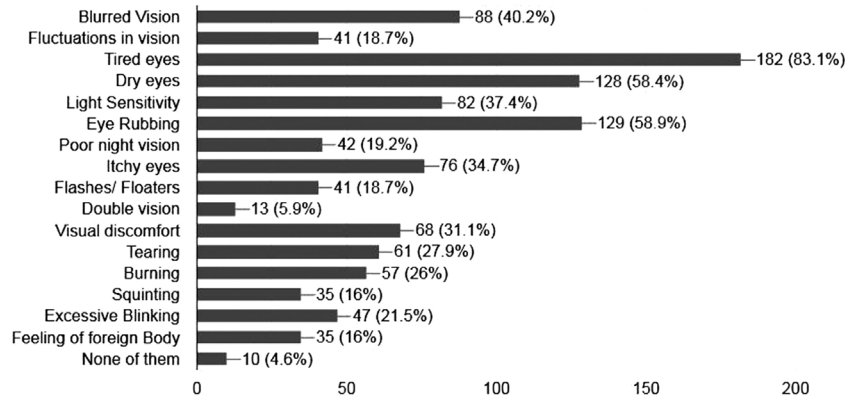


Figure 1. Usual daily screen time of responders

**Table 1.** Statistical analysis of results in groups with/without ophthalmic complaints concerning screen time.

<b>Results</b>			
<b>Question: What is the longest uninterrupted time you spend working on the computer?</b>	<b>Had ophthalmic complaints reported</b>	<b>No ophthalmic complaints reported</b>	<b>Row Totals</b>
<b>Less than 20 min</b>	4 (2.78) [0.54]	4 (5.22) [0.29]	8
<b>1 - 2 hours</b>	23 (24.29) [0.07]	47 (45.71) [0.04]	70
<b>More than 2 hours</b>	47 (43.38) [0.30]	78 (81.62) [0.16]	125
<b>I am not sure</b>	2 (5.55) [2.27]	14 (10.45) [1.21]	16
<b>Column Totals</b>	76	143	<b>219 (Grand Total)</b>



**Figure 2.** Incidence of ocular and visual complaints among interviewed students during the online education process

The Chi-Square test was used to challenge hypotheses about whether the incidence of ophthalmic complaints was dependent or independent of time spent working on the computer.

The analysis used Vassarstats, opened on Windows 10 (Table 1);  $X^2(3, n=219) = 4.88$ ;  $p=0.1808$ . The result was not significant at  $p < 0.05$ .

The result states that the variables were independent. Cramer’s V was used to test the strength of the data to determine if a significant Chi-square result had been obtained. Cramer’s V result was 0.1493.

Our eye fatigue questionnaire results show that the most common complaints among medical students during the online semester were: tired eyes (83.1%), epiphora (58.9%) and sensation of dry eyes (58.4%). Other symptoms included blurred vision in 40.2% and photophobia in 37.4%, and itchiness was reported by 34.7% of the respondents. The most minor percentage of recorded symptoms were diplopia (5.9%) and squinting (16%). There were no symptoms in 10% of the studied cohort (Figure 2).

## Discussion

In the present study, the effect of remote education on ocular and visual health during the COVID-19 pandemic was investigated by an online survey. Results highlighted that digital and online learning increases screen time at potentially dangerous eye health levels. The majority of respondents (57.1%) report screen time of more than 2 hours without interruption, over 80% of students’ complaints were eye fatigue of different severity, and almost 60% of reported complaints were dry eyes and eye rubbing.

Previous research has also shown that ocular health related to monitor usage may be affected seriously. Screens like computers, tablets or smartphones can cause damage by radiating blue light-short waves that penetrate ocular tissues and can contribute to photochemical retinal cell harm [4]. In 2020, Huseiyn Kaya evaluated the effect of distance education on visual health during the COVID-19 pandemic using an e-mail survey [5]. The author interviewed 402 students from Pamukkale University and observed that the ocular health of respondents was affected

negatively by remote education during the pandemic, and eye strain and fatigue increased. As a result of online education, deterioration of eye health occurred [5].

Zhao et al. investigated behaviours in homeschooling and school-age children's feelings with online questionnaires in 15 Chinese provinces. The authors obtained information separately from students (grades 1-9), teachers and parents. At the beginning of the 2020 first semester, all school-age children in China were homeschooled because of the pandemic situation, using digital devices (via live/recorded broadcasts). Almost 70% of parents reported that their children had more than three hours of screen time daily, and more than 80% had less than two hours of outdoor activity. Almost all parents (95%) were concerned about their children's eye health. Authors concluded that prolonged screen time and insufficient activities outdoor can severely affect children's visual health, so proper eye-protection actions and measures must be implemented [6]. Another study - by Agarwal et al. also supports our results. Their findings indicated that extended digital device use of more than 6 hours increases eye fatigue complaints [7].

Ganne et al., in research published in 2021, used an online survey with 941 participants to analyze digital eye strain, describe gadget patterns of usage, and study the digital eye strain risk factors [8]. These authors noticed that a more significant proportion of students taking online classes spent more than 6 hours per day and never took breaks (or took them infrequently). The author's results also showed that eye strain prevalence was higher among online learning students compared to the general population, and during the pandemic, there was an increase in daily screen time compared to before the pandemic. The digital eye strain score was highest among students having remote classes online, as well as in those with ocular diseases, longer screen time, smaller screen distance (less than 20 cm), those who worked with screens in dark environments and those who infrequently or never took breaks. Our study reported that 43.4% (n = 95) of respondents answered that they took occasional breaks, while an additional 5.5% (n = 12) responded that they did not take any breaks during online classes. We assume that these differences are because all our respondents are medical students with knowledge

of eye hygiene.

## Conclusion

In conclusion, it was found that eye health and eye fatigue among medical students were affected negatively by distance learning education during the pandemic and social isolation. Increased screen time during online semester causes digital eye strain, which interferes with the quality of life and is an emerging public health issue. Students need to limit their overall screen exposure and use ergonomic methods of screen viewing, use eye lubricants, keep strict visual hygiene, and use optimal correction of refractive errors. There is a need for proper eye health education for all people. Also, it was crucial to reduce the time of online classes for students and pupils and control the digital eye strain epidemic in the coronavirus pandemic.

## References

1. Zayed HAM, Saied SM, Younis EA, Atlam SA. Digital eye strain: prevalence and associated factors among information technology professionals, Egypt. *Environ Sci Pollut Res Int.* 2021;28(20):25187-95.
2. Coles-Brennan C, Sulley A, Young G. Management of digital eye strain. *Clin Exp Optom* 2019;102(1) 18-29.
3. Kim DJ, Lim CY, Gu, N, Park CY. Visual fatigue induced by viewing a tablet computer with a high-resolution display. *Korean J Ophthalmol.* 2017;31(5), 388-93.
4. Kaya H. Evaluation of the relationship between asthenopic complaints and internet addiction in university students. *Pamukkale Medical Journal* 2019;12(3):561-67.
5. Kaya H. Investigation of the effect of online education on eye health in Covid-19 pandemic. *Int J Assess Tool Educ.* 2020;7(3):488-96.
6. Zhao Y, Guo Y, Xiao Y, Zhu R, Sun W, Huang W, et al. The effects of online homeschooling on children, parents, and teachers of grades 1-9 during the COVID-19 Pandemic. *Med Sci Monit.* 2020;26:e925591.
7. Agarwal S, Goel D, Sharma A. Evaluation of the factors which contribute to the ocular complaints in computer users. *J Clin Diagn Res.* 2013;7(2):331-5.
8. Ganne P, Najeeb S, Chaitanya G, Sharma A, Krishnappa NC. Digital Eye Strain Epidemic amid COVID-19 Pandemic - A Cross-sectional Survey. *Ophthalmic Epidemiol.* 2021;28(4):285-92.