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Original Contribution

COMPUTER VISION SYNDROME: EPIDEMIC AMONG MEDICAL STUDENTS IN BULGARIA

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ABSTRACT

PURPOSE: The aim of our research is to assess the impact of monitor use and computer learning process on the visual comfort and ocular health of students from Medical Universities in Bulgaria.

METHODS: 219 students participated in the study. They were interviewed anonymously in January 2023, through an online survey. Questions concern students' ocular and visual comfort during the process of self-preparation for exams during session.

RESULTS: The survey results indicate that digital learning increases screen time at potentially dangerous for eye health levels. The most common complaints among students are eye fatigue (83.1%), tearing (58.9%), dry eyes (58.4%), blurred vision (40.2%), photophobia (37.4%), and itchiness (34.7%). Results show that 32% of respondents spent 1-2 hours working on a computer without a break; 57.1% reported that they work for more than 2 hours, and only 3.7% spent less than 20 min before taking a break.

CONCLUSIONS: It was noted that eye fatigue and visual discomfort among medical students were negatively affected by the monitor learning during the session. Increased screen time causes digital eye strain, which impairs life quality and is a socially significant phenomenon.

Key words: eye strain, ocular health, monitor education, dry eye

INTRODUCTION

Dynamic working and learning environment in the conditions of ubiquitous digitalization of modern life has a profound effect on all worldwide societies, and has different health, social, economic, and psychological results. Many students use hybrid or entirely distance learning process. Remote learning system and computer use in the self-preparing process may have adverse effects on ocular health. Digital eye strain, or computer visual syndrome, is an emerging occupational and public health problem. This is a state of eye discomfort and visual impairment associated with prolonged monitor use (computers, tablets, smartphones) and as a result of a spectrum of visual environmental stress factors (1, 2).

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It is known that around 90 % of electronic monitor users are experiencing digital eye strain signs. There are studies, which 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).

AIM

The aim of the study is to assess the effect of electronic education and computer use on eye health and comfort of medical students.

MATERIAL AND METHODS

A total of 219 students from different Medical Universities in Bulgaria, were asked about their eye health and comfort of ocular surface during the session. The majority of responses were received from Pleven Medical University with

51.1% (n = 112 people), 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).

Majority of respondents were 21-24 years old (68.5%). Respondents aged were from 18-20 made up 18.3% while from 25-28 made up 10%. The rest of the respondents were either 29-32 years old (1.8%) or older than 33 years old (1.4%). All our participants (n = 219,100%) answered the questionnaire in the English language. Majority of students were studying on the 3th and 4rd year (n = 69; 31.5%; n = 49; 22.4% respectively). Other course years, in the order of increase in number of responses were: year 1 (n = 30; 13.7%), year 5 (n = 24; 11%), year 2 (n = 23.5; 10.5%), year 6 (n = 21, 9.6%). The graduated cohort made up 3 people (1.4%). Participating students were interviewed anonymously in January 2023, using online survey- Google docs. Questions concern students' ocular and visual comfort during the process of self-preparation for exams during session. The standardized Patient Evaluation of Eye Dryness (SPEED) Questionnaire was used as the basis of our online survey, adapted for the context of the digital environment. Most questions concern eye discomfort sensation- its duration and severity, usual screen time, complaints of tired eyes, epiphora, dryness sensation, blurry vision, irritation from light, etc.

RESULTS

The findings of the study highlighted that digital and online learning increases screen time at potentially dangerous for eye health levels. 125 participants (57.1%) work 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 making a break. An additional 16 participants (7.3%) answered this question as "unsure" **(Figure 1).**

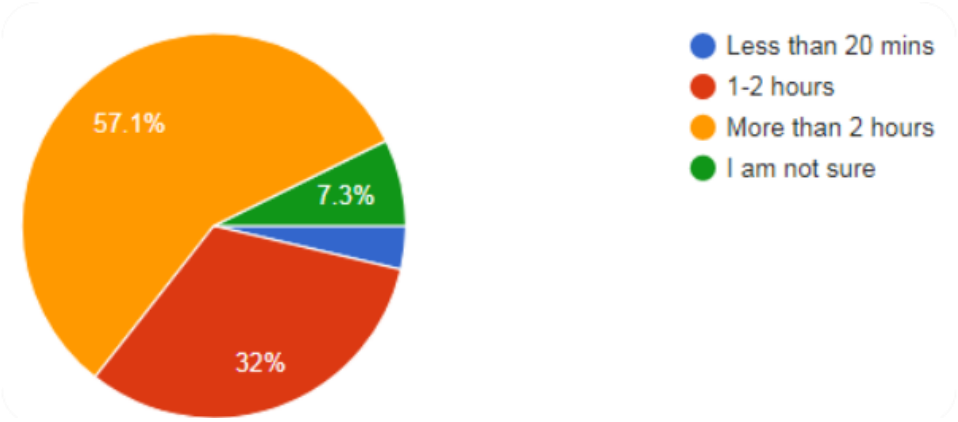

Figure 1. Usual daily screen time of responders.

In order to challenge hypotheses, if the incidence of ophthalmic complaints was dependent or independent of time spent working on the computer, the Chi-Square test was used.

The analysis was made by using Vassarstats opened on Windows 10 **(Table 1).** X^2 (3, N = 219) = 4.88, p = .1808. The result is not significant at p < .05.

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

Our eye fatigue questionnaire results show that the most common complaints among medical students during session were: tired eyes in 83.1%, epiphora in 58.9% and sensation of dry eyes in 58.4%. Other symptoms included blurred vision in 40.2% and photophobia in 37.4%. For itchiness reported 34.7%. The least recorded symptoms were diplopia (5.9%) and squinting (16%). In 10% of the cohort there were no symptoms **(Figure 2).**

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

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

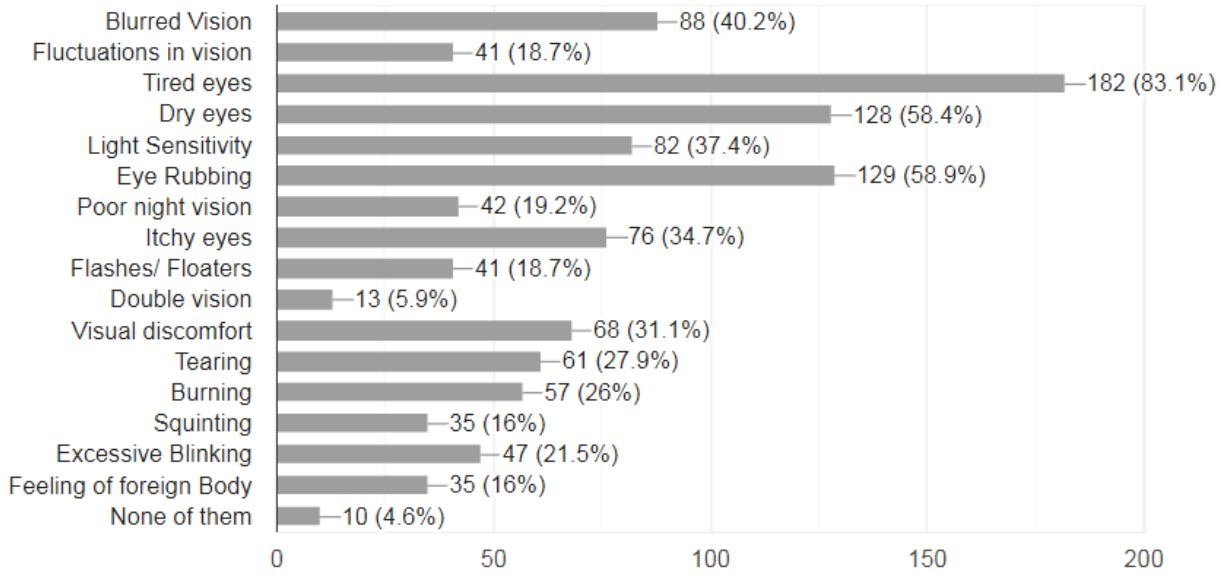

Figure 2. Incidence of ocular and visual complaints among interviewed students during online education process.

DISCUSSION

In present study, the effect of remote education and electronic device usage on ocular and visual health was investigated by online survey and results highlighted that digital and online learning increases screen time at potentially dangerous for the eye health levels. The majority of respondents (57.1%) report screen time more than 2 hours without interruption, over 80% of student's 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 retinal cells harm of photochemical character (4). In 2020 Huseiyn Kaya evaluated the effect of distance education on visual health during COVID-19 pandemic, using e-mail survey (5). Author interviewed 402 students from Pamukkale University and observed that the ocular health of respondents was affected negatively by the remote education of the pandemic process- eye strain and fatigue increase and as a result of online education a deterioration of eye health occurs (5).

Zhao et al investigated behaviors in homeschooling and school-age children feelings, with online questionnaires in 15 Chinese provinces. Authors obtained information separately from students (grades 1-9), teachers and parents. During the first academic term of 2020, all students in China switched to distance learning, due to the pandemic situation, using digital devices and online electronic education. Almost seventy percent of the surveyed parents reported that their children during this period spent more than 3 hours a day in front of a screen, and more than 80% of them spent less than two hours of activities outdoors. Almost all of parents (95%) were concerned about eye health of their children. 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 of Agarwal et al. also supports our results. Their findings indicated that extended digital device use of more than 6 hours leads to increasing of eye fatigue complaints (7).

Ganne et al., in research published in 2021, using an online survey with 941participants, aimed to analyze digital eye strain, describe gadget pattern of usage, and study the digital eye strain risk factors (8). Authors noticed that a greater proportion of students taking online classes spent more than >6 hours per day, never took breaks (or took them infrequently). The author's results also show 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 situation. 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 a dark environment and those who infrequently or never took breaks. Our study reported that 43.4% (n = 95) of respondents answered that they take occasional breaks, while additional 5.5% (n = 12) responded that they do not take any breaks during online classes. We assume that these differences are due to the fact that all our respondents are medical students, with knowledge in the field of eye hygiene.

CONCLUSION

In conclusion of this study, it was observed that eye health and eye fatigue among medical students were affected negatively by the electronic learning education process. Increased screen time during sessions causes digital eye strain, which interferes with the quality of life and is an emerging public health issue. Students need to limit total screen time and use screen protection and ergonomic working conditions, to use eye lubricants, to keep strict visual hygiene, and use optimal correction of refractive errors. There is a need for proper eye health education including the field of prevention and prophylaxis for all people, and very important is reducing the time of online classes for students and pupils to control the digital eye strain epidemic in the computer era (9).

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