

Original Research Article

Effect Of COVID-19 Lockdown On The Prevalence Of Computer Vision Syndrome In Medical Students.

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ABSTRACT

Context: Computer Vision Syndrome (CVS) refers to ocular symptoms which occur as a result of prolonged use of digital devices.

Aims: The main objective was to understand the effects of continuous online classes due to the COVID-19 pandemic on the ocular health of medical students.

Materials and Methods: This quantitative study used data from a survey questionnaire administered to 200 medical students at Tbilisi State Medical University in Georgia. The questions mainly comprised symptoms related to CVS and digital device use patterns. As a part of the research, 200 students between the ages of 18 and 26 were surveyed.

Results: After the pandemic, 33.8% of students recorded a 3 to 5-hour increase in their screen time while 29.4% reported an increase by 1 to 2 hours. Eye strain and dry eyes as a result of the pandemic saw a significant increase in affected individuals from 69 to 84 and 47 to 60 respectively. Among other non-visual ailments, there was an increase in symptoms like headaches (from 90 to 100 students), backaches (from 50 to 78), and neck pains (from 37 to 75 students).

Conclusion: It was concluded that the prevalence of symptoms related to Computer Vision Syndrome in medical students had seen a rise resulting from the online classes due to the pandemic. Awareness of CVS and the prevention of symptoms is necessary, especially among students.

Keywords: Computer vision syndrome, COVID-19, Dry eyes, Digital eye strain, Eye Health

1. INTRODUCTION

Computer Vision Syndrome

The advancement of technology over the years has contributed to the digital age we live in today. Over the years, digital devices have come to play a crucial role in our day-to-day lives. Owing to the increased dependence and productivity people spend increased hours in front of a computer or a laptop. This has resulted in increased ocular symptoms like eye strain, blurred vision, double vision, redness, and watery or dry eyes among others.^[1] These symptoms are collectively known as Computer Vision Syndrome (CVS). Thus, according to the American Optometric Association, Computer Vision Syndrome, also known as digital eye strain, could be referred to as a collection of symptoms related to eye and vision as a result of extended use of computers or other digital devices.^[2]

Causes

Computer Vision Syndrome is a result of various habits and actions over time. A major factor that contributes to the symptoms is the extended usage of computers without interruptions or breaks in between. According to^[3], viewing a computer continuously for over 2 hours is the most common cause of the syndrome. Gaze angle is yet another cause that is pertinent to CVS.^[4] This refers to the angle at which the computer user is viewing the monitor. Some research shows that the recommended position of the monitor should be at eye level to reduce discomfort and eye strain. On the contrary, some others including health and safety administrations say that the monitor must be 20 cm below the eye level.^[5] As per research conducted by^[6], gender has a role to play in the prevalence of CVS and females are more likely to be suffering from CVS than men.

Symptoms

According to^[7], the symptoms associated with CVS are categorised into four types namely asthenopia, ocular surface-related, visual, and extraocular symptoms. Asthenopia is the strain caused in the eyes due to the prolonged use of digital devices. This could also include headaches or double vision.^[8] Ocular surface-related issues refer to dry or irritated eyes caused by reduced blinking rate, glare, or lighting of the environment. Regular use of computers results in reduced blinking rate which leads to dryness of the cornea and irritated eyes.^[9] Visual symptoms include blurry vision, double vision, presbyopia, difficulty in focus, or headache. These could be caused by refractive errors or screen resolution. The final category of extraocular symptoms is characterized by the distance between the eyes and the digital device and the wrong position or angle of view. Other symptoms that accompany these include neck, back, or shoulder pains which are a result of improper sitting position during computer usage.

Prevention

The obvious method of preventing CVS is by correcting the causes of the symptoms. According to^[10], there are two ways in which an individual can prevent CVS which are environmental factor correction and personal eye care. The first method is to enhance environmental factors like lighting. Improper lighting in the working environment can lead to visual strain. Taking short breaks between prolonged computer use is the most advised form of preventive measure. According to^[11], symptoms were less prevalent when the computer was placed below eye level at an angle of 14 degrees and one arm distance. Timely eye examinations and the use of the right eyeglasses are additional steps individuals can take to avoid further problems.

Role of Corona Virus Disease in Computer Vision Syndrome

The pandemic and the repetitive lockdowns have resulted in longer digital interactions as the population ranging from students to working adults are forced to work in front of a digital device for longer hours than usual. According to^[12], a report on media consumption states that daily average screen time has seen a hike up to 13 hours due to work from home and e-learning. The overall prevalence of CVS symptoms was 98.7% among undergraduate medical students in Pakistan as per a study conducted in^[13]. Deterioration of ocular health has been drastic during the pandemic and measures must be taken by individuals to avoid further deterioration.^[14]

2. MATERIALS AND METHODS

- This will be quantitative research that will utilize data from survey questionnaires to support the research.
- This study will be conducted among students of TSMU who are willing to participate.
- The required data will be collected through Google Forms.
- The analysis of the data will be done via data analysis and statistical program Minitab.

The following questions were what was included in the survey:

General

- Age
- Gender

Lifestyle

- What kind of diet would you say you had?
 1. Plant-based (vegan, vegetarian)
 2. Rich in carbohydrates and sugar (bread, rice, pasta, potatoes, etc)
 3. Fatty foods (takeout, fried food, etc)
 4. Animal-sourced protein products (chicken, beef, turkey, fish, pork)
 5. Balanced diet (a good proportion of everything)
- Has your diet changed since the pandemic started?
- If so, how?
 1. More plant-based (vegan, vegetarian)
 2. Richer in carbohydrates and sugar (bread, rice, pasta, potatoes, etc)
 3. More fatty foods (takeout, fried food, etc)
 4. More animal-sourced protein products (chicken, beef, turkey, fish, pork)
 5. Balanced diet (a good proportion of everything)

Eye condition

- Did you suffer from any of these ailments related to the eyes after long usage of screens before the pandemic?
 1. Dry eyes
 2. Eye strain
 3. Watery eyes
 4. Red eyes
 5. Double vision
 6. Others (Please mention them)
- What do you suffer from after the lockdowns of the pandemic?
 1. Dry eyes
 2. Eye strain
 3. Watery eyes
 4. Red eyes
 5. Double vision
 6. Others (Please mention them)
- Do you suffer from any of these other ailments after screen time before the pandemic?
 1. Headache

2. Backache
 3. Shoulder pain
 4. Neck pain
 5. Others (Please mention them)
- Do you suffer from any of these other ailments after screen time after the pandemic?
 1. Headache
 2. Backache
 3. Shoulder pain
 4. Neck pain
 5. Others (Please mention them)
 - What do you do to reduce these ailments?
 1. Eye lubricant (eye drops)
 2. Break time
 3. 20-20-20 rule
 4. Ergonomic devices (chairs, back support, neck support)
 5. Ice compress for eye pain
 6. Ice compress for headache.
 7. Others (Please mention them)

Device setup

- How bright is your screen?
 1. Very bright
 2. Bright
 3. Normal
 4. Dark
 5. Very dark
- What is the brightness of the room?
 1. Very bright
 2. Bright
 3. Normal
 4. Dark
 5. Very dark
- Do you have a blue light filter on?
- What is the distance between your device and your eyes?
- To what degree is your screen set up with your eyes?
 1. 5-10 degrees above eye level
 2. 15-20 degrees above eye level
 3. More than 20 degrees above eye level
 4. At eye level
 5. 5-10 degrees below eye level
 6. 15-20 degrees below eye level
 7. Less than 20 degrees below eye level
- Please select how many hours a day you look at your devices (laptop, monitor, tablets, mobile phones, TV, etc) before the pandemic.
 1. 1-2 hrs
 2. 3-5 hrs
 3. 6-8 hrs

4. More than 8 hrs
- How has that changed after the pandemic?
 1. 1-2 hrs more
 2. 3-5 hrs more
 3. 1-2 hrs less
 4. 3-5 hrs less
 5. No change
 - How often do you take breaks?

Computer Vision Syndrome awareness

- Have you ever heard of what computer vision syndrome (CVS) is?
- If you have, where did you get knowledge of it?

3. RESULTS

The survey was conducted among 200 students of Tbilisi State Medical University. A majority of the respondents were female which is 66.8% while males only accounted for 32.2%. 45% of the students belonged to the age group of 21-23 while there was a considerable percentage of respondents who belonged to the age group, 18-20 (29%) and 24-26 (21%). A minuscule percentage of respondents making up 5% were above the age of 26. These results are shown in **Figure 1**.

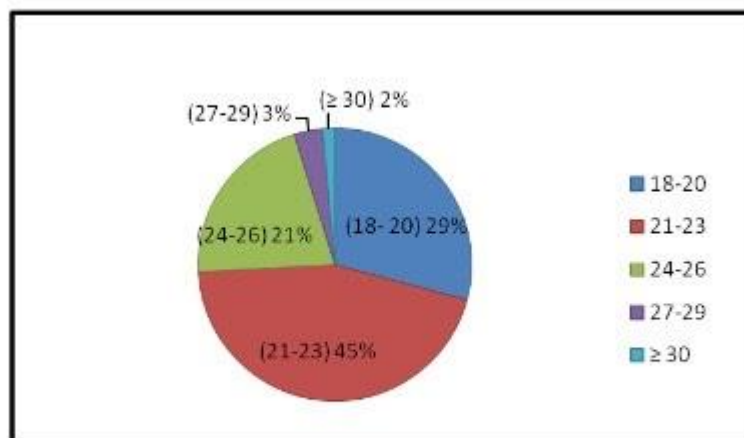


Figure 1. Age groups of participants.

The intake of food rich in carbohydrates and sugar among students plummeted from 33.8% down to 12.5% pre and post-pandemic respectively. The intake of fatty food including take-outs saw a rise from 12.6% to 21.6%. There was a decrease in the percentage of students following a balanced diet after the pandemic from 25.1% to only 9.6%.

Before the pandemic, 51.9% of the students suffered from eye strain, 35.3% suffered from dry eyes, and 30.8% suffered from watery eyes due to screen time. The lesser seen symptoms among students were red eyes (16.5%) and double vision (6%). After the pandemic, 57.5% of the students suffered from eye strain, 41.1% of the students suffered from dry eyes, and 32.2% suffered from watery eyes due to the increase in screen time. The

lesser seen symptoms after the pandemic were red eyes (24.7%) and double vision (7.5%). Additionally, 1.4% of students reported ocular migraine and itchy eyes.

Table 1: Changes in visual ailments before and after the pandemic

Visual Ailments	No. of Participants	
	Before	After
Dry eyes	47	60
Eye strain	69	84
Watery eyes	41	47
Red eyes	22	36
Double vision	8	11
None	9	8

Other than visual symptoms, the students were asked about other ailments they have experienced. Before the pandemic, 66.2% of students suffered from headaches, 36.8% from backaches, 27.2% from neck pain, and 25.7% from shoulder pain. After the pandemic, the number of students experiencing headaches reduced to 64.9% while students with back aches increased to 50.6%. An increased percentage of students (48.7%) experienced neck pain and 36.4% suffered from shoulder pain.

Table 2: Changes in non-visual ailments before and after the pandemic

Non-visual ailments	No. of participants	
	Before	After
Headache	90	100
Backache	50	78
Shoulder pain	35	56
Neck pain	37	75
None	5	6

56.8% of the students indicated that the brightness of their screen was normal while 22.3% described their setting as Dark. The least percentage of students (14.6%) described their screen as Bright. Out of the population, 58.1% had the device's blue light filter on while 41.9% didn't.

62.6% of the students described the lighting in their room during device usage as normal while 19.2% described it as Bright. The least percentage of students (11.8%) described the lighting of their room as Dark. 49.5% of the respondents keep their devices 10-15 inches away from their eyes while 23.8% have less than 10 inches of distance between their device and their eyes. 16% of the respondents have a 15-20 inches distance. A majority of the students (36.2%) keep their devices at eye level. 25.6% of students use their devices 5-10 degrees below eye level while 19.6% use their devices 15-20 degrees above eye level. The least used angle was 5-10 degrees above eye level by 9% of the students.

The students were asked about their screen time before the pandemic. A majority of the respondents (42.4%) used digital devices for 3-5 hours. 31.7% indicated that their screen time was equivalent to 6-8 hours while the least yet a significant percentage of students (19%) used their devices for more than 8 hours. Post-pandemic, 33.8% of the respondents showed an increase in their usage by 3-5 hours while 29.4% saw an increase in screen time

by 1-2 hours. The same percentage of people (29.4%) saw no change in their screen time patterns.

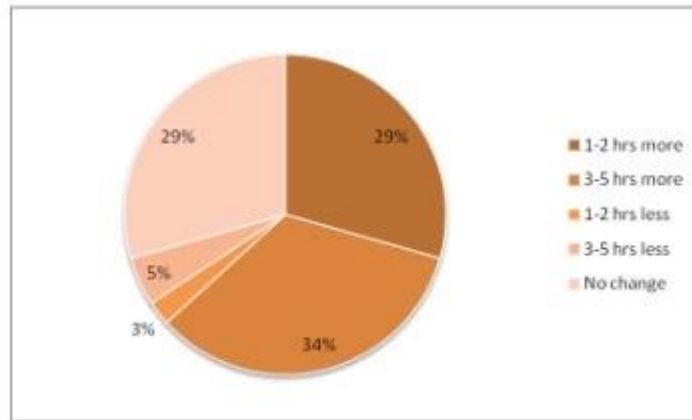


Figure 2. Changes in the hours of screen time after the pandemic

Among the respondents, 32.3% of the students took 1-hour breaks between their screen time while 22.9% of the respondents took a break every half an hour. 25.5% took breaks every 2 hours while 13.5% took a break every hour and a half.

Out of the target population, only 25.2% of the respondents were aware of Computer Vision Syndrome while 74.8% had never heard of it. **Figure 3** shows the distribution of where and how those who had awareness gained it. Most of the participants had their exposure to information on social media (about 37.3%), but coming across mentions of CVS while researching for something else was also common (about 31.1%).

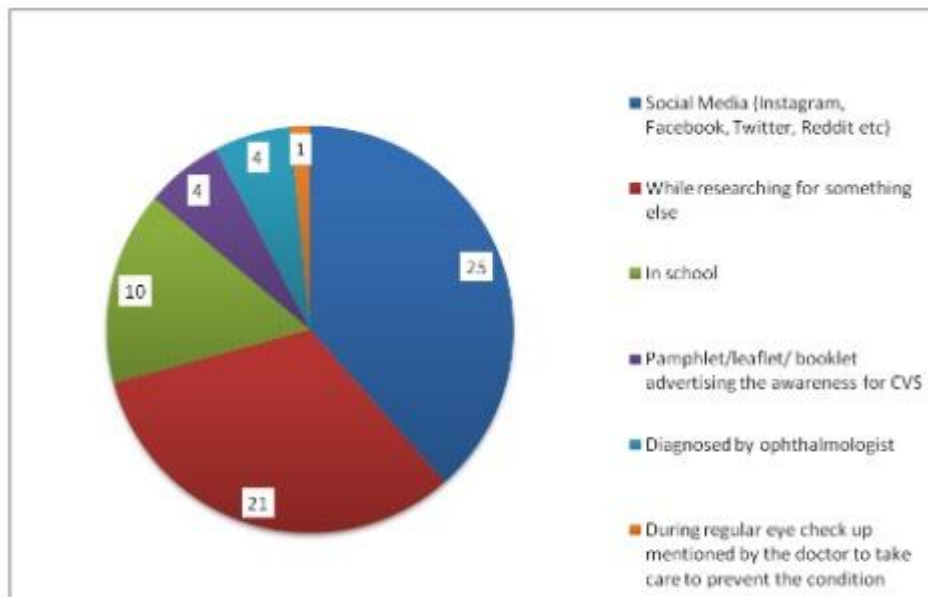


Figure 3. Participants' awareness about CVS.

4. DISCUSSION

The rise in the use of digital platforms for online education as a result of the Corona Virus Disease (COVID) -19 pandemic lockdowns has contributed to increasing eye discomfort among students. The ensuing symptoms of prolonged use of digital devices are referred to as CVS.

Our study was conducted to record and understand the effects that continuous online classes during the pandemic have had on the eye health of medical students.

Optic symptoms such as dry, red, and watery eyes coupled with eye strain are some of the more prevalent symptoms we found amongst our participants before and even after the pandemic. This can be seen in **Table 1.** and is also reflected in a study done in China amongst university students where they found that the common leading symptoms of computer vision syndrome are “heavy eyelids,” “dryness,” and “feeling of a foreign body”.^[15] Statistical significance was observed for redness, burning sensation, and dry eyes; however, the same was not observed for other symptoms in a study done in Chennai.^[16-17] found that an elevation in the time spent on computers increases the risk of CVS significantly which is echoed in our survey results (seen in **Figure 2.**) which shows that the largest percentage (34%) was seen in the participants' screen time for 3-5 more hours after the pandemic. Moreover,^[18] states that working continuously for more than 4 hours has been associated with eye strain.

Other ailments such as headaches, backache, and shoulder and neck pain were associated with the visual symptoms and also saw increases in each of them after the pandemic as seen in **Table 2.** This piece of evidence resonated with a study done where the

most common symptom was headache affecting 43.5% (177/407) of the participants.^[14] The reason for this is thought to be due to bad posture, and long and increased hours spent in front of the screen which is again conveyed in the results from our survey. The Chennai study mentioned in the previous paragraph showed similar results with about 43.3% of medical students with headaches and approximately 61% of students who complained of neck and shoulder pain.^[16] That is why it is important to take a short break, stretch the muscles and go for a walk to improve work efficiency and lower ocular ailments caused by stress as it restores and relaxes the accommodative system of the eyes hence preventing ocular strain and visual fatigue.

Associating factors such as the brightness level, eye level, and blue light filter have also shown significance in their contribution to CVS. Good lighting in the room will improve visual comfort and performance and should be adjusted to reduce glare on the monitor. It is known that at times the brightness, contrast, and font size can be modified on the computer to enhance visibility.^[19] The same article states that nurses also recommend some alterations where the computer monitor should be 15 to 20 degrees below eye level (about 4-5 inches) as measured from the center of the monitor and twenty to twenty-eight inches from the eyes. A Malaysian study found there was a major reduction in symptoms of CVS among students who viewed the screen below eye level than those who viewed the computer screen at or above eye level.^[20] This also resonated with another study that concluded ocular symptoms and neck pain was less likely if the device was held just below eye level.^[21]

Electronic devices utilized in education such as computers, smartphones, and tablets emit blue light (400–490 nm) from their light-emitting diodes and produce electromagnetic fields, both of which interfere with the body's circadian rhythm.^[22] This article also states that commercially accessible blue light-filtering spectacle lenses reduce phototoxicity by 10.6%–23.6%, without depressing visual performance. Thus, it has been recommended for the defense of the eyes against blue light.

Furthermore, in the study of^[23], students' diets and lifestyles, and history of diseases were evaluated. In this paper, the relationship between fruit and vegetable consumption and the risk of asthenopia was investigated and as per the results of the study, it was found that dark-green leafy fruit consumption is related to a lower risk of asthenopia. As is evident in our study, many of the participants have had a reduced balanced diet (from approximately 25% to 9.6%). A proper diet is important in maintaining good eye health, the failure of which could lead to eye problems and a greater risk of CVS.

Limitation

The study included qualitative research conducted among students in a single institution based on self-recorded symptoms without any examination. Hence, the results may not apply to a larger sample of students. The non-implementation of exclusion criteria could have had considerable effects on the estimation of the prevalence of CVS. Since we are students ourselves, we are also not fit to diagnose the participants' symptoms and conclude on the increase of CVS amongst our student body. We are merely stating our findings.

Furthermore, our study is not specifically designed to consider the prevalence of CVS in students who don't have pre-existing eye/systemic health conditions and the difference in the ones who do. In addition to that, this study also does not take into consideration the effect

of COVID infection on ocular health and its part in the prevalence of CVS amongst our student body. These are some of the things to consider moving forward with future studies.

5. CONCLUSION

With this study, we intended on finding a difference in the prevalence of symptoms of CVS Syndrome in medical students after the COVID-19 pandemic lockdowns. There was indeed an increment in most of the symptoms- mostly being dry, watery, red eyes with eye strain and non-ocular symptoms like headache, and back and neck pain. These symptoms are ones that we tend to ignore daily because of how mundane and common they are. With that being said, we hope that this study raises awareness of CVS because the chronicity of these manifestations is detrimental to overall eye health and is not something that should be taken lightly.

Ethical consideration

Ethical approval is not required for this manuscript as it comes under the non-interventional studies (as a survey) and we have been granted an exemption from the scientific research department of our university, TSMU.

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Nil

Conflicts of interest

There are no conflicts of interest.

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