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Computer Vision Syndrome: An Emerging Public Health Problem Amongst Secondary School Students in South East Nigeria in the Post-Pandemic Era

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ABSTRACT

Background: Globally, Covid-19 pandemic pushed all students indoors. This necessitated mandatory e-learning for all students. Students were compelled to spend 8-12 hours in front of digital devices. This unregulated e-learning has left students at risk of developing Computer Vision Syndrome, (CVS). CVS, a spectrum of eye and vision related problems resulting from the uninterrupted use of digital devices for as little as 2 hours per day, is an emerging public health challenge. This study aimed to assess the ocular, visual and systemic presentations of CVS amongst secondary school students and the associated risk factors.

Materials and Methods: This is a cross-sectional, non-interventional study. The data was generated using self-administered questionnaire and was analyzed with SPSS 23.0. Frequency and percentage of quantifiable variables were analyzed. The independent variables and the dependent variables were grouped and their associations were analyzed. P-value of 0.05 was considered significant.

Results: A total of 1695 students participated. Commonest ocular symptoms were eye rubbing 33.0% and tearing 31.0%, while the commonest visual symptom was blurry vision 49.5%. Headache was the major systemic complaint 44.1%. Prolonged use of devices for 3 or more hours and use of 3 or more devices often resulted in some visual symptoms. These were statistically significant with a p value of < 0.001.

Conclusion: The study observed that duration of exposure to digital screen has linear relationship to CVS. It also noted that number of digital devices used, hours spent and continuous use of screens are strong risk factors for developing CVS.

Keywords: Computer Vision Syndrome, e-learning, pandemic

INTRODUCTION

Covid-19 has turned the world upside down. The pandemic sent humanity indoors, replacing human contacts with electronic connections.[1] Students from all over the world were pushed into their homes for infinite months. The Federal Government of Nigeria, on March 23, 2020, closed all schools and educational institutions nationwide.[2] This necessitated the mandatory e-learning for all students in private and public schools. Without any preparation, and sufficient guidelines,[3] it became routine practice for school students to spend 8-12 hours in front of laptops, computers or mobile screens. The inevitable surge in the use of digital technology was the much needed panacea to mitigate the turbulent situation. This unregulated e-learning has left a cohort of students at dire risk of developing CVS.[3] Over half of Nigeria's population is under 19 years of age and expectedly, they are students.[4]

These students were compelled to continue their learning online. Unprepared, students embraced a new dawn in learning. This study aims to assess the ocular, visual and systemic presentations of computer vision syndrome amongst secondary school students and also assess the associated risk factors. Till date, to the best of our knowledge, the studies done on CVS amongst students in secondary schools in Nigeria are scanty.

LITERATURE REVIEW

Prolonged exposure to digital devices can lead to a spectrum of eye disorders ranging from eye strain to age related macular degeneration, (ARMD). Computer Vision Syndrome (CVS) is a spectrum of eye and vision related problems resulting from the uninterrupted use of digital devices for as little as 2 hours per day.[5] It is an emerging public health challenge that is directly proportional to the duration of exposure to digital devices. The prolonged exposure to digital devices not only affect the eye, but also the musculoskeletal system and alters the circadian rhythm in the human body.[6-9] The symptoms range from eye and vision related problems such as blurring of vision, headache, tearing, and burning sensation to musculoskeletal disorders such as those affecting ergonomics, for example, neck pain, shoulder pain, back pain. Others are problems relating to circadian rhythm seen in sleep disorders.[10-11] The pandemic has heightened the issues relating to CVS.

Despite the harmful effects of CVS, the online learning goes on unhinged and has a strong promise to dominate the educational sector in the years to come. It is important to observe the symptoms of CVS amongst the secondary school students as the pandemic has changed the trajectory of learning system at the world stage.

MATERIALS & METHODS

This is a cross sectional, non-interventional analytic study. The data was generated using self-administered questionnaire. The study was conducted in 2 popular secondary schools in Enugu State, one private, the other public. Both are located in the state metropolis. The students of these schools were actively engaged in online learning during the lockdown. For the purpose of this study, students in the senior secondary classes were recruited as they were more visually tasked during this period.

A total of 1695 consenting students who had access to and utilized digital devices were enrolled into the study from both schools. Students were aged between 12 and 19 years. Informed consent was obtained from parents of participating students who were below the ages of 18. Prior to entry into the school, permission to conduct the study was obtained from the administrative body of the schools; aim of the study was well explained to the authorities. The study was conducted from 1st of March to 31st of March, 2021.

At the end of the study, the students were offered health talk on protecting the eyes while using digital devices. Those that had symptoms were treated subsequently at Enugu State University Teaching Hospital, Parklane, ESUTHP Enugu at no cost to patient.

Ethical approval was obtained from the Health Research Ethics Committee of ESUTH Parklane, Enugu.

Instrument for the study

The self-administered questionnaire was divided into 4 sections. Section A reflected on the socio-demographics of the study population. Section B reflected on the baseline information as regards the CVS. It explored on the risk factors; the hours spent on the screen, type of gadget used, habits of using the devices then ocular, visual and systemic symptoms associated with CVS. Section C reflected on the Practice adopted by the students while using the devices, while section D reflected on the knowledge the students had of CVS.

Statistical methods and Data analysis:

Data was entered using Microsoft Excel 2017 and analyzed with the aid of Statistical Package for the Social Sciences (SPSS)

version 23.0. for quantitative variables. The independent variables and the dependent variables were grouped and using statistical tools, their associations - were analyzed. Odds ratio was used to assess the level of association and a p-value of 0.05 was considered significant.

Validation and Pilot study

A pilot study was conducted prior to the study amongst trainees in a cybercafé where young people came to acquire digital skills. Subsequently, pit falls in the questionnaire were identified and re-edited. This was further validated by 2 ophthalmologists and an epidemiologist prior to distribution amongst secondary school students.

RESULT

A total of 1695 students participated in the study. Of this 53.8 %(913) were males and 46.2%(782) were females. Mean age of the participants was 15 SD:1.263 while the range was 12-19. Participants were enrolled in senior secondary classes (SS1-SS3) at the time of study. Total number of students recruited from public school was 1207 (71.2% (1207), while those that were recruited from private school was 28.8%(488).

Presentations

Commonest ocular symptoms experienced were eye rubbing 33.0%(560) and tearing 31.0%(527) while blurry vision 49.5%(839) was the commonest visual symptom. Again the commonest systemic complaint was headache 44.1%(748). Prolonged use of devices for 3 hours or more often resulted in some form of visual symptoms, blurry vision 49.5%(839), eye strain 41.4%(702) and double vision 25.2% (427).

Figure 1: Frequency of ocular symptoms

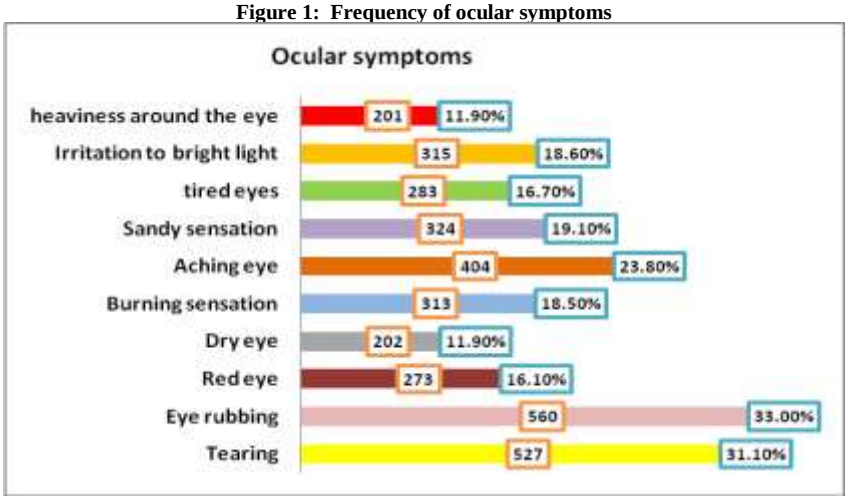


Figure 2: Frequency of visual symptoms

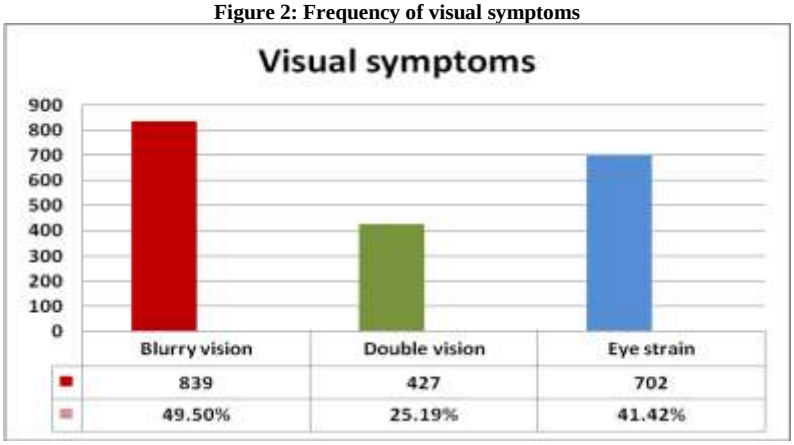
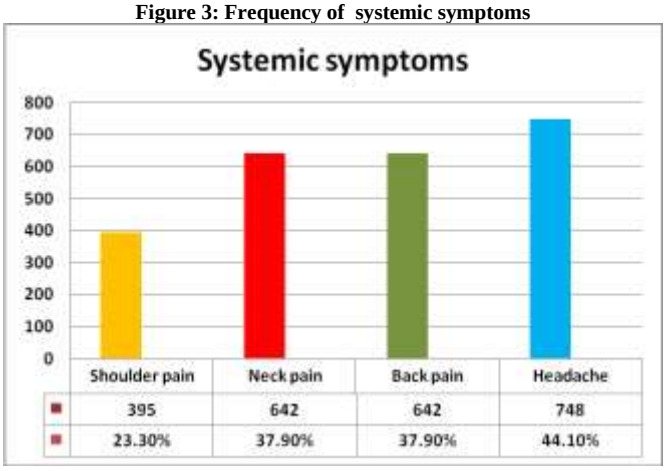


Figure 3: Frequency of systemic symptoms



Risk factors:

A greater number 86.7%(1466,) of the participants had access to 2 devices (a laptop and mobile phone). Mobile phones were the most commonly used 84.1%(1425) while laptops came second 31.6%(535). Digital devices were mainly used for entertainment in form of social media 70.0%(1186) and academic activities 65.9%(1117). Over 40% (711) of the students used devices for less than 2 hours. Those in senior classes SS3, used devices 45.5%(771) more for academic activities as compared to those in lower classes, SS1 15.8%(263). Most of the students used these devices both day and night 58.5 %(992).

It was observed that nearly 13%(217) have used these devices for greater than 5 years, while 13.9%(235) students have used it for a period of one year. A third of the participants did not know how long they have used these devices. Those who used 3 or more devices experienced some degree of digital eye strain and this was statistically significant with a p value of 0.001. Furthermore, the hours spent on the digital screen was strongly associated with varying levels symptoms of the CVS (3-4 hrs, mild 30.0%, moderate 48.4% and severe 19.0%), (>5hrs 8.3% mild, 9.7% moderate, 42.9% severe) and these findings were statistically significant p=0.005 Prior to the lockdown era, the 51.1%(866)of the students used digital devices for 1-2 hours in a day compared to 40.7%(690) in the pandemic era, also 60.0%(1017) used devices between 3 hours to 6 hours or more/day in the pandemic era.

It was also observed that varying levels of severity of symptoms were observed among those that used 5 or more devices 54.0%(915) as compared to those that used 1-2 devices 34.3%(581)and this was statistically significant with a p value of 0.002.

Practices

It was also noted that 85.1 %(1442) participants never used any protective eye glass while on the screen, 71.6%(1213) never has any protective software in the systems. However, 79.8%(1353) participants were in the habit of reducing brightness of the screen while at work. 57.6%(977) participants were in the habit of multi tasking. Many students 71.1%(1205) students did not feel this affected their sleep patterns.

DISCUSSION

As the world raced to adapt measures to contain the Covid-19 virus, this was not without consequences. As the outbreak surged, schools remained closed indefinitely.[12] The students were compelled to continue their learning online. Unprepared, students embraced a new dawn in learning.

This study aimed to identify symptoms of CVS and its associated risk factors. It is noteworthy that literature of studies done on CVS mainly targets students in higher institutions of learning and online workers.

Few studies have targeted students in secondary school such as the one in Indonesia, Saudi Arabia and India.[13-17] In Africa and in Nigeria, such information is still scanty. This information will play a crucial role in regulating online learning and use of digital devices for secondary students with caution as it affects the overall wellbeing of a person.

Symptoms of Computer Vision Syndrome

The study observed that commonest symptoms relating to CVS were ocular symptoms, (11.1% to 33.0 %), visual symptoms (24.14%-41.4%) and systemic systems (23.3%-44.4%). The commonest ocular symptom was eye rubbing (33.0%), while commonest visual symptom was eye strain (49.5%). Most common systemic complaint was headache. These findings are similar to the studies done in Saudi Arabia.[14] Headache was identified as the most selected systemic symptoms in multiple studies [18,15,19, 17,16 & 20-22] and this was as a result of prolonged use of the digital devices.[23] Headache might be direct sequel to glare from the screen, improper lighting at the work place or inappropriate brightness of the screen or combination of one or more of these factors.[24] Headache is a common systemic manifestation experienced by CVS patients and it is attributed to the contraction of extra ocular muscles and ciliary muscles as they constantly maintain the lens in the accommodating phase. Throughout the time, focusing and refocusing are required repeatedly to see in different distances from the screen to the keyboard and to work documents, leading to eye muscle fatigue causing headache.[25]

Other common symptoms experienced were tearing, aches, sandy sensation (ocular), eye strain (visual) neck pain and back pain (systemic). A Chinese study reported itchiness and dryness of the eye as major ocular symptoms[26,27] though they were not the main presentations in other studies.[16,17, 20 22]

Another common ocular symptom was eye fatigue-asthenopia. It consists of subjective complaints that causes discomfort in the eye.[28] Manifestations of asthenopia includes complaints such as eye discomfort, tearing, dryness, blurred vision, inability to focus, foreign body sensation.[29] This is an important condition that affects attention and academic performance. In the current stage, the use of digital devices is increasing, depending on the technological developments. Prolonged near work, increased cognitive load, using computer/screen can affect the eye fatigue complaints. [12]

A cross sectional analysis of symptoms of CVS and demographic characteristics showed some association with age and educational level/ demand. Those that are above 14 years of age had more manifestations of CVS symptoms. The young age groups are seemingly more vulnerable as the visual apparatus is still immature and are more tasked visually.[28] Again, the children tend to over compensate for the short falls on space and light management by positioning themselves more close to the gadgets such that beyond the visual damage, they are compromised in posture, thereby developing back ache and neck pain at a tender age. These findings were reflected in the studies done in India.[30,31] Again, education / the class a student belongs to, directly relates to the visual task carried out by the eye. Thus higher the classes, more vulnerable are the children to CVS. It is paramount to note that secondary school children are engaged in online activities unlike ever before. The pandemic imposed e-learning is not without its health hazards. It is worse in young children, as they will eventually come with preventable health hazards that can affect the overall well being of an individual.

Risk factor Assessment

CVS is a disease that is direct relationship to hours spent on the screen. It was observed that on the average, 40.9%(693) spent 3-4 hrs /day on the screen. While 31.8%(539)

used devices in the dark. Dark room use of computers not only cause eye muscle fatigue, but can disrupt body's natural rhythm and increase one susceptibility to medical conditions like obesity, heart disease, depression etc.[16.17] Severity of symptoms was high amongst the group that used devices for greater than 5 hours or more. These findings are similar to the study done in Tamil Nadu in India.[17] Regarding the total number of hours spent working on computer per day, more than half the students 59.6%(1002) of students were working less than 2 hours per day on the computer compared to the remaining 40%(693) who spent more than 3 hours working on the computer. 79.8%(553) of those working more than 3 hours were found to have 7-12 symptoms of CVS while 20%(140) had greater than 13 symptoms of CVS. Studies have established a strong association between symptoms of CVS and duration of exposure to gadgets. [22]

In addition, those that used the devices without any interruption tend to have more symptoms than those who used them in an interrupted manner. This was also noted in a study in Gonder in Ethiopia.[32] The study in Sri Lanka[33] also found that students who took frequent breaks were at lower risk of developing symptoms of CVS compared to those who worked at a stretch on the computer.[33] It showed that the major factors associated with CVS are either environmental (improper lighting, display position and viewing distance) and/or the user's visual abilities (uncorrected refractive error, oculomotor disorders and tear film abnormalities).[28,34] In order to minimize the risk factors of CVS young people who use computers must be trained in the proper steps to be take in good practices of computer use including both environmental factors and visual abilities. Significant eye symptoms related to video display terminal use often occur and should not be underestimated. The increasing use of electronic devices with flat -panel display should prompt users to take appropriate measures to prevent or to relieve the eye symptoms arising from their use. [35,33]

CVS is an emerging public health threat. The benefit of technology is not without its flaws. Children are particularly at risk as their eyes are overburdend with unlimited online classes. The pandemic era witnessed explosion in helpless dependency on electronic devices. Compulsory home confinement led to upward trend in the use of gadgets for rest and relaxation. One of the significant ocular complication of CVS post pandemic is new onset myopia and progression of existing myopia.[36,37] This affects school children more than others. The time to act is now!

CONCLUSION

This study highlights the symptoms and associated risk factors of CVS amongst secondary school children. It is increasingly clear that the young people are spending more time indoors, tasking their eyes electronically to learn, play, socialize and entertain themselves uninterrupted. If these activities go unchecked, it will affect the students, the quality of life as well as future productivity. Policies have to be implemented to restrict the use of screen amongst these age groups to have a healthy and productive society. The future lies in our hands and an informed set of guidelines have to be set up.

Declaration by Authors

Ethical Approval: Approved

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