

The Impact of Computer Vision Syndrome on Sleep Quality and Academic Performance of Medical Students: A Literature Review

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ABSTRACT

Computer use is almost inevitable in this modern era. Facing towards digital device for more than 2 hours can lead to Computer Vision Syndrome (CVS). Around the world, the average screen time of daily digital use is 6 hours and 40 minutes which increases the risks of getting CVS. During the period of the Covid-19 pandemic, medical students often use digital devices as their source of learning and physical contact should be minimized. Nowadays, prolonged screen time is like a normal thing for them as a result of adapting to life after the pandemic. Almost 90% of digital device users around the world are affected by the presence of Computer Vision Syndrome's symptoms such as eye strain, headache, dry eye, blurred vision, diplopia, etc. One of the symptoms, such as dry eye, could decrease quality of life. CVS is also affecting sleep quality and daily activity performance. Therefore, the risk of medical students being affected by CVS is bigger than before. This review focuses on how Computer Vision Syndrome could affect the medical student's academic performance. CVS might not be a fatal disease that could lead to death but its prevention could provide better daily life. Further research for CVS as one of the modern-era ophthalmological diseases is needed to improve the prevention and management of this disease.

Keywords: computer vision syndrome; screen time; medical students; sleep quality; academic performance.

INTRODUCTION

Computer Vision Syndrome is a group of ocular and vision problems as a result of prolonged use of digital devices [1]. As a common tool in this digital era, it is almost certain that office workers, institutions, organizations, and other disciplines are using digital devices (computers, smartphones, e-readers, etc.). Around 60 million people around the world are having Computer Vision Syndrome. Furthermore, the number of cases is expected to increase by at least a million cases every year [2]. Approximately, 64-90% of digital workers have this syndrome. A recent study found that teenagers around 18 years old in America spend approximately 7.5 hours using devices as a source of entertainment. With that example, it is most likely that increased digital device use could lead to increased visual strain and could cause various problems as Computer Vision Syndrome [3].

CVS could lead to several problems for medical students. As their need for computer devices is frequent. Besides, the COVID-19 pandemic increased the need for virtual education [4]. A survey in Paraguay found that 8 out of 10 medical students have CVS. More precisely it was 82.5% of the total samples, have CVS [4].

From a study in Egypt, 86% of the medical student samples had Computer Vision Syndrome complaints such as dry eye (28%) and blurred vision (31%) as a result of excessive screen time daily. Moreover, 34% of them were spending prolonged hours of screen time without rest [5].

In Indonesia, a study in the Faculty of Medicine in Universitas Diponegoro has resulted in 73.5% of the subjects having CVS. Of those subjects, 76.9 % of them have poor sleep quality. The subjects mostly use a computer or laptop for more than 4 hours continuously (63.9%) with total exposure to computers or laptops for more than 6 hours per day in a week. CVS causes sleep quality as it causes sleep disturbance and day dysfunction [6].

Poor sleep quality as a result of the presence of CVS symptoms is causing problems for medical students in their studies. Another study found that sleep disturbance, lower sleep duration, and daytime dysfunction are causing fatigue and negatively affecting their performance in academic activity. Many of them are having difficulties in cognitive function and maintaining concentration. Moreover, difficulties in those situations could lead to depression [7].

Future research hopefully can raise students' awareness of using digital devices to prevent the re-occurrence of CVS symptoms and manage it when they have it.

METHODS

This review emphasizes how Computer Vision Syndrome could lead to some disturbances for medical students, especially in their academic process. A structured search was done across different databases such as PubMed, ResearchGate, Scholar, and Scopus journals. The search used a combination of keywords like "Computer Vision Syndrome", "screen time", "medical students", and "academic performances".

CONTENT REVIEW

Pathophysiology

A visual Display Terminal (VDT) consists of small pixels that emit electronic radiation which is brighter in the middle and darker on its edge. This pixel's character causes human eyes to struggle to maintain their focus on those pixels. Therefore, there was a constant lag of focus and the eyeball remained relaxed at the resting point of accommodation (dark focus) and the eyes couldn't regain their focus back. The effort of the ciliary muscle of the eye to reclaim its focus many times causes eye fatigue. Moreover, it can cause pain in the eye, blurry eyes, or musculoskeletal symptoms of the CVS [8].

Epidemiology

Around 60 million people globally are suffering from CVS. It is predicted to keep on rising to about a million cases each year [2]. Systematic review-based research has found that the prevalence of CVS particularly in Asia, the Middle East, and Europe is 66%. The highest prevalence was in Saudi Arabia with a 95% occurrence of CVS [9].

Symptoms

Computer Vision Syndrome consists of some types of symptoms which are

- *Extra-Ocular Symptoms*

Extra-ocular symptoms are related to musculoskeletal and other symptoms that do not appear in the eyes such as headache, sore neck, back pain, and carpal Carpal-tunnel Syndrome. Those symptoms appeared as a result of continuously maintaining body position (head, neck, and hands) which caused excessive muscle tension [10].

- *Ocular Symptoms*

Ocular symptoms could occur at the inside (asthenopia) or surface of the eyeball. Asthenopia or eye strain appears as an outcome of preserving the eyeball and vision for a long duration towards the computers or other VDTs [11]. Ocular surface symptoms are usually related to the blink rate and the tear film. Tear films consist of a superficial lipid surface that prevents evaporation; middle aqueous lacrimal glands that produce water, sodium, and protein; and a mucinous deep layer consisting of glycoprotein and hydrophobic lipoprotein layer [12].

Prolonged screen time could reduce the blinking rate of the eye. This could cause an evaporation of the tear films which leads to evaporative dry eye problems. Too much tear film evaporation could end up damaging the epithelial surface of the eyeball [13].

- *Visual Symptoms*

Visual symptoms are vision disturbances such as diplopia or blurry vision which causes difficulties in object perception [8].

Diagnosing CVS

CVS can be diagnosed through some examinations such as:

- *Historical Examinations*

Digging the patient's history for eye disturbance such as refraction errors like myopia or astigmatism could determine the cause of eye strain caused by excessive VDT use. Examining their history of daily digital activity, rest patterns, and environmental conditions is also important [14].

- *Objective Eye Health Examination*

Evaluating any probabilities of other eye problems such as dry eye like TBUT (tear-breakup time) test to determine further determination of the CVS' symptoms [14].

- *Subjective Evaluation*

Questionnaire-based examination such as with CVS-Q (Computer Vision Syndrome Questionnaire) to determine the probability of suffering from CVS [15].

The Impact of Computer Vision Syndrome on Medical Student's Academic Performance

During the Covid-19 pandemic, gadgets became something that couldn't be taken away from our daily lives [16][17]. In the aftermath of the Covid-19 pandemic, digitalization became something certain. This was a result of new normal adaptation in many aspects of our lives [18]. The rapid rise of digitalization led to excessive screen time [19][20]. This also led to many health problems for young generations such as CVS [21].

The impact of digitalization couldn't be separated from medical student's daily activities too which could possibly cause CVS to them. A study in a private university in Paraguay proved that 82.5% of the subjects were having CVS [4]. Another study in Egypt found that 86% of medical student subjects were having complaints of CVS symptoms mainly blurry vision (31%) and dry eye (28%) [5]. In Universitas Diponegoro in Indonesia, 73.5% of the medical student samples were having CVS [7].

CVS complaints are proven to be causing eye fatigue which affects academic work. Problems with lighting and continuous radiation of the computer in medical student's academic activities are causing eye strain [22]. Prolonged use of computers without rest is also proven to contribute to headaches, especially TTH (Tension-type Headache) caused by bad posture and muscle contractions of the head and neck which can be triggered by physical or psychological causes. Stress and emotional conflict can cause this headache in medical students [23].

Excessive screen time which leads to Computer Vision Syndrome could have an impact negatively on medical students. Ocular health problems eventually correlate to psychological and sleep disturbances, more sedentary behaviors, and less physical activity [24]. Sleep duration ($p=0.000$), sleep latency ($p=0.000$), and habitual sleep efficiency symptoms lead to daytime dysfunction which leads to concentration problems, daytime sleepiness, and poor cognitive and learning abilities which in turn lowers academic performance ($p=0.000$) [7]. In Bangladesh, with a high level of VDT use in medical students, it is found that 35.6% of the subjects have poor results in academic performance. Besides, 14.1% have poor attendance. Excessive use of digital devices (which is related to the risks of CVS' appearance) is strongly correlated ($p<0.01$) [25].

Management

As the need for digital devices in medical students is massive, it is very unlikely for them to highly reduce their screen time. However, a good rest in between digital device uses is highly recommended as it could prevent further complications of CVS symptoms. Besides, applying good position and reading distance from the screen (at least 50 cm) and the rule of 20-20-20 (which are: after 20 minutes of work in front of digital devices, rest the eye by looking at an object 20 feet away for 20 minutes) are the best possible management in preventing the appearance or the worsening of CVS [1].

CONCLUSION

Excessive screen time in this era couldn't be avoided even by the medical students. Digitalization in the learning process could lead to Computer Vision Syndrome. More than half of the subjects in many different studies globally found that medical students had this syndrome. It is also found that CVS could lead to many problems especially sleep disturbance which also leads to poor academic performance. Further research is still needed to increase the awareness of students in this modern era. As high screen time can't be avoided, good management such as body posture, device distance from users' eyes, and enough rest are the key to managing CVS problems.

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