BJMS
Borneo Journal of Medical Sciences

REVIEW ARTICLE

Computer Vision Syndrome in University Students: A Narrative Review of Prevalence, Pathophysiology, and Management Strategies

Thirumurugan Nyanasegram[1], Aizuddin Hidrus[1], Azizan Omar[1], Mohammad Saffree Jeffree[1], Loganathan Salvaraji[2], Sahipudin Saupin[1]*

[1] Department of Public Health Medicine, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Jalan UMS, 88400, Kota Kinabalu, Sabah, Malaysia
[2] Johor Bahru District Health Office, Ministry of Health Malaysia, Jalan Abdul Samad, Kolam Ayer, 80100 Johor Bahru, Johor, Malaysia

*Corresponding author's email: drsahi@ums.edu.my

Received: 30 September 2025

Accepted: 15 December 2025

Published: 13 July 2026

DOI: https://doi.org/10.51200/bjms.v20iSuppl.8001

Keywords: *Computer vision syndrome, Digital screens, Dry eyes, Policy*

ABSTRACT

Background: Computer Vision Syndrome (CVS), or Digital Eye Strain, involves vision-related problems from prolonged uses of digital screens. The severity of its symptoms, which include ocular fatigue, headaches, blurred vision, dry eyes, and neck and shoulder pain, often correlates with screen time duration. Objectives: This narrative review examines the prevalence, consequences, and mitigation strategies for CVS among university students, a population particularly vulnerable due to their extensive reliance on digital devices for academic and leisure activities. **Methods:** search was conducted using databases such as PubMed, Scopus, and Google Scholar. The search focused on peer-reviewed articles published in English using keywords like "Computer Vision Syndrome," "Digital Eye Strain," "university students," and "prevalence." **Results:** The literature indicates a high prevalence of CVS among students, which rates often exceeding 70%. Key contributing factors include prolonged screen duration, improper workstation ergonomics, inadequate lighting, and uncorrected vision problems. Effective interventions include ergonomic adjustments, adherence to regular visual breaks like the 20-20-20 rule, proper eye care, and the use of computer glasses. **Conclusion:** CVS is a significantly and highly prevalent occupational health issue among university students that can negatively impact academic performance and quality of life. This review serves as an essential tool for educators and healthcare

practitioners by consolidating evidence on effective prevention and management. Future research prioritizes longitudinal studies to tract CVS progression, intervention-based trials to compare management strategies, and deeper investigations into the psychological impacts of chronic CVS symptoms.

INTRODUCTION

As of late 2023, the world's 5.3 billion internet users spend an average of 6 hours and 41 minutes online daily (DATAREPORTAL-Digital Around the World, 2023). This profound integration of digital devices such as computers, smartphones, and tablets into daily life has given rise to Computer Vision Syndrome (CVS), a significant public health issue. CVS, also known as Digital Eye Strain, is a group of eye and vision-related problems that result from prolonged use of any digital screen. It represents a complex of ocular, visual, and musculoskeletal symptoms, including eye strain, headaches, blurred vision, dry eyes, and neck and shoulder pain. These symptoms are often caused by a combination of factors such as poor lighting, screen glare, improper viewing distances, poor posture, and uncorrected vision problems (Anbesu & Lema, 2023).

The COVID-19 pandemic dramatically accelerated digital transformation, with educational institutions shifting to web-based learning and increasing students' reliance on screens for lectures and coursework. (De' et al., 2020). This sharp rise in mandatory screen time has likely exacerbated the prevalence and severity of CVS among students compared to the pre-pandemic era. University students are a particularly vulnerable demographic due to intense visual demands for their academic work, which often involves hours of reading, writing, and research on digital devices, compounded by additional screen use for social and recreational activities. (Kaur et al., 2022).

Global statistics indicate that over 60 million people suffer from CVS, with a million new cases emerging annually (Dessie et al., 2018). While initially studied as an occupational hazard for office workers, research has increasingly highlighted its prevalence in higher education (L. Wang et al., 2021). Studies from around the world report that most university students experience at least one symptom of CVS, with prevalence rates ranging from 70% to over 90% in some populations (L. Wang et al., 2021). Given its potential to impair vision, reduce academic productivity, and diminish overall quality of life, understanding the scope and management of CVS within the student populations is of paramount importance (C. Wang et al., 2023). Consequently, this narrative review aims to synthesize existing literature with the following specific objectives:

1. To examine the prevalence and associated risk factors of CVS among university students globally.
2. To discuss the pathophysiology and underlying mechanisms that contribute to the ocular and musculoskeletal symptoms associated with prolonged digital device use.
3. To evaluate current management strategies and preventive measures, including optical corrections, ergonomic interventions, and the 20-20-20 rule, to mitigate the burden of CVS in this demographic.

METHODOLOGY

This article is a narrative review of the existing literature on CVS. search was conducted using the electronic databases PubMed, Scopus, and Google Scholar to identify relevant studies between 2020 and 2025. The search strategy employed a combination of keywords and Medical Subject Headings (MeSH) terms, including "Computer Vision Syndrome," "Digital Eye Strain," "asthenopia," "students," "university," "college," "prevalence," "risk factors," and "management." This review included peer-reviewed articles, systematic reviews, meta-analyses, and textbooks published in English.

The primary focus was on studies involving university or college students' populations. Articles concerning pediatric or non-student adult populations were excluded unless they provided foundational information on pathophysiology or management relevant to the target demographic. Approximately 150 records were initially identified. Following the removal of duplicates and screening of title and abstracts for relevance, 61 full-text articles were critically reviewed. Ultimately, 41 studies met the inclusions criteria and were synthesized in this review. While a formal risk-of-bias assessment was not performed due to the narrative nature of this review, included studies were critically appraised for methodological clarity, sample size appropriateness, and relevance to the specific research objectives. Information from these selected articles was extracted and organized narratively to cover the definition, prevalence, pathophysiology, risk factors, and management strategies for CVS.

PREVALENCE OF CVS

The prevalence of CVS has been escalating, in tandem with the worldwide surge in the utilization of digital devices. Several studies have consistently reported a significant occurrence of CVS among university students. Common symptoms associated with CVS include discomfort in the neck or shoulders, headaches, and dry eyes (Al Tawil et al., 2020; Fan et al., 2021; Gadain Hassan, 2023; Zalat et al., 2022). Contributing to its prevalence are factors such as extended computer usage, improper posture, and a lack of knowledge and preventative actions (Gadain Hassan, 2023). Smartphone usage and online studying have also been linked to an increased rate of CVS (Iqbal et al., 2021). Nevertheless, university students consistently demonstrate a pattern of being avid consumers of digital technology, utilizing it extensively for both academic and recreational activities. A comprehensive analysis may uncover prevalence rates varying from 60 to 90% among this demographic, underscoring the substantial influence of digital gadget usage on this group (Bibek Raj Parajuli et al., 2021). The disparity in prevalence rates also indicates the impact of additional factors, such as individual visual capabilities and ergonomic habits. This establishes the basis for comprehending CVS within the framework of university students, a demographic particularly vulnerable due to their extensive dependence on digital gadgets for educational objectives. The complexity of CVS, encompassing its symptoms and underlying causes, highlights the significance of this work in tackling a contemporary health issue. Another study revealed a significant occurrence of CVS, impacting 74% of the participants (León-Figueroa et al., 2024). However, more studies needed to highlight

Table 1: Global Prevalence of CVS among University Students

Country	Prevalence (%)	Key Risk Factors Identified	Study (Year)
Saudi Arabia	89.7	Daily digital device use > 7 hours.	(Albasheer et al., 2025)
Ethiopia	84.4	Screen glare, lack of breaks, improper viewing angle	(Zenbaba et al., 2021)
United States of America	83.1	Poor sleep quality, extended online content delivery	(Garlock et al., 2025)
Colombia	82.5	Daily device use > 6 hours	(Ramírez-Velandia et al., 2022)
China	77.1	Online learning duration, lack of anti-glare screen	(C. Wang et al., 2023)
Spain	65.4	Daily device use > 6 hours	(Ortiz-Toquero et al., 2024)
India	53.2	Daily screen time > 4 hours	(Thapar et al., 2025)

the rising issues as the current research are limited.

PATHOPHYSIOLOGY OF COMPUTER VISION SYNDROME

The underlying causes of CVS are diverse and include several factors. Persistent fixation on a close object, such as a computer screen, results in the continuous contraction of the ciliary muscles of the eye, which in turn leads to ocular fatigue and pain (Pavel et al., 2023). This is worsened by the decreased frequency of blinking that is noted when using screens, which contributes to the symptoms of dry eye. Moreover, the presence of glare and reflections on the screen might exacerbate eye fatigue. Neck and shoulder strain can be exacerbated by ergonomic problems, such as incorrect workstation arrangement and seating posture, which can further intensify the pain associated with CVS (Kaur et al., 2022).

The most seen symptoms during computer usage are reduced blink rate, eye fatigue, headache, neck discomfort, blurred vision, and eye strain. Moreover, it has been suggested that extended computer use, and unfavourable lighting conditions might reduce the efficiency of the human visual system. Furthermore, research indicates that the blue light emitted by computer screens might reduce melatonin synthesis. Undesirable reflections, head placement, and gaze direction when using visual display devices can lead to symptoms of Computer Vision Syndrome.

The ocular focusing mechanism on humans varies while reading written text compared to viewing visual display units, leading to discernible differences in reactions. Reading printed text and reading on a computer have distinct disparities. These factors encompass differences in the distance at which an object is viewed, the angles at which one's vision is directed, the frequency of blinking, the appearance of texts, and the need for adjustment. In addition, reading on a computer might lead to an enlargement of the palpebral fissure. Printed letters are comprised of distinct characters that are plainly visible on the surface, whereas Visual Display Terminal letters are formed by pixels created when an electrical beam strikes the phosphor-coated rear surface of the screen. Every pixel demonstrates a significant level of brightness at its centre and progressively decreases in luminosity towards the periphery. The pixel characters are intentionally meant to challenge human visual focus (Wimalasundera Saman, 2006). Nevertheless, the focusing mechanism has a delay in synchronizing with the computer screen due to the computer

Table 2: Major Categories of Symptoms in Computer Vision Syndrome (Dhar-Munshi et al., 2019).

Symptom category	Symptoms	Possible causes
Asthenopia	• Eye strain • Tired eyes • Sore eyes	• Binocular vision • Accommodation
Oculo-motor problems	• Dry eyes • Watery eyes • Irritated eyes • Contact lens problems	• Infrequent blinking
Visual	• Blurred vision • Slowness of focus change • Double vision • Presbyopia • Transient blindness	• Refractive error • Accommodation • Binocular vision • Presbyopic correction • Bleaching of photopigment, with the viewing eye becoming light-adapted
Extra-ocular	• Neck pain • Back pain • Shoulder pain	• Computer screen location

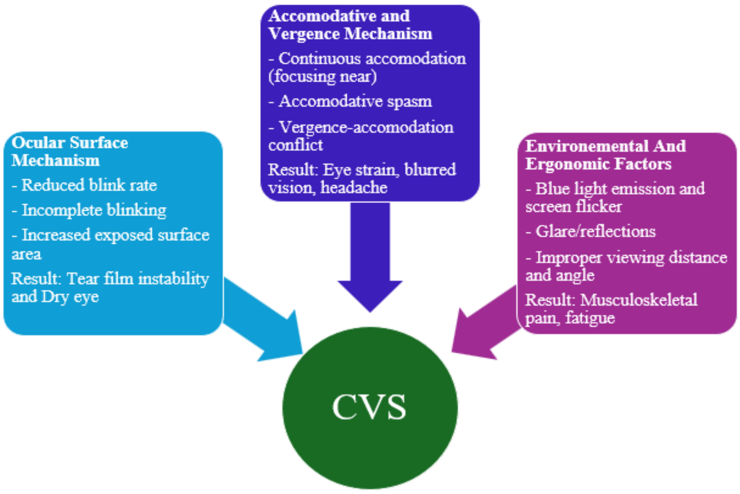


Figure 1: Pathophysiological Framework of CVS. The diagram illustrates the interplay between three primary domains: (1) Ocular Surface Mechanisms (e.g., reduced blink rate leading to evaporative dry eye), (2) Accommodative Mechanisms (e.g., ciliary muscle spasm from prolonged near focus), and (3) Extra-ocular Factors (e.g., poor lighting, glare, and ergonomics). These factors contribute to the complex symptoms of digital eye strain.

user's vertical gaze position preference, which contrasts with reading printed text (Asharlous et al., 2022). The precise phrase for this place is known as the dark focus.

Hence, the eyes strive to achieve a state of relaxation called the resting point of accommodation or dark focus, while simultaneously exerting effort to focus on the individual pixels of letters. The cyclical adaptation and re-adaptation of the eye's focal point by the ciliary body causes ocular tiredness and gives rise to symptoms associated with visual accommodation (Anshell Jeffrey, 2005). Ocular symptoms related with Computer Vision Syndrome arise due to the absence of proper adjustment in focusing the eyes. Moreover, the pictures generated by pixels and raster technology exhibit indistinct edges, leading to a reduction in visual clarity and a delay in the capacity to focus owing to the blurred appearance of text characters (Anshell Jeffrey, 2005). Therefore, computer-based visual activities necessitate substantial exertion on the eyes, including frequent swift eye movements (saccadic eye movements), ongoing focus adjustments (accommodation), and alignment demands (vergence). These actions need the continuous relaxation and contraction of the muscles of the eye (Alemayehu, 2019).

FACTORS AFFECTING CVS

Age and Gender

University students often belong to the age group of late adolescence to early adulthood, which is characterized by a high level of flexibility and perseverance. Nevertheless, the visual requirements and digital behaviours of this demographic also expose them to a greater likelihood of acquiring Computer Vision Syndrome. The literature suggests that the prevalence of CVS varies among different age groups in the university population. This variation is generally associated with the level of digital device usage and lifestyle characteristics.

According to an article published in India, being above the age of 14 was identified as one of the prominent risk factors for experiencing symptoms of Digital Eye Strain among students (Mohan et al., 2021). According to a study, there was a negative link between age and Digital Eye Strain scores. This phenomenon may be elucidated by the inverse relationship between the duration of gadget usage and age. Consequently, age cohorts below 33 years old had a higher prevalence of elevated Digital Eye Strain scores (Ganne et al., 2021). A paper investigating the effects of e-schooling with Digital Eye Strain during the Covid-19 pandemic on school-age children in India in 2020 reported similar findings. The study revealed that children under the age of five did not exhibit any signs of CVS, but the older age group had elevated CVS scores (Gupta et al., 2021). Given the specific emphasis of this study on ocular CVS experienced by students in educational institutions, the age range indicated for participants was around 5 to 27 years.

Many studies frequently document differences in the occurrence and symptoms of CVS based on gender. Women often have a greater prevalence of CVS. The diversity in outcomes can be ascribed to several causes, such as hormonal disparities, variations in visual and coping techniques, and divergent patterns of digital device utilization among genders. Women had a nearly threefold greater probability of getting CVS compared to males (Zenbaba et al., 2021). The meibomian gland activity and tear secretion were influenced by the balance of androgen/oestrogen hormones, leading to a decrease in tear production (Maskin et al., 2007). According to a study, decreased levels of testosterone and increased levels of oestrogen in an individual contribute to meibomian gland malfunction, leading to the development of dry eyes (Ma'roef et al., 2023). Moreover, the use of cosmetics and contact lenses in females has been associated with heightened vulnerability to dry eye symptoms, which are a prevalent aspect of CVS (Maskin et al., 2007).

Duration of Computer Use

The length of continuous computer use is a major contributing factor to CVS. Studies repeatedly demonstrates a direct association between prolonged durations of screen usage and the incidence of CVS symptoms (Efendi et al., 2022). University students, specifically, are susceptible to extended periods of uninterrupted computer usage for academic endeavours, such as composing papers, programming, creating designs, and performing research, hence heightening their vulnerability to acquiring CVS. Prolonged screen use, especially surpassing two consecutive hours, has been associated with an increased probability of developing symptoms of CVS (Bibek Raj Parajuli et al., 2021). Extended and frequent computer use might worsen the symptoms of CVS as time goes on. This element is vital for undergraduate students who may have accumulated years of extensive screen exposure during their academic journey. Study has also recorded the effects of prolonged screen time on foveal responses and visual field illumination, emphasizing the physiological consequences of protracted screen exposure on the eyes.

Types of Digital Devices

Various categories of digital gadgets can have diverse effects on the risk of CVS. Smaller displays, such as smartphones and tablets, can lead to more pronounced eye strain (Lindo-Cano et al., 2022). This is because the smaller text and pictures on these screens require users to examine them at closer distances and exert more effort to see them well. On the other hand, bigger displays like desktop computers, although they may be less tiring for the eyes, can nevertheless cause CVS if they are not positioned or utilized properly (Hynes et al., 2022). The way electronics are utilized also impacts the likelihood of CVS. For instance, when using tablets and smartphones for leisure activities, people commonly adopt non-ergonomic positions, which can lead to an increased risk of experiencing neck and shoulder pain. This pain is a frequent symptom of CVS (Wangsan et al., 2022).

Break Patterns and Screen Time Management

Periodic intervals of rest from prolonged exposure to screens are essential in reducing the effects of CVS. The 20-20-20 rule, which suggests focusing on an object 20 feet away for 20 seconds every 20 minutes, is frequently advised to alleviate eye fatigue. Studies have shown that sticking to such break patterns can greatly improve CVS symptoms. Although the advantages of taking frequent breaks are well-established, a significant number of students may lack knowledge about these practices or struggle to continuously incorporate them into their routine, particularly when faced with time constraints (Sheppard & Wolffsohn, 2018).

Computer usage attributes have a crucial role in determining CVS among university students. The utilization of digital devices and the management of screen time can either worsen or alleviate the risk of CVS. Comprehending these aspects enables the creation of focused treatments and educational initiatives designed to encourage better computer usage habits. This is essential for decreasing the occurrence and consequences of CVS among university students.

Workspace Setup

The risk of CVS is substantially influenced by the ergonomic design, which encompasses the arrangement of seats, workstations, and computer postures. Implementing effective ergonomic design principles might mitigate the likelihood of CVS by encouraging optimal posture and minimizing ocular and bodily strain (Anbesu & Lema, 2023; Chowdhury et al., 2018). CVS is more likely to occur due to factors such as incorrect body posture, prolonged use of visual display terminals, and close-range screens (Anbesu & Lema, 2023). The alignment of the monitor is a crucial design feature because bad posture and office design mostly impact the trunk, as stated by (Chowdhury et al., 2018). Studies have shown that implementing ergonomic training programs can effectively decrease the likelihood of developing musculoskeletal problems, which are known to be a potential cause of CVS (Bassey Etuknwa & Humpheries, 2018). Musculoskeletal diseases are linked to the usage of non-ergonomic chairs and desks in home workstations

Lighting and Glare

Optimal illumination is essential for preventing ocular fatigue. Optimally, the ambient lighting should possess a comparable level of luminosity to that of the computer screen. The excessive disparity in luminosity between the screen and the surrounding environment compels the eyes to continuously adapt, resulting in weariness and tension. Studies suggest that diffused lighting, which minimizes intense shadows and glare, has positive effects (Khan et al., 2022). External light sources causing glare on the computer screen can greatly heighten the likelihood of experiencing eye strain. To optimize screen visibility, it is advisable to position the screen in a location that is not immediately exposed to light sources, utilize blinds or curtains to regulate natural light, and arrange work lighting in a manner that avoids direct illumination of the screen or eyes. Matte screen filters are also capable of effectively minimizing glare (Lin et al., 2019).

Eye Care Practices

Regular eye examinations are crucial for identifying and rectifying visual issues that might lead to CVS. Optometrists can diagnose conditions such as myopia, hyperopia, or astigmatism, and recommend corrective eyewear to alleviate eye fatigue. In addition, they could identify early indications of eye fatigue and provide guidance on suitable measures to alleviate CVS (Sheppard & Wolffsohn, 2018). Individuals who often use screens might benefit from wearing glasses that have anti-reflective coating. These lenses mitigate screen glare and environmental glare, minimize the quantity of blue light that reaches the eyes, and enhance visual comfort. Even those without visual impairments can benefit from using properly made computer glasses to mitigate the risk of Computer Vision Syndrome by eliminating glare and enhancing the visual experience (Ma'roef et al., 2023).

IMPACT OF CVS

Academic Performance

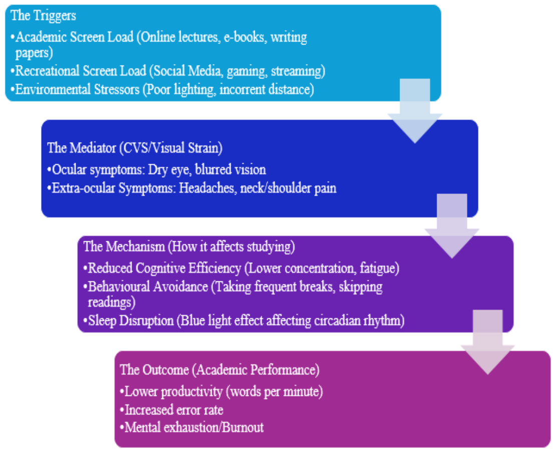
Research has established a correlation between symptoms of CVS, such as eye strain, blurred vision, and headaches, and a decline in focus and efficiency. These symptoms can greatly affect a student's capacity to concentrate on academic tasks, particularly those that need prolonged visual attention, such as reading, writing, and computer-based research (Abudawood et al., 2020). Visual discomfort and its related symptoms might hinder the process of acquiring knowledge and understanding. Students who have unattended CVS may encounter difficulties in participating in extended reading or conducting research on screens, which are essential aspects of higher education learning. This can result in diminished recall of knowledge and comprehension of course content (Mersha et al., 2020).

Quality of Life

The symptoms of CVS can extend their impact to daily life activities and social interactions. For instance, eye discomfort and headaches can reduce a student's ability to engage in social activities, sports, or hobbies, especially those that involve screen use or require acute visual attention. This can lead to a reduction in overall quality of life and social well-being. The excessive use of screens, especially in the evenings, can disrupt sleep patterns due to the blue light emitted by digital devices. Poor sleep quality, a potential consequence of CVS, can further exacerbate symptoms of eye strain and fatigue, creating a vicious cycle that impacts both academic performance and general health. The chronic discomfort associated with CVS can also have psychological implications(Raiturcar, 2021). The constant experience of physical symptoms like headaches and eye strain can lead to increased stress levels, anxiety, and frustration, particularly during high-pressure academic periods. This can affect mental health and well-being, further complicating the student's university experience.

Progression of Myopia

An important ocular health issue resulting from the COVID-19 pandemic is the development of new myopia and the accelerated progression of existing myopia caused by excessive near work distance (Kaur et al., 2022). Digital screen-time has also been considered as a potential modifiable environmental risk factor that can increase the risk of myopia progression. Prevention of myopia progression has been prioritized due to the associated risks of myopic macular degeneration, retinal detachment, glaucoma, and cataract (Holden et al., 2016).



from digital dependency to academic impairment. Excessive academic and recreational screen time (Antecedents) leads to the development of CVS (Mediator). This physical and visual discomfort triggers secondary mechanisms such a cognitive fatigue, sleep disruption, and avoidance behaviours, which ultimately compromise academic efficiency and performance (Outcome).

PREVENTION AND MANAGEMENT STRATEGIES

Education and awareness

Educational and awareness programs are fundamental in preventing CVS. Universities may conduct awareness campaigns to educate students on the symptoms, dangers, and significance of prompt care for CVS. Workshops and seminars that prioritize ergonomics, eye health, and safe digital device usage are crucial for conveying practical information. These sessions should include topics such as the ideal arrangement of workstations, the importance of frequent eye examinations, and efficient routines for taking breaks during extended periods of screen usage (Coles-Brennan et al., 2019).

Workplace design

Ergonomic workspace design is crucial in minimizing the danger of CVS. Ensuring the appropriate alignment of the desk and chair, which promotes the maintenance of proper posture, as well as placing the monitor correctly, are of utmost importance. This entails placing the monitor at a level that aligns with or slightly below the user's eyes and at around the length of one's arm. Universities can provide guidance to students on how to set up their study rooms in an ergonomic manner, especially for those who use laptops and tablets. Additionally, the promotion of portable ergonomic equipment such as laptop stands, and extra keyboards might be encouraged (Chowdhury et al., 2018).

Break Pattern

Efficient solutions for managing screen time are crucial. Taking regular pauses and following the 20-20-20 rule can effectively reduce eye strain. Implementing digital curfews, particularly before to going to sleep, is advised to mitigate sleep disruptions associated with excessive screen usage. Universities can integrate these activities into students' everyday routines, potentially by implementing regulated timetables and reminders (Alqahtani, 2022).

Eye health examinations

Frequent eye examinations are essential for detecting and resolving any visual problems that may contribute to CVS. Universities could support and promote eye health services or establish partnerships with eye care professionals in the local community. Additionally, a successful approach involves instructing students on the advantages of computer glasses, which are specifically engineered to reduce ocular fatigue (Maskin et al., 2007) .

Blue-light Filter

Implementing blue light filters on digital devices helps alleviate ocular fatigue and enhance the quality of sleep. Utilizing software that urges users to take breaks or automatically adjusts screen settings according to the time of day might be advantageous. These technical tools may be seamlessly incorporated into students' digital devices, providing a practical method to mitigate the danger of Computer Vision Syndrome (Lin et al., 2019).

Lifestyle

Promoting a wholesome lifestyle is essential for preventing CVS. Consistent physical exercise helps mitigate musculoskeletal complaints linked to extended computer usage. Proper hydration and a well-balanced diet are essential for sustaining optimal eye health. Universities can facilitate the adoption of these lifestyle improvements by implementing campus health programs and student wellness initiatives (Coles-Brennan et al., 2019).

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

While this review provides a comprehensive synthesis of the current literature, several limitations must be acknowledged. First, most included studies utilized a cross-sectional design, which precludes the establishment of causal relationships between digital device use and the progression of CVS symptoms over time. Second, there is significant heterogeneity in the diagnostic criteria for CVS across studies; while some researchers utilized validated instruments like the Computer Vision Syndrome Questionnaire (CVS-Q), others relied on ad-hoc symptom checklists, making direct prevalence comparisons difficult. Third, most data were self-reported, introducing the potential for recall bias and subjective interpretation of symptom severity. Finally, few studies controlled for confounding variables such as pre-existing ocular surface disease, contact lens wear, or environmental factors such as humidity and air quality in the university setting.

To advance our understanding of CVS in student populations, future research should prioritize the following areas:

- Cohort studies tracking students from their first year through graduation are needed to determine the cumulative effect of academic screen exposure on the visual system.
- Future protocols should integrate objective clinical measures such as non-invasive tear break-up time (NIBUT), blink rate analysis, and accommodation micro-fluctuations alongside subjective questionnaire to validate symptom reports.
- Rigorous Randomized Controlled Trials (RCTs) are required to evaluate the effectiveness of common interventions, particularly the "20-20-20 rule" and blue-light blocking filters, specifically within the context of high-intensity academic reading.
- As education adopts immersive technologies, research must investigate the unique visual burdens imposed by Virtual Reality (VR) and Augmented Reality (AR) headsets in university training programs.

CONCLUSION

In short, a comprehensive strategy is necessary to prevent and handle CVS among college students. Educational and awareness initiatives, ergonomic treatments, screen time management, eye care practices, technology solutions, and lifestyle alterations can help reduce the occurrence and effects of CVS. This comprehensive approach not only tackles the acute symptoms of CVS but also fosters long-term health and well-being among students in the digital era. It is crucial for educational institutions to acknowledge the importance of these techniques and actively participate in their execution to protect the well-being and academic achievement of their students.

REFERENCES

Abudawood, G. A., Ashi, H. M., & Almarzouki, N. K. (2020). Computer Vision Syndrome among Undergraduate Medical Students in King Abdulaziz University, Jeddah, Saudi Arabia. Journal of Ophthalmology, 2020. https://doi.org/10.1155/2020/2789376

Al Tawil, L., Aldokhayel, S., Zeitouni, L., Qadoumi, T., Hussein, S., & Ahamed, S. S. (2020). Prevalence of self-reported computer vision syndrome symptoms and its associated factors among university students. European Journal of Ophthalmology, 30(1), 189–195. https://doi.org/10.1177/1120672118815110

Albasheer, O., Jareebi, M. A., Alnami, R. M., Soweedi, A. M., Alqahtani, S. S., Ageeli, A. M., Arif, F. Y., Judayba, A. H., Hakami, A. M., Otayf, D. A. H., Almraysi, S. A., Najmi, A. Y., Alqassim, A. Y., Ryani, M. A., & Bahri, A. A. (2025). Computer Vision Syndrome Among Saudi University Students: A Cross-Sectional Analysis of Risks and Discipline Variations. Healthcare (Switzerland), 13(21). https://doi.org/10.3390/healthcare13212798

Alemayehu, A. M. (2019). Pathophysiologic Mechanisms of Computer Vision Syndrome and its Prevention: Review. World Journal of Ophthalmology & Vision Research, 2(5). https://doi.org/10.33552/wjovr.2019.02.000547

Alqahtani, M. M. (2022). Computer Vision Syndrome in Medical Students: Awareness, Prevalence and Risk Factors. Journal of Ophthalmology and Advance Research, 1–12. https://doi.org/10.46889/joar.2022.3305

Anbesu, E. W., & Lema, A. K. (2023). Prevalence of computer vision syndrome: a systematic review and meta-analysis. Scientific Reports, 13(1). https://doi.org/10.1038/s41598-023-28750-6

Anshell Jeffrey. (2005). VISUAL ERGONOMICS HANDBOOK (Anshell Jeffrey, Ed.). Taylor & Francis Group.

Asharlous, A., Doostdar, A., Ghaemi, V., Farzi, M., Yekta, A., Mortazavi, A., Ostadimoghaddam, H., & Khabazkhoob, M. (2022). Binocular Function in Different Gaze Positions. Journal of Ophthalmic and Vision Research. https://doi.org/10.18502/jovr.v17i2.10792

Bassey Etuknwa, A., & Humpheries, S. (2018). A Systematic Review on the Effectiveness of Ergonomic Training Intervention in Reducing the Risk of Musculoskeletal Disorder. Journal of Nursing and Health Studies, 03(02). https://doi.org/10.21767/2574-2825.1000032

Bibek Raj Parajuli, C., Raj Parajuli, B., Koirala, S., & Bajracharya, A. (2021). Computer vision syndrome: a rising problem during COVID-19 period amongst students and online workers. https://doi.org/10.3126/jpahs

Chowdhury, N., Aghazadeh, F., & Amini, M. (2018). Ergonomic assessment of working postures for the design of university computer workstations. Occupational Ergonomics, 13(S1), S37–S46. https://doi.org/10.3233/OER-170252

Coles-Brennan, C., Sulley, A., & Young, G. (2019). Management of digital eye strain. In Clinical and Experimental Optometry (Vol. 102, Issue 1, pp. 18–29). Blackwell Publishing Ltd. https://doi.org/10.1111/cxo.12798

DATAREPORTAL-Digital Around The World. (2023).

De', R., Pandey, N., & Pal, A. (2020). Impact of digital surge during Covid-19 pandemic: A viewpoint on research and practice. International Journal of Information Management, 55. https://doi.org/10.1016/j.ijinfomgt.2020.102171

Dessie, A., Adane, F., Nega, A., Wami, S. D., & Chercos, D. H. (2018). Computer vision syndrome and associated factors among computer users in Debre Tabor town, Northwest Ethiopia. Journal of Environmental and Public Health, 2018. https://doi.org/10.1155/2018/4107590

Dhar-Munshi, S., Amed, S., & Munshi, S. (2019). Computer Vision Syndrome: an Update. British Journal of Neuroscience Nursing, 15(Sup2), S10–S11. https://doi.org/10.12968/bjnn.2019.15.sup2.s10

Efendi, S., Sriyanah, N., Fatmawati, F., Livana, P. H., Suswani, A., & Nuratifah, N. (2022). Duration of smartphone usage in online learning during the COVID-19 pandemic and the occurrence of computer vision syndrome in the students of MTsN 1 Bone. International Journal of Health Sciences, 7652–7659. https://doi.org/10.53730/ijhs.v6ns5.11668

Fan, Q., Wang, H., Kong, W., Zhang, W., Li, Z., & Wang, Y. (2021). Online Learning-Related Visual Function Impairment During and After the COVID-19 Pandemic. In Frontiers in Public Health (Vol. 9). Frontiers Media S.A. https://doi.org/10.3389/fpubh.2021.645971

Gadain Hassan, H. A. (2023). Computer Vision Syndrome Among Medical Students at the University of Khartoum, Sudan: Prevalence and Associated Factors. Cureus. https://doi.org/10.7759/cureus.38762

Ganne, P., Najeeb, S., Chaitanya, G., Sharma, A., & Krishnappa, N. C. (2021). Digital Eye Strain Epidemic amid COVID-19 Pandemic–A Cross-sectional Survey. Ophthalmic Epidemiology, 28(4), 285–292. https://doi.org/10.1080/09286586.2020.1862243

Garlock, M., Speth, M., & McEchron, M. (2025). Computer vision syndrome and its relationship with sleep and fatigue in medical students. BMC Medical Education, 25(1). https://doi.org/10.1186/s12909-025-07503-1

Gupta, R., Chauhan, L., & Varshney, A. (2021). Impact of E-schooling on digital eye strain in Coronavirus Disease Era: A survey of 654 students. In Journal of Current Ophthalmology (Vol. 33, Issue 2, pp. 158–164). Wolters Kluwer Medknow Publications. https://doi.org/10.4103/joco.joco_89_20

Holden, B. A., Fricke, T. R., Wilson, D. A., Jong, M., Naidoo, K. S., Sankaridurg, P., Wong, T. Y., Naduvilath, T. J., & Resnikoff, S. (2016). Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. Ophthalmology, 123(5), 1036–1042. https://doi.org/10.1016/j.ophtha.2016.01.006

Hynes, N. J., Cufflin, M. P., Hampson, K. M., & Mallen, E. A. H. (2022). The effect of image resolution of display types on accommodative microfluctuations. Ophthalmic and Physiological Optics, 42(3), 514–525. https://doi.org/10.1111/opo.12949

Iqbal, M., Elzembely, H., Elmassry, A., Elgharieb, M., Assaf, A., Ibrahim, O., & Soliman, A. (2021). Computer Vision Syndrome Prevalence and Ocular Sequelae among Medical Students: A University-Wide Study on a Marginalized Visual Security Issue. The Open Ophthalmology Journal, 15(1), 156–170. https://doi.org/10.2174/1874364102115010156

Kaur, K., Gurnani, B., Nayak, S., Deori, N., Kaur, S., Jethani, J., Singh, D., Agarkar, S., Hussaindeen, J. R., Sukhija, J., & Mishra, D. (2022). Digital Eye Strain- A Comprehensive Review. In Ophthalmology and Therapy (Vol. 11, Issue 5, pp. 1655–1680). Adis. https://doi.org/10.1007/s40123-022-00540-9

Khan, N., Ahmed, M. S., Wadud, S. A., Kabir, M. S., Hoque, M. M., Chowdhury, N., Faruk Hossain, M. G., & Rahman, S. (2022). Ocular manifestations among the professional computer workers attending the out patient department of Bangabandhu Sheikh Mujib Medical University : a cross sectional study. Bangabandhu Sheikh Mujib Medical University Journal, 14(3), 31–37. https://doi.org/10.3329/bsmmuj.v14i3.56595

León-Figueroa, D. A., Barboza, J. J., Siddiq, A., Sah, R., Valladares-Garrido, M. J., Adhikari, S., Aguirre-Milachay, E., Sah, S., & Rodriguez-Morales, A. J. (2024). Prevalence of computer vision syndrome during the COVID-19 pandemic: a systematic review and meta-analysis. BMC Public Health, 24(1). https://doi.org/10.1186/s12889-024-17636-5

Lin, C. W., Yeh, F. M., Wu, B. W., & Yang, C. H. (2019). The effects of reflected glare and visual field lighting on computer vision syndrome. Clinical and Experimental Optometry, 102(5), 513–520. https://doi.org/10.1111/cxo.12878

Lindo-Cano, E. F., García-Monge, V. A., Castillo-Cadillo, K. J., Sánchez-Tirado, E. A., Távara, I. M., & Morales, J. (2022). Computer-digital Vision Syndrome Among University Students of Lima City. The Open Public Health Journal, 15(1). https://doi.org/10.2174/18749445-v15-e2208104

Ma'roef, V. X., Adriyani, R., & Putra, I. W. G. A. E. (2023). RISK FACTORS OF COMPUTER VISION SYNDROME: A REVIEW OF OCULAR CAUSES AMONG SCHOOL AND COLLEGE STUDENTS. Jurnal Kesehatan Lingkungan, 15(1), 1–15. https://doi.org/10.20473/jkl.v15i1.2023.1-15

Maskin, S. L., Thomas, P., & Tseng, S. C. G. (2007). Reversing dry eye syndrome : practical ways to improve your comfort, vision, and appearance. Yale University Press.

Mersha, G. A., Hussen, M. S., Belete, G. T., & Tegene, M. T. (2020). Knowledge about Computer Vision Syndrome among Bank Workers in Gondar City, Northwest Ethiopia. Occupational Therapy International, 2020. https://doi.org/10.1155/2020/2561703

Mohan, A., Sen, P., Shah, C., Jain, E., & Jain, S. (2021). Prevalence and risk factor assessment of digital eye strain among children using online e-learning during the COVID-19 pandemic: Digital eye strain among kids (DESK study-1). Indian Journal of Ophthalmology, 69(1), 140–144. https://doi.org/10.4103/ijo.IJO_2535_20

Ortiz-Toquero, S., Sanchez, I., Serrano, A., & Martin, R. (2024). Prevalence of Computer Vision Syndrome and Its Risk Factors in a Spanish University Population. Eye & Contact Lens, 50(8). https://journals.lww.com/claojournal/fulltext/2024/08000/prevalence_of_computer_vision_syndrome_and_its.1.aspx

Pavel, I. A., Bogdanici, C. M., Donica, V. C., Anton, N., Savu, B., Chiriac, C. P., Pavel, C. D., & Salavastru, S. C. (2023). Computer Vision Syndrome: An Ophthalmic Pathology of the Modern Era. In Medicina (Lithuania) (Vol. 59, Issue 2). MDPI. https://doi.org/10.3390/medicina59020412

Raiturcar, T. P. (2021). Knowledge, Attitudes and Practices of Computer Vision Syndrome among Medical Students in Goa. Epidemiology International, 06(01), 9–14. https://doi.org/10.24321/2455.7048.202102

Ramírez-Velandia, F., Paz-Arteaga, J.-C., Constanza Penagos-Aldana, L., Paternina-Navarro, A., & Palencia-Sánchez, F. (2022). Computer Vision Syndrome in Students of a Medical School in Colombia. A Cross-Sectional Study. https://doi.org/https://doi.org/10.31235/osf.io/vr25p

Sheppard, A. L., & Wolffsohn, J. S. (2018). Digital eye strain: Prevalence, measurement and amelioration. In BMJ Open Ophthalmology (Vol. 3, Issue 1). BMJ Publishing Group. https://doi.org/10.1136/bmjophth-2018-000146

Thapar, R., Kumar, N., Unnikrishnan, B., Mithra, P., Chhillar, P., Singh, J., Hyder, M., Agrawal, M., Choudhary, R., & Jain, H. (2025). Computer Vision Syndrome and Its Risk Factors among Undergraduate Students of a Medical College in Mangalore. Universal Journal of Public Health, 13(3), 718–725. https://doi.org/10.13189/ujph.2025.130320

Wang, C., Joltikov, K. A., Kravets, S., & Edward, D. P. (2023). Computer Vision Syndrome in Undergraduate and Medical Students During the COVID-19 Pandemic. Clinical Ophthalmology, 17, 1087–1096. https://doi.org/10.2147/OPTH.S405249

Wang, L., Wei, X., & Deng, Y. (2021). Computer Vision Syndrome During SARS-CoV-2 Outbreak in University Students: A Comparison Between Online Courses and Classroom Lectures. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.696036

Wangsan, K., Upaphong, P., Assavanopakun, P., Sapbamrer, R., Sirikul, W., Kitro, A., Sirimaharaj, N., Kuanprasert, S., Saenpo, M., Saetiao, S., & Khamphichai, T. (2022). Self-Reported Computer Vision Syndrome among Thai University Students in Virtual Classrooms during the COVID-19 Pandemic: Prevalence and Associated Factors. International Journal of Environmental Research and Public Health, 19(7). https://doi.org/10.3390/ijerph19073996

Wimalasundera Saman. (2006). Computer Vision Syndrome. Galle Medical Journal, 11(1), 25–29.

Zalat, M. M., Amer, S. M., Wassif, G. A., El Tarhouny, S. A., & Mansour, T. M. (2022). Computer vision syndrome, visual ergonomics and amelioration among staff members in a Saudi medical college. International Journal of Occupational Safety and Ergonomics, 28(2), 1033–1041. https://doi.org/10.1080/10803548.2021.1877928

Zenbaba, D., Sahiledengle, B., Bonsa, M., Tekalegn, Y., Azanaw, J., & Kumar Chattu, V. (2021). Prevalence of Computer Vision Syndrome and Associated Factors among Instructors in Ethiopian Universities: A Web-Based Cross-Sectional Study. Scientific World Journal, 2021. https://doi.org/10.1155/2021/3384332