COMPUTER VISION SYNDROME IN YOUNG ADULTS WITH REFRACTIVE ERRORS

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ABSTRAK

Computer Vision Syndrome (CVS), juga dikenal sebagai *Digital Eye Strain*, adalah kumpulan gejala mata dan visual akibat penggunaan perangkat digital dalam waktu lama. Penelitian menunjukkan bahwa sekitar 50-90% orang yang menggunakan perangkat digital dalam waktu lama mengalami gejala CVS. Pada pasien dengan kelainan refraksi dan ambliopia, CVS dapat memperburuk gangguan penglihatan yang ada, sehingga menjadi perhatian yang signifikan bagi para profesional perawatan mata. Kelainan refraksi merupakan penyebab utama gangguan penglihatan secara global, yang mempengaruhi sekitar 2,6 miliar orang. Studi ini menyoroti kebutuhan penting untuk intervensi dini, pendidikan pasien, dan perawatan multidisiplin untuk mengurangi morbiditas penglihatan jangka panjang. Disajikan laporan kasus seorang laki-laki berusia 18 tahun dengan riwayat miopia sejak 8 tahun yang lalu dan memiliki kebiasaan bermain ponsel dan membaca sambil berbaring atau di tempat gelap. Datang dengan keluhan mata lelah, sakit kepala, dan pandangan buram pada kedua mata setelah menonton televisi atau menggunakan ponsel dalam waktu lama. Visus dilaporkan OD 1/60 S -11.0, C -2.00 X 180°, OS 1/60 S -9.75, C -1.00 X 170° dengan koreksi OD 0,5 F1 NBC dan OS 0,2 NBC. Pemeriksaan tonometri menunjukkan tekanan intraokular pada kedua mata 17 mmHg. Hasil pemeriksaan fundoskopi menunjukkan diskus optikus *tilting* ke arah superior pada kedua mata, retina tigroid, dan atrofi peripapiler pada kedua mata.

Kata kunci : ambliopia terkait CVS, *computer vision syndrome*, kelainan refraksi terakit CVS

ABSTRACT

Computer Vision Syndrome (CVS), also known as Digital Eye Strain, is a collection of eye and visual symptoms resulting from prolonged use of digital devices. Research shows that around 50-90% of people who use digital devices for a long time experience symptoms of CVS. In patients with refractive error and amblyopia, CVS can worsen existing visual impairment, making it a significant concern for eye care professionals. Refractive errors are the leading cause of visual impairment globally, affecting approximately 2.6 billion people. This study highlights the critical need for early intervention, patient education, and multidisciplinary care to reduce long-term visual morbidity. Presented is a case report of an 18-year-old man with a history of myopia since 8 years ago and has a habit of playing with his cell phone and reading while lying down or in a dark place. Comes with complaints of tired eyes, headaches, and blurry vision in both eyes after watching television or using a cell phone for a long time. Visus is reported as OD 1/60 S -11.0, C -2.00 X 180°, OS 1/60 S -9.75, C -1.00 X 170° with correction OD 0.5 F1 NBC and OS 0.2 NBC. Tonometry examination showed intraocular pressure in both eyes of 17 mmHg. A direct fundoscopy showed optic disc tilting towards superior in both eyes, tigroid retina, and peripapillary atrophy in both eyes.

Keywords *: computer vision syndrome, CVS-related amblyopia, CVS-related refractive errors*

INTRODUCTION

Refractive errors represent a leading cause of visual impairment globally, affecting approximately 2.6 billion individuals, with myopia alone projected to impact nearly 50% of the world's population by 2050 (Holden et al., 2016). Among these, astigmatism a condition characterized by irregular corneal curvature is prevalent in up to 40% of adults, often coexisting with other refractive disorders (Zhang et al., 2023). When compounded by pathological axial

elongation, as seen in degenerative axial myopia, the risk of irreversible retinal damage, including macular atrophy and optic disc abnormalities, escalates significantly (Yap & Meyer, 2024). Modern lifestyle factors, particularly prolonged digital device usage, further exacerbate ocular strain, contributing to computer vision syndrome (CVS), a multifactorial condition marked by asthenopia, blurred vision, and headaches (AOA, 2021). In pediatric and adolescent populations, delayed correction of refractive errors may precipitate amblyopia, a neurodevelopmental disorder resulting from inadequate visual stimulation during critical periods (Ilyas & Yulianti, 2012).

Globally, the prevalence of CVS varies depending on the population studied and the intensity of digital device usage. Studies indicate that approximately 50-90% of individuals who use digital devices for extended periods experience symptoms of CVS (Rosenfield, 2016). For example, a study conducted in the United States found that nearly 65% of adults reported symptoms of digital eye strain (AOA, 2021). Adolescents are also at risk, with 42% of U.S. students aged 10–17 exhibiting CVS-related symptoms due to excessive smartphone and tablet use (Sheppard & Wolffsohn, 2018). In Brazil, a study of university students found that 55% experienced eye strain linked to prolonged use of laptops for academic work, compounded by poor lighting and frequent breaks (Gomez et al., 2023). In South Korea, a 2022 survey of 1,200 high school students revealed that 63% reported CVS symptoms, with 40% attributing discomfort to excessive online gaming and late-night smartphone use (Moon et al., 2022). Similarly, in Asia, where digital device usage is particularly high, the prevalence of CVS is notably elevated. A study in India reported that 73% of IT professionals experienced CVS symptoms (Logaraj et al., 2014). A study in Chennai reported a CVS prevalence of 46% among IT professionals, with inadequate workplace ergonomics and limited awareness exacerbating the condition (Logaraj et al., 2014). A 2022 survey in Maharashtra found 32% of farmers using mobile apps for agriculture reported eye strain (Kharat et al., 2022).

In Indonesia, the rapid digital transformation and increasing internet penetration have contributed to a rise in CVS cases. With over 200 million internet users and a significant portion of the population relying on digital devices for work, education, and entertainment, the risk of CVS is substantial (Asosiasi Penyelenggara Jasa Internet Indonesia [APJII], 2022). A study conducted among university students in Indonesia revealed that 70% of participants experienced symptoms of CVS, with eye strain and dryness being the most commonly reported issues (Widyaningrum et al., 2021). However, limited access to eye care services exacerbates the burden, only 30% of Indonesians with visual discomfort seek professional help (Ministry of Health, 2019). A 2021 survey found that 48% of teenagers used smartphones for more than 5 hours daily, often in dimly lit environments, leading to a 34% prevalence of severe CVS symptoms (Putra et al., 2021). Such habits highlight the urgent need for targeted interventions, including screen-time guidelines and ergonomic education. The high prevalence of CVS in Indonesia underscores the need for greater awareness and preventive measures to mitigate its impact on public health.

The intersection of these conditions presents a complex clinical challenge, particularly in young adults with prolonged screen exposure and untreated refractive errors. For instance, uncorrected astigmatism and myopia not only reduce visual acuity but also strain accommodative mechanisms, worsening CVS symptoms (Tripathy, 2023). Concurrently, degenerative axial myopia predisposes individuals to sight-threatening complications such as retinal detachment and choroidal neovascularization, necessitating vigilant monitoring (Sitorus et al., 2017). Amblyopia, often undiagnosed in adolescents, further complicates management, as its treatment efficacy diminishes with age (Pediatric Eye Disease Investigator Group [PEDIG], 2003).

This study highlights the critical need for early intervention, patient education, and multidisciplinary care to mitigate long-term visual morbidity. The findings aim to reinforce

clinical guidelines for managing complex refractive errors in screen-dependent populations, emphasizing preventive strategies and timely optical correction.

METHODS

Case report studies are the basis for this research with a research period of October 2024 at Bhayangkara Hospital, Semarang. Data was obtained by carrying out the patient's history, basic physical examinations of the eyes, and other support examinations of the patient's eyes in this case report.

CASE REPORT

A male young adult aged 18 years came to the Bhayangkara Hospital eye clinic with asthenopia, headaches, and blurred vision in both eyes after screen use. Eight years ago (in 2016), when the patient was 10 years old, the patient began to feel blurry vision in the right and left eyes. These complaints arise when patients see objects from a distance and tend to squint their eyes to see clearly. Then the patient checked himself at an eye doctor, and from the results of the examination, it was found that the patient had myopia. The patient said that at that time, both his eyes were -0.5 D. However, patients rarely use prescription glasses because they feel uncomfortable. Three years ago, the patient complained that his blurry eyes were getting worse, especially in the right eye. These complaints are accompanied by double vision and feeling tired (asthenopia). The patient likes to use his cell phone every day and likes to read in a dimly lit place while sleeping for around 4-8 hours a day.

The patient checked himself again at the eye optician and found that his minus was increasing, the patient said that at that time his eyes were -5 D. With this condition, the patient still liked to take off his glasses because he felt uncomfortable. In the last month, the patient said his eyes had become increasingly blurry, since the last 2 years, the patient has not used his glasses at all. The patient feels uncomfortable when trying to focus on distant objects. The patient still often plays games on his cellphone to this day. The patient admitted that he often experienced mild headaches after long periods of activity, especially when watching television or using a cell phone for a long time. The patient also often rides a motorbike at night, which makes it difficult for him to see the road, his vision becomes double. Currently, the complaint of blurry eyes is felt to be getting worse, blurry eyes are felt to be more dominant in the right eye, which makes it difficult for the patient to carry out his activities. Denied complaints of red eyes, dizziness, watery eyes, pain, itching, glare from light, and fogginess.

The patient has a history of myopia since 8 years ago when the patient was 10 years old, with a history of using minus glasses for the past 8 years but rarely used. Habit of playing with cellphones and reading while lying down or in a dark place, and the patient does not exercise regularly. Vital signs examination was within normal limits. Visus was reported as OD 1/60 S -11.0, C -2.00 X 180°, OS 1/60 S -9.75, C -1.00 X 170° with correction OD 0.5 F1 NBC and OS 0.2 NBC. Physical examination of the eyes reported decreased foveal reflexes in both eyes. Tonometry examination showed that the intraocular pressures were 17 mmHg in both eyes. A direct fundoscopy showed optic disc tilting towards superior in both eyes, tigroid retina, and peripapillary atrophy in both eyes.

From the history and ocular examination, the patient's diagnosis was computer vision syndrome ec composite myopia astigmatism, axial degenerative myopia, and amblyopia. The treatment given to the patient was oxymetazoline HCl 3x1 drops ODS, hydroxypropyl methylcellulose 3x1 drops ODS, vitamin A 2000U 1x1, zinc 1x20 mg, and mecobalamin 1x500 mcg. In addition, patients are prescribed glasses and given education regarding routine use of glasses, reducing screen time, routine eye control, and applying the 20-20-20 rule.

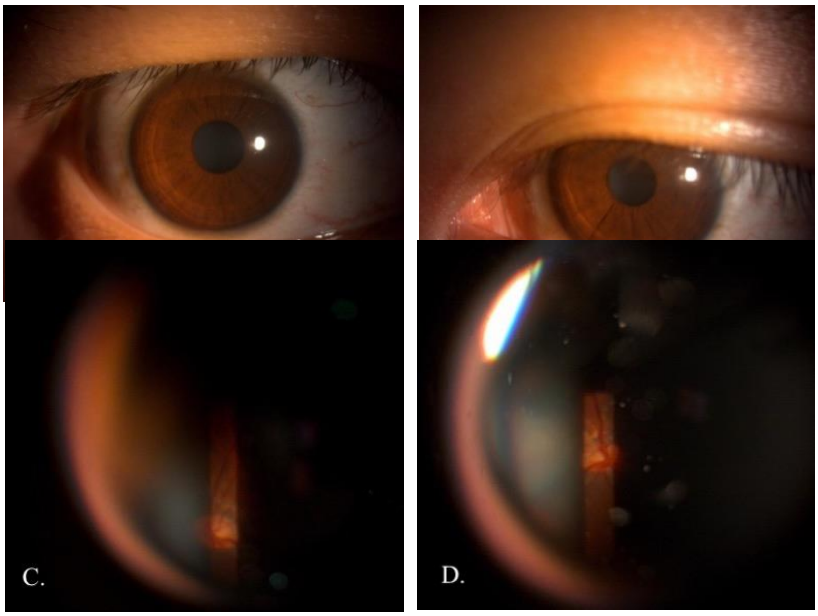

Figure 1. Ocular Examinations (a) OD with slit-lamp; (b) OS with slit-lamp; (c) Direct funduscopy OD; (d) Direct funduscopy OS

RESULT AND DISCUSSIONS

Computer Vision Syndrome (CVS), also known as Digital Eye Strain, is a collection of ocular and visual symptoms resulting from prolonged use of digital devices such as computers, tablets, and smartphones. It is characterized by eye strain, dryness, blurred vision, and headaches, among other symptoms (Sheppard & Wolffsohn, 2018). In patients with refractive errors and amblyopia, CVS can exacerbate existing visual impairments, making it a significant concern for eye care professionals. Young adults are one of the most vulnerable populations to Computer Vision Syndrome (CVS) due to their extensive use of digital devices for work, education, and entertainment. This demographic is particularly at risk because of their prolonged screen time, often coupled with poor visual habits and ergonomic practices. Patient in this case report is young adult aged 18 years old.

The primary cause of CVS is prolonged exposure to digital screens, which leads to increased accommodative and convergence demands on the visual system (Rosenfield, 2016). In patients with refractive errors, uncorrected or improperly corrected vision can further strain the eyes, worsening CVS symptoms. Amblyopia, or "lazy eye," adds another layer of complexity, as the brain suppresses input from the weaker eye, leading to increased reliance on the stronger eye and increased visual fatigue (Levi, 2020). The pathophysiology of CVS involves multiple factors, including reduced blink rate, accommodative spasm, and dry eye syndrome. Prolonged screen use reduces the blink rate, leading to tear film instability and ocular surface dryness (Portello et al., 2013). In patients with refractive errors, the eyes must work harder to focus, causing accommodative fatigue. Amblyopia further disrupts binocular vision, increasing the risk of eye strain and discomfort (Levi, 2020).

In this case report the patient’s uncorrected myopia and astigmatism since childhood created a foundation for progressive ocular strain. Myopia progression from -0.5 D at age 10 to -11.0 D at 18 aligns with studies linking delayed optical correction to accelerated axial elongation, a hallmark of degenerative myopia (Holden et al., 2016). Prolonged near-work activities, such as smartphone use (4–8 hours daily), exacerbated accommodative fatigue, consistent with CVS pathophysiology (AOA, 2021). Diagnosing CVS involves a comprehensive eye examination, including a detailed patient history and assessment of visual

acuity, refractive error, and binocular vision function (AOA, 2021). In this case report the patient's symptoms of asthenopia, headaches, and blurred vision after screen use align with CVS diagnostic criteria (AOA, 2021). Poor ergonomic habits (e.g., reading in dim light, supine smartphone use) likely aggravated accommodative spasms and dry eye symptoms. The patient's amblyopia (best-corrected VA: 0.5 OD, 0.2 OS) likely stemmed from anisometropia and prolonged deprivation of clear retinal images. Amblyopia management is most effective during the "critical period" (before age 7–10), with diminishing returns in adolescence (Ilyas & Yulianti, 2012). Despite this, partial occlusion therapy and pharmacological penalization (e.g., atropine drops) may still yield modest improvements, though neither was attempted here (PEDIG, 2003). This case highlights systemic failures in pediatric vision screening, particularly in low-resource settings where access to optometric care is limited.

Fundus findings, including tigroid retina, peripapillary atrophy, and optic disc tilting are pathognomonic of degenerative axial myopia (Yap & Meyer, 2024). These changes arise from mechanical stretching of the sclera and choroid due to excessive axial elongation (>26.5 mm), which disrupts Bruch's membrane and retinal pigment epithelium (Sitorus et al., 2017). The patient's axial length was not measured directly but inferred from high myopia (-11.0 D), which correlates strongly with staphyloma formation and macular complications (Holden et al., 2016). Such structural damage underscores the urgency of myopia control strategies, such as low-dose atropine or orthokeratology, which were not utilized here (PEDIG, 2003).

Treatment for CVS typically involves a combination of lifestyle modifications, ergonomic adjustments, and corrective measures. For patients with refractive errors, proper correction with glasses or contact lenses is essential (Rosenfield, 2016). Excessive screen time is a major risk factor for CVS, as it increases the duration of near work and reduces blink rates. Limiting screen time and encouraging outdoor activities can help mitigate the risk of CVS, especially in children with refractive errors and amblyopia (Rosenfield, 2016). Blue light filters, such as screen protectors or specialized glasses, can help reduce eye strain by minimizing exposure to high-energy visible light emitted by digital devices (Sheppard & Wolffsohn, 2018). While these filters may provide some relief, they are not a substitute for proper refractive correction or vision therapy in patients with amblyopia. Ergonomic adjustments, such as proper screen positioning, adequate lighting, and regular breaks, can significantly reduce CVS symptoms. The 20-20-20 rule, which involves taking a 20-second break to look at something 20 feet away every 20 minutes, is particularly effective (AOA, 2021). Artificial tears can help alleviate dry eye symptoms associated with CVS by replenishing the tear film and improving ocular surface lubrication (Portello et al., 2013).

The 20-20-20 rule, though evidence-based for reducing digital eye strain (Tripathy, 2023), was not adopted by the patient in this case report, highlighting poor awareness of preventive measures in high-risk populations. While lubricants (Hydroxypropyl Methylcellulose) provided symptomatic relief, long-term CVS management requires behavioral modifications, such as screen-time reduction and blue-light filters, which were not emphasized in follow-up in this patient (Tripathy, 2023). Regular eye exams are crucial for young adults to detect and correct early refractive errors. Proper prescription glasses or contact lenses can significantly reduce the risk of CVS by alleviating accommodative strain (Rosenfield, 2016). Untreated CVS can lead to chronic eye strain, persistent dry eye, and reduced quality of life. In patients with refractive errors and amblyopia, untreated CVS can exacerbate existing visual impairments and hinder the effectiveness of treatments such as vision therapy (Levi, 2020). Chronic CVS symptoms can lead to psychological stress and reduced quality of life. Young adults may experience frustration, anxiety, and fatigue due to persistent visual discomfort, which can affect their overall well-being (Sheppard & Wolffsohn, 2018). Educating patients about the risks of prolonged screen use and the importance of proper visual hygiene is crucial for preventing and managing CVS. Amblyopic patients may benefit from vision therapy to improve binocular

function and reduce visual strain. Patients with refractive errors and amblyopia should be informed about the additional risks they face and the steps they can take to protect their vision (Sheppard & Wolffsohn, 2018).

CONCLUSION

Computer Vision Syndrome (CVS) presents a significant challenge for patients with composite astigmatism, axial degenerative myopia, and amblyopia. These conditions complicate the visual demands of digital screen use, leading to increased strain and discomfort. A comprehensive management approach that includes proper corrective lenses, vision therapy, ergonomic adjustments, and lifestyle changes is essential to alleviate symptoms. Regular eye exams are crucial for monitoring both refractive error progression and retinal health, especially in patients with axial degenerative myopia. By addressing these factors, clinicians can help mitigate the impact of CVS and improve the quality of life for patients with complex refractive errors.

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