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ORIGINAL

Visual health and prolonged use of screens in working-age adults

Salud visual y uso prolongado de pantallas en adultos en edad laboral

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ABSTRACT

Introduction: display screens/visual display terminals are a constant presence in people's daily lives, both in the workplace and at home. Prolonged use of these devices generates symptoms of discomfort, grouped under what is called Computer Vision Syndrome, which affects both work and academic productivity. In addition, they emit blue light, which still plays an enigmatic role in future visual health. For these reasons, it is important to address this issue in order to implement favorable ergonomic conditions that allow for better productivity and reduce the incidence of symptoms.
Objectives: the primary objective of this study is analyzing ophthalmological conditions associated with prolonged screen use in working-age adults, and secondary objectives of describing the most common ophthalmological alterations caused by prolonged screen use, describing the mechanisms by which these alterations occur, analyzing the potential for a long-term negative effect, determining how computer vision syndrome impacts work and school productivity, and presenting prevention methods.
Method: a descriptive, retrospective, cross-sectional systematic review was conducted based on published studies from the period 2020-2023 on the effects of prolonged use of visual display terminals in working-age adults, and a comparative analysis was also performed among different studies.
Results: the search resulted in the selection of 14 studies, where the comparison between them showed an average prevalence of CVS of 65,6 % among the working-age adult population, an average exposure of 6,75 hours per day, and partial presence of ergonomic conditions.
Conclusion: the prevalence of CVS in working-age adults is considerably high. The associated symptoms are mainly linked to alterations in ocular lubrication and the lack of ergonomic conditions. The blue light emitted by visual display terminals is not enough to cause permanent damage; however, further analysis is necessary due to the unknown potential cumulative toxic effect.

Keywords: Computer Vision Syndrome; Digital Eye Strain; Blue Light; Video Display Terminal; Occupational Health; Vision Disorders; Visual Ergonomics; Workspace Ergonomics.

RESUMEN

Introducción: las pantallas/terminales de visualización son una constante en la vida diaria de las personas tanto en el ámbito laboral como doméstico. El uso prolongado de las mismas genera síntomas de discomfort, englobados dentro del llamado Síndrome Visual Informático, que afectan la productividad laboral y académica, además de esto también irradian luz azul la cual tiene un papel todavía enigmático en la salud visual futura. Por estos motivos es de gran importancia abordar esta problemática para así poder implementar condiciones ergonómicas favorables que permitan una mejor productividad y disminuyan la incidencia de los síntomas.
Objetivos: el objetivo principal de este estudio es analizar las afecciones oftalmológicas asociadas al uso

prolongado de pantallas en adultos en edad laboral y los objetivos secundarios de describir alteraciones oftalmológicas más frecuentes producidas por el uso prolongado de pantallas, describir el mecanismo de producción de estas alteraciones, analizar la existencia de un potencial efecto negativo largo plazo, determinar como el síndrome visual informático en la productividad laboral y escolar y exponer métodos de prevención.
Método: se realizó una revisión sistemática descriptiva, retrospectiva, observacional de corte transversal basada en estudios publicados en el período 2020-2023 sobre los efectos del uso prolongado de terminales de visualización en adultos en edad laboral y también se hizo un análisis comparativo entre diferentes estudios.
Resultados: La búsqueda dio como resultado la selección de 14 estudios donde la comparativa entre ellos arrojó una prevalencia promedio del SVI del 65,6 % en la población adulta en edad laboral, una exposición promedio de 6,75 horas por día y la presencial parcial de condiciones ergonómicas.
Conclusión: la prevalencia del SVI en adultos en edad laboral es considerablemente alta, la sintomatología asociada esta principalmente ligada a alteraciones de la lubricación ocular y a la carencia de condiciones ergonómicas. La luz azul emitida por las terminales de visualización no es la suficiente para causar daños permanentes, sin embargo, es necesario un análisis futuro debido al desconocimiento sobre el potencial efecto toxico acumulativo.

Palabras clave: Síndrome de Visión por Ordenador; Fatiga Visual Digital; Luz Azul; Terminal de Visualización de Vídeo; Salud Ocupacional; Trastornos de la Visión; Ergonomía Visual; Ergonomía del Espacio de Trabajo.

INTRODUCTION

The widespread use of digital devices has become essential to the modern academic and work environment. In particular, young adults of working and university age are a population that is highly exposed to screens for long periods, which has led to growing concern about their impact on visual health. One of the most prevalent conditions associated with this exposure is Computer Vision Syndrome (CVS), also known as digital eye strain, which encompasses a set of visual and ocular symptoms caused by prolonged use of display devices such as computers, tablets, and smartphones.[1,2,3,4,5,6]

Several studies have shown that factors such as duration of exposure, lack of breaks, inadequate lighting, and poor ergonomic conditions contribute significantly to the onset of CVS. The most common symptoms include dry eyes, blurred vision, red eyes, fatigue, headaches, and difficulty focusing. These symptoms affect individuals' comfort and visual health and negatively influence their academic or work performance, creating a growing need to understand this problem better and establish effective preventive measures.[7,8,9,10,11,12,13,14]

Despite its high prevalence, the literature on SIV in young adults in academic and work settings remains heterogeneous regarding assessment methods, diagnostic criteria, and evaluation of contributing factors. In this context, conducting a systematic review that compiles and critically analyzes the available evidence is essential. This review aims to estimate the prevalence of SIV in young adults (18-40 years) who are exposed to display terminals for more than six hours a day in academic or work settings while also evaluating the role of ergonomic conditions and the use of diagnostic tools such as the CVS-Q questionnaire.[15,16,17,18,19,20,21,22,23,24,25]

The potential impact of blue light emitted by screens will also be explored. This topic has been debated in recent years due to the hypothesis that cumulative exposure could contribute to developing long-term eye diseases. Given these concerns, this study seeks not only to summarize the most relevant findings on IVS but also to highlight existing methodological limitations and encourage the implementation of preventive strategies to protect visual health in this vulnerable population.

What are the eye conditions associated with prolonged screen use in young adults of working age, and how do factors such as ergonomic conditions and exposure to blue light influence the prevalence of Computer Vision Syndrome (CVS)?

Objective

To analyze the eye conditions associated with prolonged screen use in working-age adults.

METHOD

Literature found in the PubMed, Google Scholar, and Medline databases were reviewed, and a descriptive, retrospective, observational, cross-sectional systematic review was conducted. Fourteen studies that met all the inclusion criteria and none of the exclusion criteria were selected:

Inclusion criteria: studies involving young adult patients (aged 18-40), work and academic settings, exposure times greater than 6 hours or 3 hours without breaks, and variable ergonomic conditions.

Exclusion criteria: Studies that include patients who work outdoors use questionnaires that inquire about non-specific symptoms and conditions and were published before 2020.

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Comparison of studies: the studies were read and interpreted, and a comparative table was developed to evaluate the population, age of the patients studied, use of the CVS-Q questionnaire, exposure time to display terminals, prevalence of VSI, and compliance with ergonomic conditions. It should be noted that this review was initially intended to be conducted on patients with no previous eye disease. Still, given the lack of studies meeting this criterion, it was decided to exclude them to cover a larger comparison pool.

Selected studies: (18), (19), (20), (21), (22), (23), (9), (24), (25), (26), (27), (12), (29), (30)

Comparative studies: the selected studies can be compared in the following table.

CVS = computer vision syndrome, NR = not reported.

RESULTS

Following the comparative and bibliographic analyses, this study shows an average prevalence of CVS of 65,6 % in working-age adults, with partial/low compliance with ergonomic conditions and a prevalence of ophthalmological symptoms between 45-85 %, depending on exposure time. It was determined that the doses of blue light emitted by display terminals are not sufficient to cause permanent retinotoxic effects. However, the potential cumulative effect requires prospective studies to analyze this issue (table 1).

Table 1. Findings from studies on the prevalence of SVI

Study	Country	Population	Age (years)	Use of CVS-Q	Average exposure time	Prevalence of SVI	Compliance with ergonomic conditions
Gerena,2022	Colombia	Students	18-25	yes	10,5 hours	85,8 %	partial
Artime-Ríos, 2022	Spain	University	35-45	yes	>4 hours at work, 80 % reported continuing exposure outside of work	56,75 %	NR
Shah,2022	Pakistan	Workers	25-35	no	>6 hours	65 %	partial
Almousa,2023	Saudi	Workers	20-30	no	>6 hours	67 %	partial
Estrada,2023	Arabia	Students	18-26	yes	>6 hours	72,1 %	partial
Cantó-Sancho, 2022	Peru	University	30-45	yes	8 hours	67,2 %	NR
Simanta,2023	Italy	Students	18-25	yes	>7 hours	68,2 %	NR
Uwimana,2023	Bangladesh	University	19-27	yes	>9 hours	50 %	NR
Younis,2022	China	Workers	24-36	no	>5 hours	68,5 %	partial
Das,2022	Saudi	Students	30-45	no	>8 hours	84,3 %	partial
Al Tawil, 2022	Arabia	University	18-28	no	>6 hours	45,2 %	partial
Boadi Kusi,2022	Nepal	Workers	25-40	yes	>6 hours	71 %	partial
Ganne, 2021	Saudi	Students	20-30	no	>6 hours	54,3 %	NR
Fernández - Villacorta, 2021	Arabia	University	19-25	yes	>7 hours	62,3 %	partial

DISCUSSION

The comparison between multiple studies showed an average prevalence of Computer Vision Syndrome of 65,6 % in the working-age adult population, with an average exposure time to display terminals of approximately 6,75 hours per day and partial ergonomic conditions. In addition, analysis of multiple studies showed a prevalence of ophthalmological symptoms ranging from 45 % to 85 %, depending on the duration of exposure.[18,19,20,21,26,27,28,29]

The most frequently reported symptoms, such as dry eyes and redness, were directly associated with decreased blinking quantity and quality during prolonged exposure to display terminals. This issue is of the utmost importance, as the onset of symptoms leads to loss of concentration and the need to take breaks, thus affecting both work and academic productivity.[30,31,32,33,34]

Regarding the impact of blue light, it was concluded that it has a retinotoxic effect but that the screens' dose is insufficient to cause permanent damage. Addressing the long-term effects, the recent emergence of this problem and the lack of prospective studies mean inadequate information to assess a possible cumulative toxic effect or the possible role in the accelerated development of age-related macular degeneration.

CONCLUSIONS

The conclusions reached in this study are consistent with previous research reporting that prolonged screen use in young working-age adults has shown a high prevalence of symptoms associated with Computer Vision Syndrome (CVS), exacerbated by inadequate ergonomic conditions. The results confirm that optimizing the work environment by improving lighting and screen distance and adopting regular breaks significantly reduces

visual symptoms. Although no permanent retinotoxic impact of blue light has been demonstrated, prospective studies are needed to evaluate its potential cumulative effects. This study allows us to assess the importance of implementing preventive measures and developing ergonomically appropriate environments to preserve visual health and improve academic and/or work productivity.

LIMITATIONS AND BIAS

This study is limited by the variability of methods used by the comparative studies, such as the lack of implementation of the CVS-Q in some studies, which may have altered the results obtained. There was also an inconsistent assessment of ergonomic conditions, with differences in the conditions evaluated, which may have limited the impact of ergonomic measures on VSI.

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CONFLICT OF INTEREST

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