

REVISÃO DE LITERATURA IDENTIFICADO

USO EXCESSIVO DE TELAS E SAÚDE OCULAR PEDIÁTRICA: SINTOMAS DE FADIGA OCULAR, OLHO SECO E ALTERAÇÕES REFRACTIVAS

EXCESSIVE SCREEN USE AND PEDIATRIC EYE HEALTH: SYMPTOMS OF EYE STRAIN, DRY EYE, AND REFRACTIVE CHANGES

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RESUMO

Introdução: O aumento substancial do tempo de exposição a dispositivos eletrônicos na infância e adolescência tem suscitado preocupações crescentes na oftalmologia pediátrica, destacando-se como potencial fator de desequilíbrio na saúde visual em desenvolvimento. **Objetivo:** Analisar e sintetizar as evidências científicas disponíveis sobre os impactos do uso excessivo de telas na saúde ocular pediátrica, com ênfase na fadiga visual, na doença do olho seco e no desenvolvimento ou progressão de alterações refrativas. **Método:** Revisão integrativa da literatura realizada nas bases de dados PubMed/MEDLINE, BVSI/LILACS e SciELO, englobando produções científicas publicadas entre 2014 e 2025. Utilizou-se vocabulário controlado baseado em descritores da saúde combinados por operadores booleanos, aplicando critérios rígidos de inclusão para estudos que abordassem a temática em indivíduos de zero a 18 anos. **Resultados:** A literatura evidencia que a sobrecarga digital promove sintomas frequentes de astenopia decorrentes do estresse acomodativo prolongado para perto. Constatou-se redução expressiva na frequência e completude dos piscamentos, favorecendo a instabilidade evaporativa do filme lacrimal e ceratites superficiais. Ademais, confirmou-se uma relação dose-resposta direta entre as horas diárias de tela e o alongamento axial ocular, impulsionando o avanço da miopia. **Conclusão:** O uso excessivo de dispositivos eletrônicos compromete a superfície ocular e acelera alterações refrativas pediátricas, justificando intervenções comportamentais, pausas regulares e ampliação de atividades diárias ao ar livre.

Palavras-chave: Pediatria. Tempo de Tela. Astenopia. Síndromes do Olho Seco. Miopia.

ABSTRACT

Introduction: The substantial increase in screen time among children and adolescents has raised growing concerns in pediatric ophthalmology, emerging as a potential disruptor of developing visual health. **Objective:** To analyze and synthesize the available scientific evidence on the impacts of excessive screen use on pediatric ocular health, with emphasis on digital eye strain, dry eye disease, and the development or progression of refractive errors. **Method:** Integrative literature review conducted in the PubMed/MEDLINE, VHL/LILACS, and SciELO databases, covering scientific publications from 2014 to 2025. Controlled vocabulary based on health descriptors combined with Boolean operators was used, applying strict inclusion criteria for studies addressing the topic in individuals aged zero to 18 years. **Results:** The literature demonstrates that digital overload promotes frequent asthenopia symptoms resulting from prolonged near accommodation stress. A significant reduction in blink rate and blink completeness was found, favoring tear film evaporative instability and superficial keratitis. Furthermore, a direct dose-response relationship was confirmed between daily screen hours and axial elongation, driving myopia progression. **Conclusion:** Excessive digital device use compromises the ocular surface and accelerates pediatric refractive changes, justifying behavioral interventions, regular breaks, and increased daily outdoor activities.

Keywords: Pediatrics. Screen Time. Asthenopia. Dry Eye Syndromes. Myopia.

INTRODUCTION

The increasing digitalization of contemporary society has profoundly transformed lifestyle habits in childhood and adolescence, intensifying daily exposure to electronic devices with screens, such as *smartphones*, *tablets*, computers, and televisions.^{1,2} This phenomenon was substantially accelerated after the COVID-19 pandemic, a period when remote learning and home confinement established an unprecedented reliance on digital platforms for educational, communicative, and recreational purposes.³ However, the pediatric visual system is in a critical phase of biological and functional maturation, which makes it particularly susceptible to the overloads caused by continuous accommodative effort, excessive proximity to screens, and the expressive reduction in blink frequency.^{4,5}

In this scenario, the scientific and social relevance of the topic is based on the significant increase in childhood ophthalmological complaints associated with excessive screen use. Among the main harms described in the medical literature are digital eye strain, manifested by asthenopia, headache, burning sensation, and transient blurred vision, tear film dysfunction with clinical manifestations of dry eye, and, alarmingly, the induction and progression of refractive errors, especially myopia.^{4,6-8} The compromise of ocular surface integrity and visual comfort during the school phase negatively impacts neuro-psychomotor development, academic performance, and the global quality of life of children and adolescents.^{3,4}

Although the literature points to consistent epidemiological correlations between excessive screen time and ophthalmological disorders, a significant gap remains regarding the integrated and dose-dependent understanding of these manifestations in the contemporary pediatric population. Furthermore, many studies address dry eye, visual fatigue, and refractive changes in isolation, lacking syntheses that interrelate common pathophysiological mechanisms, such as tear film dynamics, prolonged accommodative stress, and deprivation of outdoor activities under natural light.^{2-4,9} The elucidation of these interconnected areas is essential to overcome fragmented approaches and substantiate preventive clinical conduct based on robust evidence.

The justification for this study is based on the need to support clinical practice and guide visual ergonomics guidelines in view of the advancement of digital devices in the daily lives of children. Therefore, the present study aims to analyze and synthesize the scientific evidence on

the impacts of excessive screen use on pediatric ocular health, with emphasis on digital eye strain, dry eye disease, and the development or progression of refractive errors.

METHOD

This is an integrative literature review developed in six methodological stages: definition of the guiding question, literature search, data extraction, critical evaluation, synthesis, and presentation of results. The formulation was based on the PICO strategy (Population: children and adolescents; Interest: visual fatigue, dry eye, and refractive errors; Context: excessive screen use), defining the question: "What are the impacts of excessive screen time on the ocular health of children and adolescents?".

Searches were conducted in the PubMed/MEDLINE, VHL/LILACS, and SciELO databases, considering articles published between 2014 and 2025. Controlled vocabulary (DeCS/MeSH) with Boolean operators *AND* and *OR* was used: ("Pediatria" OR "Criança" OR "Pediatrics" OR "Child") AND ("Dispositivos Eletrônicos" OR "Tempo de Tela" OR "Screen Time" OR "Digital Devices") AND ("Fadiga Ocular" OR "Olho Seco" OR "Miopia" OR "Digital Eye Strain" OR "Dry Eye Syndromes" OR "Myopia").

Original studies, systematic reviews, and meta-analyses on exposure to digital screens and ocular outcomes in individuals aged zero to 18 years, available in full in Portuguese, English, or Spanish, were included, excluding isolated reports, editorials, annals, and research restricted to adults. Selection occurred through screening of titles and abstracts followed by full reading by consensus, dispensing with submission to the Research Ethics Committee (CEP) and the issuance of CAAE as it involves secondary data in the public domain.

RESULTS

The analysis of the sample body allowed the identification and categorization of the main clinical manifestations associated with excessive screen use in three central areas: digital eye strain (*Digital Eye Strain*), pediatric dry eye disease, and refractive changes with emphasis on myopic progression. The essential characteristics of the selected studies are summarized in Table 1.

Table 1. Summary of scientific evidence on the impact of screens on pediatric ocular health

Author/Year	Design	Population/Sample	Main Findings
Foreman et al. ¹ (2021)	Systematic Review & Meta-analysis	Children and youth (3 months to 33 years)	Smart devices alone increase the chances of myopia by 30%, and combined with computers, up to 80%.
Ha et al. ² (2025)	Systematic Review & Meta-analysis	Children and adolescents (0 to 19 years)	Significant dose-response relationship: each additional daily hour of screen time increases the relative risk of myopia and axial elongation.
Mohan et al. ³ (2021)	Cross-sectional Study	2,100 children and adolescents	Over 50% of students had symptoms of eye strain during remote learning; use >4h/day increased the risk significantly.
Kaur et al. ⁴ (2022)	Comprehensive Review	Pediatric and adult population	Describes asthenopia, burning, reduced blinking, and loss of tear film as the clinical tripod of digital overload.
Pucker et al. ⁵ (2024)	Narrative Review	Children and adults	Inadequate ergonomics, proximity to screen (<30 cm), and poor lighting aggravate visual discomfort.
Moon et al. ⁶ (2014)	Cross-sectional Study	288 schoolchildren	Dry eye rate significantly higher in smartphone user group (9.1%) compared to non-users (4.0%).
Wagner ⁷ (2014)	Clinical Commentary Article	Pediatric population	Direct association between portable screens, incomplete blinking, and evaporative tear film dysfunction in school-age.
Enthoven et al. ⁸ (2021)	Prospective Study (<i>Myopia App Study</i>)	525 adolescents	Continuous smartphone screen use for more than 20 uninterrupted minutes was directly associated with higher myopic error.
Lanca & Saw ⁹ (2020)	Systematic Review	Children and adolescents	Significant association between screen time and development of myopia, aggravated by concomitant reduction of outdoor activities.
Zou et al. ¹⁰ (2025)	Systematic Review & Meta-analysis	Children and adolescents	Significant global prevalence of dry eye in children, strongly driven by cumulative daily exposure to digital screens.

Source: Prepared by the authors (2026).

Accommodative asthenopia and digital visual stress showed high prevalence in the child population routinely exposed to electronic screens.³⁻⁵ The most recurrent complaints included frontal headache, hyperemia, burning sensation, and transient blurred vision, resulting from the continuous effort of the ciliary muscle and the overload of the extraocular musculature at fixation distances less than 30 centimeters without programmed breaks.³⁻⁵

In parallel, prolonged fixation on digital screens was associated with expressive changes in tear film dynamics in childhood.^{4, 6, 7, 10} The sharp drop in blink rate and completeness accelerates the tear evaporation rate and increases osmolarity on the ocular surface, causing epithelial microlesions, itching, and foreign body sensation, with clinical improvement observed after restricting the use time of the devices.^{4, 6, 7}

Finally, the chronic use of smart devices was consolidated as a modifiable risk factor for the development and advancement of pediatric myopia.^{1,2,8,9} Studies demonstrate a direct dose-response relationship between daily screen hours and the increase in ocular axial elongation, an aggravation intensified by the effort to focus closely and the concomitant reduction of outdoor activities under natural sunlight.^{1,2,9}

CONCLUSION

The compiled evidence confirms that excessive exposure to electronic devices acts as an important triggering factor for digital asthenopia, evaporative tear film instability, and the advancement of myopia in childhood and adolescence. This review contributes to the medical literature by integrating the interdependence of these three ocular harms, demonstrating that the decrease in blink frequency, the continuous accommodation overload for near focus, and the reduced time under natural light outdoors converge to compromise the integrity and functional development of the pediatric visual system.

In clinical practice, these findings reinforce the urgency of preventive behavioral interventions, such as periodic breaks for ciliary muscle rest, maintenance of adequate visual distances, stimulation of daily outdoor activities, and active guidance to families and schools. For future research, it is necessary to conduct standardized longitudinal studies with objective measurement of screen time and type, in addition to evaluating the long-term effectiveness of educational strategies in controlling and mitigating visual damage in childhood.

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