International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(REVIEW ARTICLE)

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The Effect of Excessive Gadget Use on Visual Fatigue and Bruxism Risk in Children: A Literature Review

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International Journal of Science and Research Archive, 2026, 18(01), 619-622

Publication history: Received on 14 December 2025; revised on 20 January 2026; accepted on 22 January 2026

Article DOI: https://doi.org/10.30574/ijsra.2026.18.1.0128

Abstract

The use of digital gadgets among children has increased significantly along with technological development and the implementation of online learning. Excessive screen exposure is associated with visual fatigue or digital eye strain, characterized by blurred vision, eye dryness, ocular discomfort, and headaches. In addition to visual complaints, prolonged gadget use is linked to psychological stress and sleep disturbances, which are known risk factors for parafunctional habits such as bruxism in children. This literature review aims to analyze the relationship between excessive gadget use, visual fatigue, and the risk of bruxism in children. Literature was collected from PubMed, Scopus, Google Scholar, and relevant textbooks published between 2020 and 2025. The reviewed studies indicate that excessive screen time is consistently associated with increased visual fatigue and may indirectly contribute to bruxism through mechanisms involving stress, neurophysiological fatigue, and sleep disruption. Regulation of screen time and proper visual ergonomics are essential to reduce adverse effects on children's visual and oral health.

Keywords: Gadget Use; Visual Fatigue; Bruxism; Children

1. Introduction

The development of digital technology has brought significant changes to children's daily lives, particularly in the use of gadgets such as smartphones and tablets. Gadgets are used not only as a means of entertainment but also as tools for online learning. Intensive and uncontrolled gadget use may have negative effects on children's health, both physically and psychologically. One of the most frequently reported consequences is visual fatigue, which is characterized by eye strain, blurred vision, eye discomfort, and headaches resulting from prolonged screen exposure. In addition, excessive gadget use has been associated with increased stress and sleep disturbances, which may potentially trigger bruxism in children. Childhood bruxism can lead to tooth wear, masticatory muscle pain, and temporomandibular joint disorders. Therefore, examining the effect of excessive gadget use on visual fatigue and the potential development of bruxism in children is essential [1].

Eye fatigue is one of the most common complaints among gadget users, particularly children, due to prolonged and repetitive direct interaction between the eyes and digital screens. This condition occurs because the eyes are continuously forced to accommodate and maintain focus at a relatively close distance[2]. In the literature, eye fatigue is often equated with Computer Vision Syndrome (CVS) or Digital Eye Strain (DES), which refers to a group of visual and ocular symptoms arising from prolonged use of digital devices. The daily duration of screen exposure, known as screen time, may have both positive and negative effects on visual health, depending on the intensity, duration of exposure, and type of content accessed. Eye fatigue represents a manifestation of visual system disturbance, characterized by dry eyes due to reduced blinking frequency, as well as constant accommodative and convergence demands. Environmental

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factors such as poor ergonomics, inadequate lighting, air-conditioned environments, contact lens use, a history of ocular disease, and refractive errors further increase the risk of developing this condition [3].

Excessive gadget exposure not only affects the visual system but may also influence children's psycho-emotional conditions and parafunctional behaviors, including bruxism. Several studies have shown that children with longer screen time durations tend to exhibit a higher frequency of tooth grinding. Gadget use, particularly at night before bedtime, is known to disrupt sleep quality and increase anxiety levels, both of which are recognized risk factors for sleep bruxism. Children who are actively engaged in social media reportedly spend longer periods in front of screens, thereby increasing the likelihood of emotional dysregulation and suboptimal sleep patterns [4].

Overall, increased screen time duration may have detrimental effects on children's visual health and psycho-emotional well-being. Visual disturbances such as eye fatigue or Digital Eye Strain (DES) may act as chronic visual stressors that ultimately contribute to an increased risk of the onset or exacerbation of bruxism.

2. Material and Methods

This study was a literature review using a thematic analysis approach to analyze data from various literature sources, including books/e-books, regulations, modules, journal articles, and other publications. The focus of this study's analysis is on the relationship between between gadget use, visual fatigue, and bruxism. Data collection began with a comprehensive literature search through several websites such as Google Scholar, policies or regulations, and several sources related to the topic of focus of the study.

The next step is to conduct an in-depth analysis of all the literature that has been collected to understand the overall context related to the research focus. The collected literature is then reviewed, modified, and developed in accordance with the research topic to produce relevant and detailed data to identify the essence of each piece of literature found.

3. Result and Discussion

3.1. Gadget uses in children

The prevalence of gadget use among children has increased markedly in recent years, particularly during and after the COVID-19 pandemic. Children frequently use gadgets for gaming, video streaming, social media, and online learning. Several studies report that daily screen time exceeding recommended limits is associated with various health complaints, including visual discomfort, sleep disturbances, and increased emotional stress. Prolonged exposure to digital screens increases the visual workload and contributes to fatigue of the visual system [1,2].

Therefore, the American and Canadian Pediatric Associations recommend limiting gadget use to 1 hour per day for children aged 3–5 years and 2 hours per day for children aged 6–18 years. Although gadgets are useful for supporting learning, communication, and information exchange, excessive use can have negative effects, particularly reducing focus on learning because children are more interested in games, social media, or other entertainment content [5,6].

3.2. Visual fatigue (Digital eye strain)

Visual fatigue, also known as Computer Vision Syndrome (CVS) or Digital Eye Strain (DES), is one of the most common complaints among children who frequently use digital devices. This condition occurs due to prolonged and repetitive interaction between the eyes and digital screens, requiring continuous accommodation and convergence at a close viewing distance[2,7]. Symptoms of visual fatigue include dry eyes, eye strain, blurred vision, burning sensation, and headaches. Reduced blinking frequency during screen use contributes to tear film instability and ocular surface dryness. In addition, environmental factors such as poor ergonomics, inadequate lighting, air-conditioned environments, refractive errors, contact lens use, and a history of ocular disease further increase the risk of developing visual fatigue[3,8].

Daily screen exposure duration or screen time plays an important role in increasing the risk and severity of visual fatigue, especially in children who use gadgets excessively. Prolonged use of gadgets causes stress on visual function, particularly on the accommodation muscles when the eyes are forced to continuously view small objects at close range. As a result, the accommodative muscles (ciliary muscles) experience prolonged tension, increasing lactic acid production and causing eye fatigue. Additionally, stress on the retina can also occur due to excessive visual contrast and prolonged observation time, which ultimately contributes to a sharp decline in vision [9].

3.3. Bruxism in children

Bruxism is a parafunctional activity characterized by involuntary clenching or grinding of the teeth, occurring during wakefulness or sleep. In children, bruxism is considered a multifactorial condition influenced by psychological, neurological, and behavioral factors. Previous studies have identified stress, anxiety, emotional disturbances, and sleep disorders as important contributing factors to the development of bruxism in pediatric populations[1]. Persistent bruxism may result in tooth wear, masticatory muscle pain, headaches, and temporomandibular joint disorders.

3.4. Relationship between gadget use, visual fatigue, and bruxism

Excessive gadget use may indirectly increase the risk of bruxism in children through its effects on visual fatigue, psychological stress, and sleep quality. Visual fatigue can act as a chronic visual stressor that activates neurophysiological stress responses. Moreover, gadget use, especially before bedtime, has been shown to disrupt circadian rhythms and reduce sleep quality, increasing the likelihood of sleep bruxism[4]. Children with high screen time exposure, particularly those actively engaged in social media, tend to experience greater emotional dysregulation and sleep disturbances, which further elevate the risk of bruxism[10].

These findings were consistent with the results of a study by Anjos, et al (2023), which showed that excessive screen time significantly increases the risk of bruxism (p-value = 0.008). Although field research on the direct relationship between screen time and bruxism is still limited, an integrative review reports that psychological factors such as anxiety, stress, and depression are associated with bruxism and screen time in adolescents[11,12]. Another study by the same authors also reinforced the association between these mental factors and bruxism in adolescents. However, the causal relationship cannot yet be confirmed because most of the studies analyzed used a cross-sectional design, so excessive screen time is currently better understood as a modifiable risk factor in relation to visual fatigue and bruxism in children[1,3].

4. Conclusion

Prolonged gadget use in children is closely associated with an increased incidence of visual fatigue and may potentially trigger bruxism through mechanisms involving psychological stress, nervous system fatigue, and sleep disturbances. Ergonomic factors, viewing distance, and the duration of screen exposure are important determinants in the development of these conditions. Therefore, regulating screen time, implementing proper ergonomic practices, and providing education for both children and parents are essential to minimize the negative effects of gadget use on children's visual health and stomatognathic function.

Suggestion

Based on this discussion, further research should use longitudinal or intervention designs to explain the causal relationship between screen time, visual fatigue, sleep disorders, emotional stress, and bruxism in children. In addition, it is necessary to examine the role of mediating factors such as sleep quality and psychological conditions, as well as to differentiate between the types and contexts of gadget use. The use of objective measurements, such as screen time trackers and clinical examinations, as well as the evaluation of the effectiveness of screen time restriction interventions and stress management, are also important to produce more accurate and applicable findings.

Compliance with ethical standards

Acknowledgments

The author would like to thank all parties involved and who have helped in completing this article.

Disclosure of conflict of interest

The author reports no conflicts of interest in this work.

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