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ORIGINAL ARTICLE

DIGITAL DEVICE USE AND MYOPIA: THE RELATIONSHIP BETWEEN SCREEN EXPOSURE, NEAR WORK, AND VISUAL HEALTH

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Abstract

The rapid expansion of digital technology has changed the visual environment of children, adolescents, and young adults. Smartphones, tablets, computers, and other electronic devices are now widely used for education, communication, entertainment, and professional activities. At the same time, the prevalence of myopia has increased in many populations, creating growing interest in the possible relationship between digital-device use, prolonged near work, and abnormal ocular growth. Myopia is a multifactorial refractive condition influenced by genetic susceptibility, environmental exposure, visual behavior, and patterns of ocular development. Digital-device use should therefore not be considered an isolated cause of myopia, but excessive screen exposure may contribute to an unfavorable visual environment when it replaces outdoor activity, increases continuous near work, or encourages very short viewing distances. This article examines the relationship between digital-device use and myopia, the possible mechanisms connecting near visual activity with ocular growth, the effects of prolonged screen exposure on visual comfort, and practical strategies for reducing potentially harmful visual habits. Particular attention is given to screen distance, duration of uninterrupted near work, outdoor activity, lighting, posture, and regular visual breaks. The article also considers the responsibilities of parents, educational institutions, and healthcare professionals in promoting healthy digital behavior among children. A balanced approach that does not reject technology but incorporates appropriate screen habits, outdoor activity, and regular eye examinations may contribute to better visual health and support the prevention and management of myopia.

Keywords: myopia, digital devices, screen time, smartphones, tablets, near work, visual behavior, children, ocular growth, outdoor activity, eye health, myopia prevention.

1. Introduction

Digital technology has become an integral part of modern life. Children increasingly use smartphones, tablets, computers, and electronic learning platforms from an early age. Digital devices provide substantial educational and social benefits, but their widespread use has also changed the way people perform visual tasks. Many activities that previously required looking at distant or intermediate objects are now performed at close range and for extended periods.

This transformation has attracted attention from ophthalmologists and researchers because myopia is

becoming increasingly common worldwide. Myopia develops when the optical system of the eye focuses distant images in front of the retina. In children, this condition is frequently associated with excessive axial elongation of the eye. Although genetic factors contribute significantly to susceptibility, environmental and behavioral factors can influence the development and progression of myopia.

The relationship between digital-device use and myopia is complex. It would be scientifically inaccurate to state that smartphones or computers directly cause myopia in every child. Instead, digital technology may influence several behaviors that are relevant to ocular development. Children who spend many hours looking at screens may spend less time outdoors, perform prolonged uninterrupted near work, and hold small screens at relatively short distances. The combination of these behaviors may create a visual environment associated with increased myopia risk in susceptible individuals.

Another issue is that prolonged digital-device use can produce symptoms of digital eye strain. These symptoms may include eye fatigue, dryness, burning, temporary blurred vision, headaches, difficulty refocusing, and discomfort. Such symptoms are not identical to myopia, but they may reduce visual comfort and interfere with learning or daily activities.

Understanding the relationship between technology and myopia is therefore important for developing realistic recommendations. Complete avoidance of digital devices is neither practical nor necessary in contemporary education and society. Instead, children and adults should be encouraged to use technology in ways that support visual comfort and reduce unnecessary visual stress.

The purpose of this article is to examine the possible relationship between digital-device exposure and myopia, discuss the mechanisms that may contribute to abnormal ocular growth, evaluate the importance of near-work behavior and outdoor activity, and present practical strategies for maintaining healthy visual habits.

2. Materials and Methods

The article was prepared as a narrative review of scientific literature addressing myopia, digital-device exposure, near work, outdoor activity, visual ergonomics, and childhood ocular development. Peer-reviewed studies, systematic reviews, randomized controlled trials, and professional recommendations were considered in order to provide a broad analysis of the topic.

The literature was reviewed according to several major themes: prevalence and development of myopia, environmental risk factors, digital-device exposure, duration and distance of near work, outdoor activity, symptoms of digital eye strain, and preventive approaches. Particular attention was given to studies involving children and adolescents because ocular growth during childhood is especially relevant to myopia development.

The reviewed evidence was interpreted with consideration of differences in study design, age groups, methods used to measure screen exposure, definitions of myopia, and duration of observation. Because digital-device use is closely connected with other lifestyle factors, the analysis did not treat screen time as an independent variable in every situation. Instead, screen use was considered within the broader visual and behavioral environment.

The preventive component of the review focused on practical recommendations that can be implemented in homes, schools, and clinical settings. These included appropriate viewing distance, regular breaks, outdoor activity, adequate lighting, correct posture, appropriate device positioning, and periodic professional eye examinations.

3. Results

The analysis demonstrates that digital-device use has become an important component of children's daily visual behavior. Smartphones and tablets are commonly used at close distances, while computers are generally viewed from a greater distance. The type of device, duration of use, viewing distance, screen size, and purpose of use can therefore influence the visual demands placed on the eyes.

One of the most important factors associated with prolonged digital-device use is continuous near fixation. When a child looks at a smartphone or tablet for a long period, the eyes remain focused at a relatively short distance. This requires sustained accommodation and convergence. Prolonged near activity is not necessarily harmful by itself, because reading and studying are normal visual functions. However, very long periods without breaks may contribute to visual fatigue and may form part of a

lifestyle associated with myopia development.
Short viewing distance is another relevant factor. Children may hold smartphones closer to their faces than recommended for comfortable viewing. A shorter distance requires greater accommodative effort and increases the visual demand of the task. Encouraging children to maintain a reasonable distance from the screen is therefore a simple behavioral measure that can improve visual comfort.
The results also indicate that screen exposure should be considered together with outdoor activity. A child who spends several hours indoors using a digital device may have less opportunity to receive bright outdoor light and participate in distance-viewing activities. Research has consistently suggested that greater time spent outdoors is associated with a reduced risk of developing myopia in children. Therefore, the problem may not be screen exposure alone but the displacement of protective activities by prolonged indoor device use.
Digital devices may also influence sleep and daily routines. Evening screen use can alter bedtime habits and reduce the amount of time children spend sleeping. Although sleep and myopia involve different biological processes, an unhealthy daily routine can contribute indirectly to reduced outdoor activity, increased sedentary behavior, and prolonged periods of indoor screen exposure.
The review further shows that prolonged screen use is associated with symptoms of digital eye strain. Common complaints include dryness, burning, tiredness, temporary blurred vision, headaches, and difficulty changing focus between near and distant objects. Reduced blinking during concentrated screen viewing may contribute to ocular surface discomfort because blinking helps maintain the tear film.
Lighting conditions are another important factor. Excessive glare, insufficient illumination, and strong differences between screen brightness and surrounding light can increase discomfort. Children should therefore use digital devices in environments with comfortable and relatively even illumination rather than in completely dark rooms.
Posture also influences visual comfort. Looking down at a smartphone for prolonged periods can result in neck and shoulder discomfort in addition to eye fatigue. A suitable screen position, comfortable sitting posture, and appropriate desk arrangement can reduce unnecessary physical and visual strain.
The results support the importance of regular visual breaks. Short periods of looking away from the screen allow the accommodative system to relax and encourage blinking. A practical strategy is to periodically look at a distant object rather than maintaining continuous near fixation. Regular breaks are particularly important during long study sessions.
The review also demonstrates that parents play a major role in establishing children's digital habits. Young children often cannot regulate their own screen use effectively. Parents can establish reasonable schedules, encourage outdoor play, monitor viewing distance, and provide appropriate lighting. These measures can be introduced without eliminating technology from the child's life.
Schools also have an important role. Modern education increasingly relies on digital platforms, which means that screen exposure cannot always be avoided during lessons. Educational institutions can support visual health by incorporating breaks, alternating digital and non-digital activities, encouraging outdoor periods, and ensuring appropriate classroom lighting.
Regular eye examinations remain important regardless of screen use. Children may develop myopia gradually and may not recognize that their distance vision has deteriorated. Early examination can identify refractive changes and allow appropriate correction or myopia-control strategies when indicated.

4. Discussion

The relationship between digital-device use and myopia should be interpreted carefully. Myopia is a multifactorial condition, and attributing its development to smartphones or computers alone would oversimplify the underlying biology. Genetic susceptibility, age, family history, educational demands, near work, outdoor exposure, and individual patterns of ocular growth all interact.
One plausible explanation for the observed association between modern digital behavior and myopia is the increasing amount of time spent on near visual tasks. Smartphones provide particularly intensive near-viewing experiences because their screens are small and users often hold them relatively close. Children may also use these devices for extended periods without changing their viewing distance.
However, near work should not be treated as inherently harmful. Reading, writing, drawing, and

studying are essential activities for cognitive development. The objective of prevention should therefore be to create a balance between near work and other forms of visual activity. A healthy routine can include periods of study, breaks, outdoor activity, physical exercise, and sufficient sleep. Outdoor exposure deserves special attention because it represents a potentially protective factor that can be incorporated into daily life without expensive equipment. Bright outdoor light may influence retinal signaling mechanisms involved in ocular growth. Outdoor activity also naturally shifts visual attention toward longer distances and reduces the proportion of the day spent on continuous near tasks.

The growing use of smartphones makes visual education particularly important. Children may not realize that holding a screen extremely close or using it continuously for several hours can contribute to discomfort. Parents and teachers can explain simple principles rather than imposing unrealistic restrictions. For example, children can be encouraged to take regular breaks, avoid very close viewing, increase outdoor time, and use screens in well-lit environments.

The concept of digital eye strain should also be distinguished from myopia. Temporary blurred vision after prolonged screen use does not necessarily mean that a person has developed myopia. Digital eye strain is generally associated with temporary visual and ocular discomfort, while myopia is a refractive state related to the optical and anatomical characteristics of the eye. Nevertheless, persistent symptoms should not be ignored because they may indicate an underlying refractive error or another ocular problem.

The role of screen duration remains an important research question. Measuring screen exposure is difficult because children may use several devices for different purposes throughout the day. Some activities are performed for education, others for entertainment, and the viewing distance may differ substantially. Consequently, future studies should evaluate not only total screen hours but also viewing distance, duration of uninterrupted sessions, type of device, outdoor exposure, and overall daily activity.

Another consideration is the rapid development of digital education. It would be unrealistic to recommend complete elimination of screens from children's lives. Digital technology provides access to information, online learning, communication, and educational resources. The more appropriate objective is responsible use. Schools and families should create conditions in which children can benefit from technology without allowing screen-based activities to dominate their entire daily routine.

For children who already have myopia, lifestyle modification should complement rather than replace professional management. Appropriate optical correction remains necessary, and children with progressive myopia may require evidence-based myopia-control treatment. Outdoor activity and healthy screen habits should therefore be viewed as components of a broader management plan.

The psychological dimension should also be considered. Strict and unrealistic screen restrictions may create conflict between children and parents. Preventive recommendations are more likely to succeed when they are practical and understandable. Instead of simply prohibiting smartphone use, families can establish predictable periods for study, entertainment, outdoor activity, meals, and sleep.

Future research should continue to investigate the mechanisms connecting near work, digital-device exposure, and ocular growth. Studies with objective measurements of device use, standardized definitions of myopia, and long-term follow-up would improve understanding of the relationship. Research should also explore whether specific patterns of screen use are more strongly associated with myopia than total daily exposure.

5. Conclusion

Digital-device use has become an important part of modern childhood and cannot be separated from contemporary education and social life. Although smartphones, tablets, and computers should not be considered the sole causes of myopia, excessive and uninterrupted near-device use may contribute to an unfavorable visual environment, particularly when it is associated with short viewing distances and reduced outdoor activity.

The prevention of myopia should therefore focus on balance rather than complete avoidance of technology. Children should be encouraged to maintain an appropriate viewing distance, take regular breaks during prolonged near work, use devices under comfortable lighting conditions, maintain good posture, and spend sufficient time outdoors.

Regular eye examinations are essential because children may not recognize gradual deterioration of

distance vision. Early diagnosis provides an opportunity to correct refractive error and, when appropriate, introduce evidence-based strategies for controlling progression.
Parents and schools have an important responsibility to establish healthy digital routines. Outdoor activity, balanced schedules, appropriate visual ergonomics, and responsible screen use can be integrated into everyday life without eliminating the educational benefits of digital technology. Ultimately, the relationship between digital technology and myopia should be understood within the broader context of ocular development and lifestyle. A comprehensive approach that combines healthy visual behavior, outdoor activity, regular eye examinations, and professional myopia management offers the most practical strategy for protecting children's visual health in an increasingly digital environment.

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