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Review Article

Progression of myopia in school-aged children after COVID-19 home confinement: A systematic review

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ABSTRACT

Aim: The systematic review attempts to examine all the data concerning digital screen use's influence on myopia development in a COVID-19 epidemic.
Materials and Methods: The literature was searched on PubMed and Science Direct from December 2019 to September 2022. Using the Preferred Reporting Item for Systematic Review and Meta-Analyses (PRISMA) criteria, a total of 12 research papers were chosen for thorough evaluation after the exclusion criteria. Spherical equivalent refraction and axial length were outcomes of myopia progression. Time spent using digital devices and time spent exercising outside were examined as factors.
Result: Greater stress, increased use of electronic gadgets like laptops, tablets, and cell phones, as well as less time spent outside, have all been linked to an increase in the prevalence of myopia. Additionally, we discovered that the COVID-19 pandemic's commencement significantly changed children's behaviors since there was a switch from in-person instruction to online learning and a decline in outdoor activities because of home quarantine.
Conclusions: In children who participated in remote learning during the COVID-19 lockdown, increased reliance on digital devices for online classes has either caused or worsened visual disturbances like the rapid progression of myopia, symptoms of dry eye and visual fatigue, and vergence and accommodation disturbances. The outcomes of this methodical study show that myopia development is significantly impacted using digital screens during the COVID-19 pandemic.

1. Introduction

Myopia has been considered a serious problem globally arose.[1] By 2050 AD, the World Health Organization (WHO) predicts that about half of humanity would be myopic. One of the main risk factors for the development of myopia has recently been identified as not engaging in enough outdoor activities. The length and intensity of near-work activities are also strongly related to the development of myopia.[2] A wise understanding and knowledge of early refractive development will provide more in-depth clues into the process and policy for myopia control. A novel coronavirus (severe acute respiratory syndrome) started to spread like wildfire in China and nearly every other region of the world in December 2019.[3] However, the household quarantining and closures of educational institutions against the pandemic will not last forever, as the rapidly growing adoption of and reliance on technological gadgets and behavioral alterations caused by extended home confinement will show. The pandemic has severely disrupted the lives of thousands of schoolchildren for months in many countries.[4] The pandemic may have adversely affected the physical and mental health of the people to some extent, especially that of children and adolescents.[5] Online courses were offered and delivered via

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internet service because it is expected that more than 220 million school-aged children and adolescents will be forced to stay inside their homes. Additionally, social gatherings have been banned to stop the spread of the disease, which has decreased outdoor activities. During the COVID-19 pandemic, e-learning has replaced traditional classroom instruction as the only option for school-aged students. The COVID-19 period has seen significant changes in daily living, including an increase in children's screen time and home confinement.[6] The inadequate time spent on outdoor activities is now being considered a major risk factor for developing myopia. It has been previously suggested that the extensive use of virtual learning using digital devices and screens, due to the closure of schools and intensive home quarantine during the COVID-19 era, would eventually increase the rate of myopia. Therefore, this kind of myopia, which is also called 'Quarantine myopia', has profoundly increased during the COVID-19 pandemic.[7]

2. Materials and Methods

Screening process and articles selection according to the PRISMA guidelines.

The search was carried out using a database of PubMed and Science direct published until 1st May 2022 were searched. The following keywords and MeSH terms were used "COVID-19", "Children", "Digital eye strain", "Myopia", and "Myopia progression". All the pertinent articles were thoroughly assessed, and the references sections of the identified research paper were examined to find additional relevant articles to help ensure the completeness of the search. The inclusion criteria were original articles that were published in English between 2015 to 1st May 2022, the purpose of which was to investigate the effect of home quarantine during the COVID-19 pandemic on myopia progression in children and its associated factors. Study from around the world was included. The eligibility of the studies was first assessed on titles and abstracts. Full manuscripts were achieved for all chosen studies and the decision for final inclusion was made after a thorough examination of the paper. The exclusion criteria were studies not focusing on the use of atropine e/d, ortho k lens, and ocular surgeries. Most studies were conducted in China, Spain, Turkey, and India. NO attempts to discover unpublished data were made.

3. Results

Using the search terms, we found 329 unique articles. In the next step, the full texts of articles were checked according to the eligibility criteria and 12 articles fulfilled the criteria for being included in the main analysis. After reading the 12 articles we found that greater stress, increased use of electronic gadgets like laptops, tablets, and cell phones, as well as less time spent outside, have all been linked to an increase in the prevalence of myopia. We also found that the start of the COVID-19 pandemic had a substantial impact on children's behaviors, since there was a shift from face-to-face instruction to online learning and a decrease in outdoor activities due to home quarantine. It is essential to conduct more research on these behavioral alterations in children during the pandemic and their possible effects on ocular health. Our in-depth analysis explores whether these changes can exacerbate the development of children's myopia and negatively affect it.

4. Discussion

There is a great impact the visual environment has on the development of myopia. Major, a couple of known risk factors are reduced outdoor time and prolonged near work whereas home confinement has not been yet identified as a genuine risk factor. However, it may be associated with the increased development of myopia. This is because decreased outdoor time and increased near work are more likely to come into play during home confinement.[8]

The COVID-19 pandemic developed special circumstances for such associations to be explored. During this time, courses were delivered virtually, and children were confined to their homes. One can evaluate the effects of home confinement on the development of myopia by comparing the refractive status of a sample of school-aged children before and after confinement.[9]

Even though a recent study identified no significant correlation between sleep behaviors and refractive error, axial length, or corneal radius of curvature, retinal exposure to blue light interferes with melatonin secretion and significantly alters sleep patterns. Therefore, even though it appears that the COVID-19 pandemic is indeed connected to an increase in the development of myopia, the precise cause of the refractive change is still unknown.[10]

In comparison to the prior years, a major myopic shift and an increase in the prevalence of myopia have been seen in the 6- to 8-year-old age group in 2020. These alterations were less prominent in the comparatively older age group which is 9-13 years old children. It was quite interesting to know that the younger children (6 to 8 years old) encountered a more significant myopic shift than the older children (9-13 years old) after a period of home confinement. The younger children may have gone through more sensitization to the changes in the environmental aspects than the older children. The authors estimated that there is probably an age window where the plasticity of myopia is considerably high. Children who are within the age window may be more prone to environmental triggers, which may help in the promotion and control of their myopic progression. If there is a true existence of myopia plasticity in the age window, one may have to consider introducing myopia control during this pandemic period to look for more effective and efficient treatment

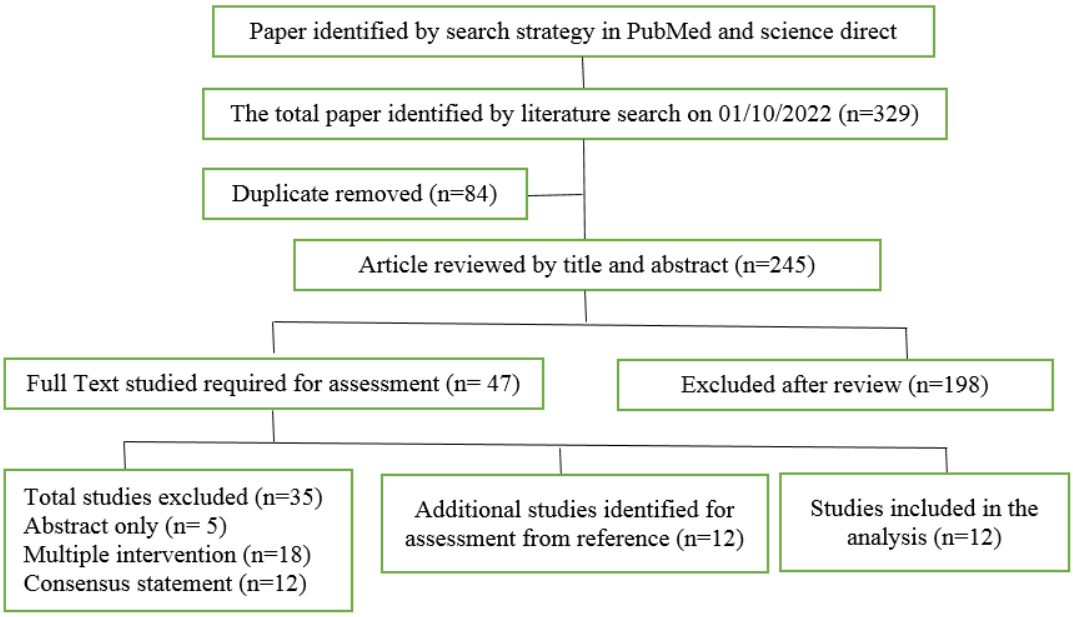

Fig. 1:

procedures. Nevertheless, this is mere speculation, further research is required before going through the clinical implementation.[11,12]

Many types of research and studies have found that myopia is more likely to develop earlier in girls compared to boys. The reason behind this observation was not fully understood. Such differences in the age of onset of myopia in contrast to the sexes might have a strong connection to girls undergoing puberty earlier than boys do.[13]

The study also discovered that the right eye was frequently myopic than the left eye. It was believed that this was connected to the dominant eye, which is often the right eye, which tends to be more myopic than the left eye, which is a non dominant eye.[14,15]

We should thus advise all our patients to put down their devices for an hour or two each day and go outside to engage in some form of physical activity. In fact, we are strongly encouraged to heed this advice as well, not just for the benefit of our patients. Myopia seems to be on the rise; thus, it appears that eye care professionals will be busier than ever. Not merely prescribing without glasses and contacts, but also undergoing optical and pharmaceutical therapies to halt the advancement of myopia.[7,16] The prevalence of myopic maculopathy rises by 67% for every extra diopter of myopia, so this is crucial information. Only one major cause of blindness, myopic maculopathy, lacks a proven cure. Therefore, it is our collective responsibility to take all reasonable steps to prevent the beginning and progression of myopia, even in these challenging times. If distance learning, remote employment, and lockdown enforcement continue soon then, practitioners should still be able to make the proper recommendations to reduce refractive change.[16]

5. Limitations

When evaluating the results of this study, it is very important to be aware of its limitations. Foremost, the refraction was non-cycloplegic and was measured by a photo-screener. While the photo-screener may be a reliable screening tool, it can never replace cycloplegic refraction which offers better measurement accuracy. Secondly, ortho-k wearers were suggested to remove their lenses the night before the screening day. However, a full washout of ortho-k lenses requires more than one night of lens discontinuation. For patients who only discontinued ortho-k wear for a single night, residual ortho-k treatment remains, and their refractive measurement would not reflect their full refractive error. Including these patients in the study have introduced measurement bias. Thirdly, no measurements were made for the precise amount of screen time, proximity to work, or outside activity. One may presume that during home confinement, the hours spent on outdoor activities were lessened and vice versa for indoor activities, including near work and screen time. The lack of quantification of these myopic risk factors limits the interpretation of the data. Furthermore, only school-age kids between the ages of 6 and 13 were included. One would have been shocked to learn how the study's inclusion of preschool-aged children might have influenced those kids' refractive status and whether they were more susceptible to environmental alterations. In this investigation, axial length and corneal curvature were not measured. When myopic progression occurs, often the axial elongation increases significantly

while the corneal curvature remains relatively stable. In the absence of these data, it would have been doubtful and confusing whether the underlying mechanism was related to true myopic progression.

6. Conclusion

The above-mentioned findings and observations suggest that the significant myopic shift might have been profoundly associated with home confinement resulting from the COVID-19 pandemic lockdown, more particularly for younger school-aged children between 6 and 8 years old. Therefore, current evidence in assessing the relationship between home confinement and myopic progression is nominal, thus further follow-up research would be most required and more beneficial. The two most significant risk variables for myopia advancement that our systematic research sought to analyze were time spent outside and screen use throughout the year. Due to rigorous home quarantine regulations, we discovered that kids often spend no time at all outdoors. As kids used electronic gadgets for play and online learning, screen time considerably rose during this time. Our data shows that because smartphones and tablets are more accessible to children's eyes than other electronic devices like televisions or personal computers, they are used by children more frequently. We found that during the pandemic, rigorous house quarantines, decreased outside time, and increased screen time were all associated with children's myopia progressing. Myopia development was also linked to the increased use of smartphones and tablets.

7. Conflict of Interest

None.

8. Source of Funding

None.

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