Review Article

IMPACT OF DIGITAL DEVICES ON MYOPIC INDIVIDUALS

ABSTRACT:

Background: Today's generation have all been using greater deal of time on their digital devices whatever it may be. It leads to surge in cases of myopia in the population especially in Asian population. The average screen time usage has increased significantly especially during pandemic situation. Digital devices also contain spectrum of rays and contain blue light which damages the retina and disturbs the eye health. This has caused a trend of increasing myopic cases in young generation. Risk factors and prevention of using digital devices should be known to public for better care of their eyes.

Objective: To study various articles on association between digital device usage and myopia in young population. Based on results of various studies, conclude and discuss the risk factors of myopia and how it can be minimized in the young generation.

Methodology: Various articles were reviewed during study, recent papers published in the last five years were considered as due to pandemic effect, there is increase in average screen time which further needed to be studied for better overview on the current situation for the individuals. Various methodologies in the published articles have been studied for reaching conclusion of identified risk factors of myopia.

Conclusion: Due to various advancement and behavioral changes in the population of developed countries and in developing countries there is increase in sedentary lifestyle of most of the population which is leading to the increase usage of digital gadgets which in turn maximize the tendency to develop myopia in the population.

Keywords: Myopia, myopia risk factors, digital devices, screen time.

INTRODUCTION

Myopia or short-sightedness or near-sightedness is a refractive error in which the visual image come to a focus in front of the retina leading to defective vision of the distant objects. Myopia is becoming more frequent over the world, and it is thought to be the most common cause of vision impairment in affluent countries without optical correction. (1) By 2050, Myopia is expected to affect close to five billion people globally, making it a major community health issue with considerable educational, economic, and social implications.(2) India, like other countries of Asian continents, has seen a surge in the incidence and prevalence of myopia.(3) Myopia has

also begun to appear at an earlier age than its prior onset which is concerning because younger children have a faster rate of advancement and they are likely to attain greater degree of short-sightedness.(4,5) Later in life, this can remarkably raise the chance of progressing into various vision threatening disorders such as glaucoma, cataract, myopic maculopathy, and retinal detachment.(6)

Urbanization, reduced outdoors time, disturbed or delayed sleep, increased duration of studies, and uninterrupted reading or in close work are all adduced as possible effects in the aetiology of myopia, which involves an interaction between environmental, behavioral and genetic factors.(2,7-12) Digital devices are now an additionally possible environmental predisposing factor for myopia in young individuals and children.(13) Smart phones, tablets, iPhone and computers are employed from such a young age in both the home and the classroom which further increases the cause.(14)

In 2018, 95% of American teenagers reported owning or having access to a smart phone, making them the fastest increasing demographic of smart phone users.(15,16) Smartphones are currently the most common gadgets for 9–16-year-old in Ireland as means to access the internet on a daily basis, while 85 percent of young people (aged 12-15 years) in the Great Britain use one on a daily basis.(17,18) Computer use has been recognized as a risk factor for near-sightedness in several studies done till date.(19-24) According to one study, myopia is closely associated with computer screen working distance in close proximity.(21) Smartphone users' working distance is often significantly less than that of computer users.(25) As a result, it's possible that prolonged and increased exposure to a digital screen(esp. smartphones) could be a cause for the development of myopia and its advancement, particularly in blooming young age.(2) However, there is limited published research on the link between myopia and the use of digital gadgets.(2) Self-reported assessment for digital devices is likely to be ineffective to predict objective behavior of smartphone but then neoteric research concentrated on these assessments to address the impact on ocular health based on the duration spent on the digital devices. The design of this study was to see if there was any correlation between ametropia/refractive status and self-reported analysis and assessment by keeping a tab on smartphone usage among children and young adults. Students' perceptions of digital technology and smartphones as a risk factor for myopia were also thoroughly investigated. (26-30)

Rationale

The rationale of the above article is in context to the new environmental factor that has been exposed to young generation i.e., digital media. The long hours spent on digital devices has various risk factors involved in maintaining eye health. The emphasis has been given to minimize the risk factors by various ways in order to maintain eye health and to prevent myopia in the younger generations.

Objective

To conclude after reviewing various studies between (Jan 2016- Dec 2021) which were focused on association of prolonged usage of digital devices on myopia.

METHODS

Numerous articles of different origin were compiled from papers with publication in journal like PubMed, Web of scholars, Scopus between January 2016 to December 2021 using the keywords 'Myopia', Myopia risk factors', 'Screen time', 'Digital devices. All published articles were looked upon including original research, meta-analysis and systematic reviews with searches restricted to the English language. The reference lists of the publications obtained were examined and relevant studies were also looked upon. Studies based on the individual who are using digital device (smartphones, tablets, laptop, computer, etc.) were considered.

RESULTS

Following are the pictorial interpretations of the various studies compiled at one place. These results contain the rate of increase in myopia due to digital devices and the average usage of digital devices hours per capita of population. These data will altogether establish the relations between the increase in digital device usage and myopia.

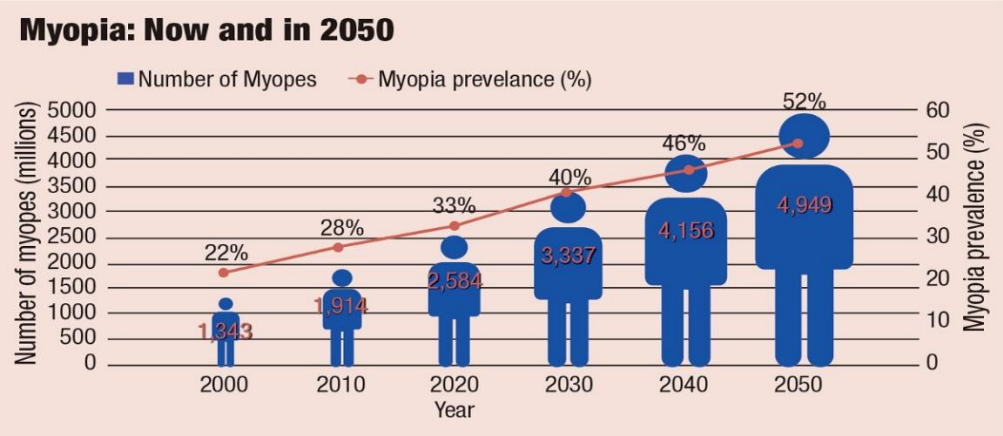

Fig. 1. Myopia syndrome

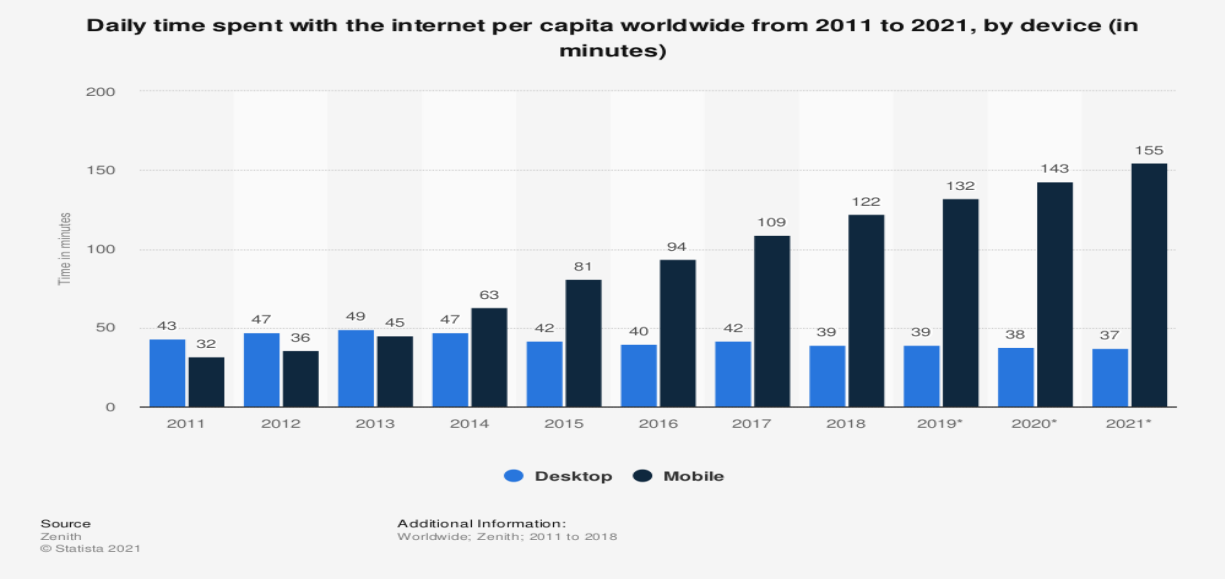

Fig. 2. Daily time spent with internet per capita

DISCUSSION:

The objective of this systematic review and meta-analysis was to integrate all of the relevant evidence on the association between digital screen time and myopia. The results of this study suggest that there really may be apparent link between screen usage and myopia prevalence or advancement. The studies in various research papers have concrete evidence of association between myopia and usage of digital devices in young age. The systematic research includes a large number of youngsters from Asia, indicating that this region had a higher frequency of myopia.38 Study has been conducted among myopic and non-myopic candidates with variation in age, average usage time, gender. The correlation has been clearly visible in statistical analysis in myopia causes with usage of digital devices. The style of living among new generations have changed over the evolution of technologies. Smartphone usage pattern among children has changed drastically over time (7, 14). With the introduction of the World Wide Web in the 1990s, people began to utilise computers more frequently. Smartphone/tablet use, on the other hand, is relatively recent, having begun around ten years ago with the introduction of the first smartphone. (31) The use of mobile devices has expanded dramatically during the last decade. In 2014, 22% of people have a smartphone; by 2019, that number had risen to 37%. (32) Youngsters are starting to use cellphones at a younger age (22 percent start at 3 years old or younger), and one in three children (1–6 years old) use smartphones for between 1 and 2 hours per day.(33,34,35)

In the year of 1980, there is a rise in myopia prevalence all over the world although there is no such presence of computers or any means of digitalization for the community. Then in the subsequent years over a decade, that is in the year 1900, there is gradual increase in the myopia cases in the world population, then there comes the computers in the household devices, then almost after a decade in the year 2000, Saw et al. proposed that there is a link between increased duration spent on computer and myopia incidences but Mutti et al. proved otherwise. Half a decade later with the achievements in the technology and development, the first of a kind i.e., smartphone was launched in the year of 2007, with various new facilities such as screen touch etc., but in the same year a paper published by Jones et al. proposed negative results on the correlation between the use of digital devices and myopia incidences. In the following year the same negative results were published by Ip et al., in 2009 and Lu et al., in 2009.Jones- Jordan et al., proposed the correlation to be possible in the year of 2011 but in the next year in 2012 said otherwise. Then almost seven years later in the year 2014, smartphone penetration was about twenty -two percent , then it is seen that there is an increase in the myopic individuals and the time to develop also seems to be a lot earlier than in the last one or two decades. Then in the year 2015, Chu et al., and Li et al., said that the relationship between the use of digital devices and myopia cannot be established but in the same year Saxena et al., proved otherwise and again in the year in 2017 Saxena et al., proposed that with the use of the digital devices for approximately 1-2 hours per day there seems to surge in the incidences of myopia in relation with the former. In the year 2019 smartphone penetration is about 37 % in the community, which lead to think that the surge in the prevalence and incidence of myopia is closely related to the use of digital gadgets.

Myopia has been more prevalent since decades and near sight of smartphones is one of the risk factors of myopia. Smartphone usage is different from conventional reading as there are various factors that are affecting the health of eye which needs to be investigated separately. The factors

are distance of smartphone from eye, brightness of the screen, contrast of screen, resolution of device, and spectrum of light originating from screen.

Moreover, smartphone addiction among children and adolescent has increased considerably which has reduced time spent in other time works. Average usage time has been 4 hours 42 min from 2 hours 31 min.(36,37) As well as sales of smartphones demonstrate the increase in ownership of smartphones these days.(38) This huge jump is now one of the environmental risk factors of myopia. The studies indicate that students spend more time in gaming, social media and other non-important tasks than time spent on their study compared to pre-smartphone era.(15) Moreover, 99% of students are currently owning a smartphone. The reports says that myopic children spend 40 minutes more on average on smartphones than the non-myopic children. As well as adults spend 45minutes more on computer than non-myopic adults. This establishes the straightforward correlation between smartphone usage and myopia. Statistical analysis of the questionnaire prepared for investigating the brightness, contrast of screen and distance between eye concludes that these factors play significant role in disturbing the health of eye.(2) Its effect can be also on near-sightedness of eye. The blue light originating from digital devices has great impact on health of the eye.

However, there are some differences in the data collected in screen usage time between those who are myopes and non-myopes. The large difference is in short duration that has been found in data that was reported by individual. These data collected from individuals are not much reliable thus, are underestimated and does not imply the actual screen time usage. In few reports usage time has been collected over a long period of time by recording actual screen usage time. The findings of those reports can be more trusted and indicates the actual behavior of digital screens on eye health. There is some gender-based differences in some myopic populations. But studies further concluded that genders did not had significant role correlating it with myopia, limiting it to some populations.(39-44).

These major developments need the consideration of current links between myopia and screen time, particularly in children and in locations where the prevalence of myopia was low prior to the arrival of digital devices. However, there hasn't been any conclusive evidence of this link. One reason for the lack of a link could be because there isn't enough screen time exposure as a risk factor to modify myopia prevalence. Because smart digital gadgets have only been available for a short period, the evidence now available may be restricted. We discovered no evidence of a recent increase in near-work activity. The belief that smartphone is not good for eye does not limits the usage of smartphone. This behavior was more seen in the myopes, knowing the facts that smartphones could damage their eye they continued using smartphones.(2) Covid has pushed the education and work to be on digital screens which furthermore added the screen usage time. This new change will make users accept these digital platforms in long term. Changes in the behavioral aspects of children due to adoption of these technologies could not be ignored. Various other factors could also be involved in the starting of myopia which needs to be further studied. Usage of digital devices on bed can disturb sleep, it needs to be further studied the correlation between myopia and lack of sleep. The importance of study includes study on impact of smartphone individually and along with the other digital devices such as television, computers, laptop. One of the strengths of the study is the extensive literature review which assisted in establishing relationship between myopia and digital devices. (2)

Limitation of Study

There are various limitations of study in reports, like some of the reports have been conducted in the Asian population there needs to be study in diversified population for the actual findings to be accurate. Several study reports claim other risk factors such as other near vision tasks to be cause of myopia, a clear perspective cannot be drawn between screen exposure and myopia. In most of the study screen time was reported by the individuals or their parents. Individuals generally underestimate their screen usage time up to 40 percent. This will lead to inaccurate results. This limitation could be overcome by installing specialized applications that records the screen time usage. This real time data could produce the accurate results which can help in establishing correlation. In further studies individuals who participated needs to be followed till they develop any refractive disorders or progressive myopia. This will make sure nothing has been missed in the study. No formal eye checkups were performed during study it was based on self-reporting which produced inaccurate results. If eye checkups by optometrist performed for verification, then the results could be much validated and accurate. The outdoor activities have not been captured which needed to be captured as screen exposure time affects the time spent outdoors. Further studies should necessarily incorporate the outdoor light exposure levels that person undergoes and other objective factors such as screen viewing angle, screen brightness and contrast, ambient lights, face to screen proximity needs to be studied further. The study based on usage of categorized digital screens needs to be performed as individual has various types of screen exposure like theatre, TV screens, and other types of screens. It might be possible that reading behavior and other risk factors of myopia has changed over time. So, these needs to be investigated further.

CONCLUSION:

The surge in prevalence of myopia has been continuing since decades and is not a new phenomenon. This surge was also there in pre smartphone era and we cannot blame the smartphone as the only risk factor of myopia. The ongoing generations are the first to be experiencing this digital growth. The studies show comprehensive correlation between digital media usage and myopia. The average screen usage time has escalated substantially in these years. Thus, smartphone has become supplementary risk factors for myopia. Smartphone usage has been affecting eye health and sleep quality. This study indicates a detailed investigation is needed for finding the actual risk factors. There are few of the conflicting reports on the association, that is evident as smartphones are recent developments. Research needs to be conducted in assorted population for accurate results. These findings will be very useful for the children, parents, teachers etc.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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