



Review Article *Comprehensive Ophthalmology*

Digital eye strain: Time for a break

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ABSTRACT

Digital eye strain (DES) has increased over time due to excessive use of digital devices by school going children and young adults working online from home, due to COVID-19 pandemic. Prolonged screen time impacts their wellness, which produces stress on visual and musculoskeletal system, in addition to circadian rhythm disturbances. Symptoms of dry eyes, eye pain, redness, watering of eyes, burning/itching sensation in eyes, blurred vision, headache, and poor quality of sleep are some of the common problems faced by the affected individuals. Recommendations to alleviate DES include creating an optimal environment while working on digital devices, taking frequent breaks, and limiting daily screen time. Preventive measures can be taken by counseling/public awareness initiated by ophthalmologists/eye healthcare workers and sensitization of teachers and parents so that timely action can prevent the children from getting adversely affected.

Keywords: Digital eye strain, Dry eyes, Video display units, Circadian rhythm, Screen time

INTRODUCTION

In recent times, digital eye strain (DES) has emerged as a lifestyle problem with prevalence reported between 22.3% and 39.8% in the community.^[1] COVID-19 pandemic created a host of issues with physical and mental well-being of people of all ages around the world, particularly in school going children and young adults.^[2] For those who had to work online, it created undue strain on the eyes. The use of multiple digital devices compounded the problem and those affected had ocular fatigue, anxiety/depression, and sleep problems. Progression of myopia and dysfunction in accommodation has increased in kids due to extended use of digital devices. Binge eating and obesity increased as a result of sedentary lifestyle. There have been articles published in various journals about DES/computer vision syndrome based on studies done in school children/IT professionals.^[3,4] However, the present article is relevant in present circumstances to reiterate the problems faced by the young generation due to overuse of display terminals and spread awareness about the emerging pandemic to one and all.

DIGITAL SCREEN-TIME

Digital screen-time is the amount of time spent with video display units (VDU) which include digital and electronic devices, such as computer, laptop or tablet, smartphone, playing video games, and watching television. During COVID-19 pandemic, screen time increased many times in daily routine among many individuals while working on VDU. The hike in duration of viewing small text on VDU at short working distance periodically leads to a host of symptoms such as eye

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strain, burning sensation, tired eyes, irritation, and blurred vision along with various musculoskeletal symptoms such as cervicgia, backache, shoulder, and wrist pain. Symptoms comprising pain behind eyes and itching sensation in eyes increased in those who were on prolonged digital activity of more than 6 hours (h).^[5] A similar study on North Indian population showed those individuals on digital devices for more than 4 h suffered from severe dry eyes.^[6]

CIRCADIAN RHYTHM

Circadian rhythm dysfunction occurs in those using digital or electronic devices for prolonged time. There is suppression of release of melatonin (essential for proper sleep) from the pineal gland caused by the blue light emitted by digital devices.^[7] A similar study done in Harvard showed that there is disruption of circadian system due to prolonged exposure to artificial light at night resulting in insomnia due to suppression of melatonin release from the pineal gland.^[8] Release of melatonin hormone is controlled by retinal ganglion cells, photosensitive in nature which contains melanopsin.

Due to sleep deprivation, there are disturbances in the circadian rhythm which results in increased tear osmolarity, shortened tear film break-up time, and diminution of tear production which culminate in the development of ocular surface disorder.^[9]

DRY EYES AND ASTHENOPIA

Individuals who were suffering from dry eye manifested symptoms of burning, irritation, grittiness, dryness, and watering from eyes while those having accommodative and/or binocular vision dysfunction complained of eye strain, ocular pain, headache, blurred vision, diplopia and light sensitivity. The constant near work leads to an increased state of accommodation, while the concomitant requirement of convergence associated with near work leads to eyestrain and headache due to strain on the extraocular muscles. A study in children has shown that spending more than 4 h screen time is associated with eye pain, foreign body sensation, watering, and redness.^[10]

While working on computers, there is decrease in blink rate and increase in palpebral aperture due to higher gaze angle. This often results in tear film instability, lipid layer deficiency and symptoms of dry eyes.^[11] Even if a person blinks frequently incomplete blinking can be a cause for evaporative dry eye. Similarly, tear film breakup is reduced due to diminished tear film thickness in the inferior corneal region.^[12]

Literature suggests that dry eye disease increases in those using smartphone than other digital devices.^[13,14] Children

tend to spend more time on smartphone-based video games and are not aware of the consequences of excessive use of these gadgets. Asthenopia associated with DES is aggravated by reduced digital screen distance, constant convergence, and accommodation.

Some studies have shown more affection of DES in females as compared to males due to higher incidence of dry eyes in females.^[15,16] However, Mohan *et al.* reported that males were at higher risk probably due to male children being involved in multitasking on digital device.^[17]

Increased screen time can affect psychological well-being and social health which can lead to anxiety and depression.^[18] Furthermore, there is a negative association of increased screen time with childhood obesity and sleep quality.^[19]

MYOPIA

A study done on schoolchildren has shown myopic shift in children between 6 and 8 years, due to forced home quarantine during COVID-19 pandemic.^[20] It possibly could be due to increased sensitivity to environmental changes in young age compared to older children. Younger kids are in a crucial point for myopia development. However, other studies in schoolchildren have shown that the fastest rate of myopia onset was between 7 and 10 years; and outdoor activity is a pivotal intervention method for preventing the onset.^[21] During COVID-19 pandemic due to restricted outdoor activity and online classes for schoolchildren bound to their homes, there has been a spurt of new-onset myopia and enhanced progression of existing myopia due to excessive near work. For those children who are into excessive gadget, there have been abnormalities in accommodative and vergence^[22] which have resulted in sudden increase of progression of myopia. It is essential to exclude accommodative spasm by doing cycloplegic refraction and a binocular function evaluation.^[23] Ocular biometry should also be a part of evaluation process and children whose axial length is more than 26 mm should periodically be called for follow-up.^[24] There are predictions of a worsening of refractive errors globally and it is estimated that more than 50% of world's population is likely to develop myopia by 2050.^[25] Younger the children more likelihood of the diagnosis getting delayed as these children may not complain compared to elderly age group. This emphasizes the need of eye care professionals to recognize children at higher risk of progression of myopia and implement appropriate measures.

MANAGEMENT

Symptoms of DES can be relieved by appropriate ergonomic use of digital devices, screen time limitation to <4 h, screen

time tracking, larger high-resolution display use, lighting adjustment, and an emphasis on outdoor activities.^[26] Forced gadget break at least 30–60 minutes (min) before bedtime, frequent breaks during screen use or the 20-20-20 rule (to focus at a distance of 20 feet away every 20 min for 20 seconds), advocating family time with non-digital based learning, and entertainment are some steps to alleviate DES.

Enforced blinking during screen time should be inculcated; this compresses the meibomian glands and ensures the formation of lipid layer, which can help with evaporative dry eye. To ensure that eyelid protects most of the globe, position of desktop should be kept at least 4–5 inches below eye level so that minimal inferior portion is exposed to environment.^[27]

For those who are frequently working on VDU, the gadgets should be at suitable distance to prevent ocular fatigue/strain. Keeping the computer at a distance of an arm's length can help in preventing DES as per recommendation of the American Academy of Ophthalmology.^[28]

Some authors have recommended blue light blocking glasses and antireflective coating^[29] to reduce eye strain. However, the American Academy of Ophthalmology website states that blue-blocking filters are not mandatory and are an unnecessary expense.^[30] Similarly, other studies have shown that there is negligible level of blue light transmission from digital devices hence blue blocking lenses have no effect on signs or symptoms of DES.^[31,32] This advocates creation of optimal environment for screen viewing such as appropriate lighting and adjusting image parameters (resolution, contrast, text size, and luminance) to minimize symptoms of DES.^[33] Furthermore, the use of artificial tears can help in ameliorating the symptoms of dry eyes.^[12]

Due to rise in use of digital and electronic devices in recent times among children and young adults, awareness among parents, caregivers, and youth needs to be increased about adverse effects of increased screen time and application of optimal ergonomic practices of screen exposure. Adopting the habit of taking short, frequent breaks can improve working efficiency, thus compensating for time spent away from the screen.^[34] School and college curriculums should implement preventive strategies, apart from teachers and parents' sensitization, to motivate all round development of the children, both physical, mental, and social.

CONCLUSION

DES due to excessive use of various digital devices for long hours is affecting children and adults all over the world. Increased screen time is leading to sedentary lifestyle, dry eye, asthenopia, and various other symptoms in affected individuals. Furthermore, a disruption in circadian rhythm is causing lack of sleep and generalized fatigue affecting

daily routine. Awareness about the perils of continuously using smartphones and other digital devices without a break and not using optimal environment while working on them can lead to avoidable ocular and musculoskeletal strain. Sensitization of parents and teachers will help in preventing DES and its unwanted side effects in school children and young adults.

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Declaration of patient consent

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Conflicts of interest

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