

E-ISSN: 2709-9369
P-ISSN: 2709-9350
www.multisubjectjournal.com
IJMT 2024; 6(11): 43-47
Received: 16-09-2024
Accepted: 19-10-2024

Arup Saha
Assistant Professor,
Department of Optometry,
Swami Vivekananda
University, Barrackpore,
West Bengal, India

Bulti Saha Debnath
Consultant Optometrist and
Vision Therapist, Nabajatak
Child Development Centre, BC
Block, Salt Lake Sector -1,
Kolkata, West Bengal, India

Debabrata Debnath
3rd Year Undergrad,
Computer Science and
Business System, Techno Main
Salt Lake, Sector V, Kolkata,
West Bengal, India

Corresponding Author:
Arup Saha
Assistant Professor,
Department of Optometry,
Swami Vivekananda
University, Barrackpore,
West Bengal, India

The impact of contemporary technology on daily existence and visual expression

Arup Saha, Bulti Saha Debnath and Debabrata Debnath

DOI: <https://dx.doi.org/10.22271/multi.2024.v6.i11a.503>

Abstract

Technology dependence becomes so great in our daily routines and lifestyle demands that it negatively impacts our day-to-day health. Regular use of laptop computers for work purposes negatively impacts eye health, deteriorates eyesight, and starts an aging process that alters the physiology of the refractive surface and raises the risk of retinal degeneration. In addition, prolonged indoor work during business hours while using digital gadgets may result in peripheral defocus.

Pathological myopia and the advancement of myopia are frequently caused by peripheral defocus. In addition, a prolonged period of time spent inside in front of an air-conditioned computer screen may be the cause of decreased blinking rate and an increased propensity for dryness. In addition to the professional use that occurs these days, school-age children suffer from the overuse of digital devices and excessive close work due to factors like study load assessments, online learning, meetings, note-taking for assignments, and other activities that compel students to use digital devices excessively and for extended periods of time.

Overuse of digital screens may reduce blink frequency and hazardous blue light emissions. Additionally, exposure may result in weariness, ocular constriction, cumulative stress, and eye strain. We have read a great deal of study on the symptoms of digital eye strain and dry eyes. Here, we'll go over the telltale signs and symptoms of digital eye strain, how it affects ocular health, how to treat it properly, how to practice vision exercises, and general preventative advice for people who use digital screens to protect their eyes.

Objectives

- The impact of everyday technology use on eye and overall health
- Symptoms of dry eyes and digital eye strain are discussed.
- Pathophysiology and ocular problems associated with prolonged use of digital screens
- The percentage of patients with computer vision syndrome among frequent users of computers

Expected outcome

- Based on an analysis of the greatest number of articles, it is estimated that 80-90% of computer users experience eye strain or weariness.
- In most situations, prolonged exposure to digital screens and short wavelength blue light can negatively impact ocular health, causing symptoms such as fatigue, stress, neck discomfort, burning feeling in the eyes, redness, reflex watering, changes in intraocular pressure, and advancement of refractive errors.
- When studying to the fullest, pay attention to your head and neck position, use a digital screen, and reduce the rate at which you blink.

Keywords: Blinking rate, digital eye strain, high IOP, dry eye alterations, computer vision syndrome, and vision 20-20-20 exercise

Introduction

Technology is developing continuously and is a major factor in the advancement of our way of life. However, in addition to its scientifically proven and essential properties, over or overuse of it may have a great deal of negative impacts on our lives. We are rapidly upgrading every aspect of our everyday lives, including our jobs and pastimes, yet we still rely heavily on technology. We are currently using digital screens like smartphones, tablets, laptops, and other devices for extended periods of time. We spend over six hours a day in front of a computer at work as professionals, and this has a negative impact on both our overall and ocular health, leading to more and more issues.

Extended periods of unplanned digital screen time may result in negative immunological reactions such as exhaustion, accommodative abnormalities, convergence anomalies, and intense ocular pain, burning, and wetness. When exposed to visible short wavelength intense blue light in excess, the eyes get uncomfortable.

Because of our official duties during office hours, we neglected to blink and instead tried to focus and concentrate on the target items on the computer screen all the time. In addition, insufficient blinking rate exacerbates severe ocular dryness and low lacrimaration, which frequently results in allergy symptoms in a dry, chilly, air-conditioned atmosphere.

In addition to these, other risk factors include squinting, uncorrected refractive errors, ocular gadgets, and others that raise the degree of ocular surface dryness known as "digital eye screen exposure." We will look for ocular symptoms, effects with eye stress, discomfort, and congestions from prolonged exposure in this study through the research paper.

Literature Review

Ugam Uska Onkar et al. found via their research effort throughout the 2021 shutdown period how using bright digital screens with maximal exposure to blue light affects ocular health. It has been shown that mobile users are the patients most affected by digital eye strain. 97% of them have watched social media updates for a maximum of 89.70% of the time, and this percentage rises during the lockdown [2].

Problems were discovered and reported as symptoms of dry eyes, including reflex tears, eye strain, headache, neck discomfort, straggling of the eyes, and high IOP.

Lofty F. ISSA et al. did a study in Saudi Arabia on the effects of mobile and digital screen exposure and its usage.

These days, the usage of smartphones and desktop computers is growing daily in popularity, but fixed or landline phone use is steadily declining. In addition, smartphones equipped with high-speed Internet access may access social media, newsfeeds, education, entertainment, and other services. High-speed mobile networks are also to blame for the unacceptably high frequency radiation they distribute, and since digital gadgets are typically used up close, they all contribute to eye strain and fatigue. In addition to affecting blink rate, prolonged staring and observing can cause severe dry eye syndromes and reflex watering.

Additionally, it was shown that, with a maximum age restriction of 12 to 18 years old and a maximum daily usage of 4-6 hours, females are more hooked than males. Sixty-six percent of the patients with significant ocular dryness, burning sensation, and redness are students. A research and campaign on health awareness might contribute to a decrease in the number of computer users who experience digital eye strain.

The combination of high contrast, prolonged exposure to blue light, and prolonged use of digital screens can also lower blink rate, which may be linked to symptoms of dry eyes and high levels of ocular stress.

Effects of everyday technology use

Given the current state of society, it is nearly hard to completely avoid using a digital screen in everyday life since we are growing reliant on them, particularly with regard to products that use artificial intelligence. Constantly using a digital screen for more than six to seven hours a day might lead to major issues that will affect the topic at hand. It won't result in abrupt vision loss, but it will increase the chance of developing disorders that might lead to blindness.

Daniel Porter's study, which was widely discussed on the American Academy of Ophthalmology website, examined

the impact of blue light on eye health [4].

Ocular difficulties are more frequently caused by harmful blue rays due to their short wavelength and high energy features. Strong, short-wavelength blue light rays from the sun that are typically visible may also be detected at maximum intensity from digital screens. Fluorescent light source, LED screen, etc. It results in age-related macular degeneration, eye fatigue, and other symptoms [4].

Blue lights are described in the research as short wavelength light rays that are also a component of the visible spectrum. The sun is the primary source of blue light, and solar radiation travels to Earth. Low-wavelength solar light has been linked to degeneration and has been linked to overall ocular health in several studies. However, blue light from the sun is also essential for maintaining our biological clock. Blue light lowers the amount of melatonin hormone secreted by humans, which is in charge of preserving sleep cycles. Thus, it disperses all of its rays following daybreak, enabling us to awaken and get on with our daily tasks.

According to natural phenomena, our atmosphere used to be able to block harmful levels of blue light. However, because of excessive pollution, this barrier is no longer in place, and as a result, harmful short wavelength radiation as well as other ultraviolet and violet rays are now reaching our ground level. It has been shown that this can kill our cells and increase the rate of retinal degeneration, thus wearing protective eyewear is essential to preventing this type of exposure [5].

As per natural phenomena we can observed that with moving the clock from noon to afternoon or evening the sunshine and raise sensitivity normally become decrease its brightness to regulate our regular hormonal activities but due to technology availability and excessive use, now we can see that night are like to becoming more brighter than the day time work due to artificial light sources. That affects our regular sleep cycle and cause tiredness. It increases our working hours with reducing rest levels [5].

However, using a laptop or mobile device with a bright screen at night might interfere with your sleep cycle because it prevents your body from producing melatonin naturally. Thus, a gradual reduction in sleep duration may also result in insufficient recovery for our neurological system and ocular physiology. Long-term screen time, particularly at night, may also be a factor in attention deficit disorder.

Extended usage of screens, particularly in kids and teenagers, might cause problems connected to attention deficiency. This is due to the fact that their ocular structures are gradually under strain from their increased effort and decreasing rest time, which may trigger unanticipated seizures and spasms.

Compared to sunshine, digital screens emit significantly less light, thus there is no immediate risk of blindness. On the other hand, extended exposure can progressively and slightly alter.

According to Daniel et al., conditions including dry eyes and slow blinking might interfere with the normal lacrimaration mechanism, which lowers tear production and causes dryness.

Dryness of the ocular surface causes a burning sensation that sets to reflexive tearing. Long-term, consistent screen use can also boost one's ability to focus on nearby things, which may exacerbate these symptoms.

- Discomfort in the eyes
- A burning feeling

- Tears in the eyes
- Reduced eye activity - Excruciating headaches
- Increased intraocular pressure, or IOP
- Back and neck discomfort - Cervical pain

Increased screen time has also been linked to obesity, sleep deprivation, and the advancement of myopia, according to a Canadian research [6].

The central nervous system is subjected to extra stress when there is little sleep or freshness in the evening due to excessive mobile usage, which can drastically cut down on sleeping hours. As a result, this may result in lower-than-expected performance quality [6].

Obesity: Engaging in computer and mobile activities might lessen the desire to go outside, especially for school-age kids who are more inclined to indoor gaming and social media browsing. Obesity may result from this decreased physical activity since the body will store more carbs than use them.

Myopia: Whether for educational or recreational purposes, excessive indoor screen time can hasten the development of myopia for a number of reasons. Reduced dopamine activity or secretion, restricted outside exposure, and extended proximity to work might all be contributing factors. Furthermore, myopia at a distance and accommodation spasms might result from stress and over accommodation. These consequences may eventually cause weariness and a reduction in the effectiveness of accommodation, which may culminate in impairment.

Development: Newborns and babies go through a cyclical process of development after birth, when they gradually pick up motor skills and learn how to interact with their surroundings. They pick up on cues from their parents and environment on how to respond, communicate, and deal with different circumstances. But even pediatric patients are growing more dependent on technology for their growth due to the pervasive usage of mobile devices. A patient's growth and development may be hampered by excessive mobile use, which may result in attention deficit problems.

Dr. Satya Karna, in an article published in July 2023, highlighted the adverse effects of excessive use of laptop, PC, and tablet computer usage, also known as computer vision syndrome. He noted that excessive use and huge time spend constantly with digital screen functioning may induce computer vision syndrome. He mentioned all the complications related that as back pain, stress, ocular dryness, tiredness, lowering vision quality. Long time blue light exposure also hampers sleeping and wake up cycle that may interfere ocular health with central nervous system [7].

In another study published at American Academy of Optometry during July 2015, Barbara L. Horn said about excess technology use and impacts to advice patients to avoid excess technology exposure to life that may interfere daily life and deteriorate quality of health. Complications are mentioned as focusing problems, lowering visual acuity, increasing amount of ocular stress, fatigue, tiredness, strain & burning etc and all are associated to computer vision syndrome. Excess digital screen exposure from very close distance may cause degenerative changes during old age and responsible for aging progression [8].

A research highlighting the effects of technology on ocular

health was released in the UK in June 2022 and can be seen on the SpaMedica page. It made clear that using computers, tablets, and cellphones for extended periods of time raises the possibility of eye problems. Blue light, which is visible light but has a strong dosage at low wavelengths, is very dangerous. While blue light from the sun and other natural sources can improve awareness and sleep-wake cycles, too much of it can have negative health impacts, including age-related degenerative changes [8].

Furthermore, extreme dryness or infections made worse by high pollution levels might lead to pathological alterations. Unexpected low-wavelength radiation from pollution can exacerbate eye conditions by penetrating the eye and disrupting focus, as well as causing aging-related changes. Ozone layers in the sky are depleted by excessive pollution, making it difficult for them to absorb dangerous rays. These short wavelength rays can cause a variety of health problems, including ocular difficulties including eye strain, aging, sleep cycle disruption, and more. Due to extended periods of time spent in front of a computer screen, it has been shown that between 50 and 90 percent of computer users have digital eye strain. Anomalies related to accommodations or limitations may arise with continuous near-work focus and concentration. Notably, myopic advancement is also observed [8].

In a medical research study conducted by Navid Anwar et al. in Lahore in 2020, focusing on the effects of technology overuse among individuals aged 18 to 25 years old, approximately 200 participants were studied over a period of six months. The sample consisted of 50% females. The study revealed that a significant number of participants who used digital screens for approximately 6 to 7 hours continuously experienced myopia. The majority of screen time was dedicated to social networking, suggesting a need to limit such overuse [9].

Furthermore, prolonged use of digital devices can lead to increased glare issues, especially when using small screens on mobile devices, which requires more effort to discern objects from a distance. Factors such as glare, high contrast, screen resolution, excess brightness etc are responsible for ocular complications and digital eye stress [11].

In April 2023, a research conducted by James S. Wolffsohn et al. identified ocular pain and eye strain as factors that may have an adverse effect on one's physical health. According to the study, a startling 97% of people who use computers and smartphones have computer vision syndrome. The main causes of this illness are surface abnormalities linked to decreased blinking during digital screen viewing and surface dryness, which can be made worse by prolonged use in air-conditioned spaces. Refractive errors also worsen quickly as a result of extended close work with digital gadgets [11].

Management & treatment

A study by Ehan Tal, Collis, Brace, Nunn, et al. identified a number of risk factors for computer vision syndrome. Among them are:

Working extremely near to digital screens; being exposed to bright screens; spending a lot of time looking at little items; performing jobs demanding high cognitive function; blinking slowly; and having dry eye syndrome already Prolonged exposure to air conditioning when using digital gadgets; refractive faults that are not addressed

Sleeping problems or abnormalities - Accommodation and vergence abnormalities

The research suggested symptomatic measures, such as taking antipyretics when necessary to treat high fevers, for management and therapy. Additionally, in order to improve the quality of vision, uncorrected refractive defects must be corrected using glasses or contact lenses ^[12].

IT workers or computer users can benefit from 20-20-20 exercise for vergence dysfunction, mild heterophoria caused by it, and visual problems. It may be suggested to use artificial or augmented tears to keep the ocular surface hydrated and less dry.

For patients who use digital displays for extended periods of time on a regular basis, protective glasses such as ARC COAT or blue block coating may be beneficial.

Exercises like the pencil push-up, the accommodating flipper exercise, and the Brock string convergence exercise are beneficial for enhancing the ability to focus at varying distances.

In addition, patient education, follow-up consultations, and eye exams are crucial for safeguarding ocular health from excessive exposure to digital screens. Thirteen Controlling ocular stress depends on one's daily activities and lifestyle, according to a different study on management measures. It was emphasised that protective eyewear is an essential tool for correcting refractive problems. Blue light-blocking lenses and specific anti-refractive coatings are advised to reduce eye strain when using digital screens. Intermittent breaks have been found to be an extremely successful strategy for preventing eye strain and improving concentration. Indirect lighting adjustments were also suggested in order to reduce glare, which is a major cause of eye strain. Limiting screen time was also advised, especially when exposed to direct sunlight ^[13].

A different research emphasized the neurological effects of digital eye strain, which can lead to more stress. Patients should educate themselves on good posture when using laptop displays since bad posture can cause excruciating pain and headaches. Furthermore, conditions like air conditioning, dryness, allergies to cold air, and migraines all increase the stress that comes with working digitally. In order to ensure comfortable computer work, protective eyewear, contact lenses, artificial tears, and vision exercises were shown to be effective ^[14].

Prevention

Following the Vision 2020 guidelines was stressed in a different study on preventative tactics in order to increase concentration and lessen dryness. Burning and tearing sensations are common symptoms of increased dryness and eye strain brought on by prolonged concentration and slow blinking. Every 20 minutes, the rule recommends taking a break from continuous distance work and blinking while focused on a place 20 meters away for at least 20 seconds. By increasing blink rate, this procedure ensures regular tear production and drainage, which is essential for preserving the healthy tear films that hydrate and nourish the cornea, promoting appropriate refraction and nutrition. Furthermore advised are fake tears and glare and blue light-filtering protective eyewear. Moreover, physiotherapy may be helpful in treating neck discomfort that results from ^[15].

According to a research, working on a particular activity for an extended period of time in an environment with illumination that is either too bright or too low might cause

digital eye strain. Stress levels might rise while using an extremely close-up digital screen and without adopting the proper posture. According to the study, the screen should be kept at least arm's length away from the eyes. Enlarging the letter size can help with lengthy work by reducing cognitive strain and improving comfort. It also helps to minimize the effects of environmental variables like pollution and hot air, which can worsen discomfort and cause eye tears. Consequently, it's critical to stay away from these situations. Proper vision exercises should be used to address non-strabismic abnormalities and uncorrected refractive defects ^[16].

Conclusion

Due to our modern lifestyle, technological progress, and professional endeavors, we are depending more and more on digital gadgets to do duties like data management and computations. To handle the demands of work on a daily basis, this dependency necessitates a great deal of accommodating effort, convergence, and appropriate correction. Digital eye strain can result from extended close work with unusual head postures and high levels of brightness during physical activity. To lower the percentage of digital eye stress among computer users, proper patient education and knowledge regarding vision exams, treating refractive problems, and the need of wearing protective eyewear are crucial. Without preventative measures, however, relying exclusively on vision exercises during medication-assisted daytime eye therapy may not be beneficial and may even be less successful in managing digital eye stress levels.

References

1. Optical, R. How digital screens impact eye health. Rochester Optical. 2023 Nov 13. Available from: <https://www.rochesteroptical.com/blog/the-impact-of-digital-devices-on-eye-health/#:~:text=Strain%20on%20the%20Eyes,eye%20discomfort%2C%20and%20blurred%20vision>
2. Usgaonkar U, Shet Parkar SR, Shetty A. Impact of the use of digital devices on eyes during the lockdown period of COVID-19 pandemic. *Indian Journal of Ophthalmology*. 2021 Jul;69(7):1901-1906. doi: 10.4103/ijo.IJO_3500_20. PMID: 34146054; PMCID: PMC8374748.
3. Issa LF, Alqurashi KA, Althomali T, Alzahrani TA, Aljuaid AS, Alharthi TM. Smartphone use and its impact on ocular health among university students in Saudi Arabia. *International Journal of Preventive Medicine*. 2021 Oct 26;12:149. doi: 10.4103/ijpvm.IJPVM_382_19. PMID: 34912525; PMCID: PMC8631113.
4. Admin. The impact of digital devices on eye health and natural solutions. Sanjeevan. 2023 Jul 5. Available from: <https://sanjeevan.in/the-impact-of-digital-devices-on-eye-health-and-natural-solutions/>
5. Digital devices and your eyes. American Academy of Ophthalmology. 2023 Nov 27. Available from: <https://www.aaopt.org/eye-health/tips-prevention/digital-devices-your-eyes>
6. Agl_Jaypee. Digital Eyestrain: The impact of prolonged gadget use on eye health. Jaypee Hospital. 2023 Dec 9. Available from: <https://www.jaypeehealthcare.com/content/digital->

- eyestrain-impact-prolonged-gadget-use-eye-health
7. The 21st Century Child: Increased technology use may lead to future eye health and vision issues. American Optometric Association. Available from: <https://www.aoa.org/about-the-aoa/press-room/press-releases/the-21st-century-child-increased-technology-use-may-lead-to-future-eye-health-and-vision-issues?sso=y>
 8. Fielding G. Technology and the impact it has on our eyes. SpaMedica. 2024 Feb 14. Available from: <https://www.spamedica.co.uk/technology-and-the-impact-it-has-on-our-eyes/>
 9. Ali Qasim MS, et al. Effects of electronic devices on vision in students age group 18-25. *Annals of Medical and Health Sciences Research*. 2021;11:1572-1577. doi: 10.54608/annalsmedical.2021.1
 10. Ranimenon. Prolonged smartphone use can lead to increased eye pressure. Dr. Rani Menon. 2023 Jul 27. Available from: <https://drranimenon.com/prolonged-smartphone-use-can-lead-to-increased-eye-pressure/>
 11. Wolffsohn JS, Lingham G, Downie LE, Huntjens B, Inomata T, Jivraj S, et al. TFOS Lifestyle: Impact of the digital environment on the ocular surface. *The Ocular Surface*. 2023;28:213-252. doi: 10.1016/j.jtos.2023.04.004
 12. Coles-Brennan C, Sulley A, Young G. Management of digital eye strain. *Clinical and Experimental Optometry*. 2019;102(1):18-29. doi: 10.1111/cxo.12798
 13. Eyestrain - Diagnosis and treatment. Mayo Clinic. 2022 Sep 15. Available from: <https://www.mayoclinic.org/diseases-conditions/eyestrain/diagnosis-treatment/drc-20372403>
 14. Admin. Digital Eye Strain - causes, symptoms and treatment. Bynocs. 2023 Nov 8. Available from: <https://www.bynocs.com/digital-eye-strain/>
 15. Rees M. What to know about computer eye strain. *Medical News Today*. 2020 Oct 8. Available from: <https://www.medicalnewstoday.com/articles/computer-eye-strain>
 16. Silver N. 8 tips to prevent eyestrain. Healthline. 2017 Sep 30. Available from: <https://www.healthline.com/health/eye-health/eye-strain>