PREVENTING DIGITAL EYE STRAIN

Time to take a closer look at the all-inclusive digital age and the resulting computer vision syndrome

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The twenty-first century is an era of electronic gadgets. New products are introduced into the market from time to time. The relative time spent on computers and other gadgets has also increased exponentially over the years.

The computer which was invented by Charles Babbage in 1791, has revolutionized our workplace today. Twenty years ago, office work involved a range of activities like typing, filing and writing and each of these activities required a variety of postural behaviour and would pose as a natural 'break' from the previous activity. Today, with computers, most of the work is performed without moving away from the desk and therefore is said to improve quality, production and efficiency.

One can say that almost all jobs today involves computer usage

whether it's a desktop, laptop, tablets or handphone devices with wi-fi connectivity. Affordability of personal computers coupled with Internet capabilities at home has introduced even more users not only adults but also young children. Due to the extensive use of this modern gadget, many studies have been conducted to address the concern of the safety of Video Display Terminals (VDT) on our health.

VDT is a term used for computer display. It is a computer output surface and projecting mechanism that shows text and often graphic images to the user, using either a cathode ray tube (CRT), liquid crystal display (LCD), a light-emitting diode, gas plasma, or other image projection technology. Studies have shown, that both ocular and non-ocular symptoms are the most frequently occurring health problems among VDT users. [1-6]

The common ocular manifestations are eye strain, dryness, irritation, burning sensation, redness, blurred vision, and double vision.

The initial concern with visual display terminals (VDTs) focused on radiation, which included X-rays, optical, radio frequency, very low and extremely low-frequency radiation.[7] Surprisingly, no clear evidence of any negative effects due to radiation on computer users was found in most studies.[8] There were apprehensions of adverse effects on pregnant women, which were found to be incorrect by evidence.[9]

Symptoms relating to rheumatology, orthopedics, psychiatry, and ophthalmology have emerged in the literature. Computer users who spent more than 30 hours per week for more than ten years reported increased frequency of somatic disorders, depression, and obsessions.

The American Optometric Association defined CVS as "The complex of eye and visual problems experienced during or related to computer use. CVS is a repetitive strain disorder that appears to be growing rapidly, with some studies estimating that 90% of the workers using computers experience CVS in some form.

The computer-related vision symptoms have been divided broadly into four main categories namely asthenopia, ocular surface-related, visual symptoms and extraocular anomalies.[10]

Two major categories leading to CVS are inappropriate oculomotor response coupled with dry eye. Physiologically, the changes that take place in our eyes when viewing near objects are miosis (pupillary constriction), accommodation and convergence.

Studies reported a high prevalence of exophoria (the tendency of the eyes to deviate outward) and convergence insufficiency (a disorder that interferes with a person's ability to read, learn, and work at near). Studies have also shown that people below 40 years of age who used VDTs lost more accommodation than those who did not.[12]

Blurred vision at near and difficulty to shift to distant gaze is a common complaint in CVS and was also the most common anomaly reported.[13]

Fortunately, these changes are transient, and workers return to baseline values by the end of the day. Standing up, moving away, and looking away from the computer can help reduce ocular symptoms and also neck, back, and shoulder pain. The aim is to take an interval from work to avoid repetitive stress. In a study involving 291 professional computer users, it was reported that yoga practices reduce visual discomfort, while the group who had no yoga intervention showed an increase in

FOUR MAJOR CATEGORIES OF SYMPTOMS IN COMPUTER VISION SYNDROME

SYMPTOM CATEGORY	SYMPTOMS	POSSIBLE CAUSES
Asthenopic	Eyestrain Tired Eyes Sore Eyes	Binocular Vision Accommodation
Ocular surface-related	Dry Eyes Watery Eyes Irritated Eyes Contact Lens Problems	
Visual	Blurred Vision Slowness Of Focus Change Double Vision Presbyopia	Refractive Error Accommodation Binocular Vision Presbyopic Correction
Extraocular	Neck Pain Back Pain Shoulder Pain	Computer Screen Location

discomfort at the end of two months.[14]

Maintaining a single posture over an extended period can cause muscular problems. Variation in posture while sitting behind the computers can improve these symptoms. Frequent breaks with computer use have been shown to increase comfort and relax the accommodative system. Taking a smaller break for 5-10 min more frequently is better than taking a longer break every 2 or 3 hours. [15,16]

Nick Bilton, a columnist, and reporter for the New York Times, in his book ('I Live in The Future and This Is How It Works') proposed a term '1,2,10' (One to Ten) to describe the commonly used distances for the current electronic forms of written communication. Mobile phones at a distance of one foot (about 30 cm), two feet (about 60 cm) for desktop devices and laptops, and 10 feet (about 3 meters) for the television screens.[17]

Display parameters have a great impact on visual performance. These parameters include character size, structure, and style; and image contrast and stability. The images on VDTs and liquid crystal display (LCD) screens are composed of tiny, bright spots called pixels or horizontal lines called rasters. They collectively form images. These images blur at the edges and lack sharp edges that the printed word has. The larger the number of dots or lines displayed on a monitor to make the picture, the sharper and clearer is the appearance of the image.

The eyes accommodate well to printed texts due to well-defined edges, but they have difficulty in sustaining focus on pixels due to blurred margins. Hence, it relaxes to a point called a resting point of accommodation (RPA), which is normally 67 cm or behind the screen. Then the eyes again try to focus on the pixels thus starting a vicious cycle, keeping the accommodation in a dynamic state. It becomes more visually demanding and even small uncorrected refractive errors become significant in computer users.

Computer use reduces the subject's ability to converge and diverge appropriately.

Often dryness, burning, grittiness or heaviness after an extended session at the computer terminal is attributed as the cause of ocular surface problems. The individual's eyes sometimes even tear excessively in an attempt to restore the chemical balance of ocular surface. Environmental factors like dry air-conditioned interiors, draught from ventilation fans, static buildup, airborne paper and general office dust also has some bearing on the ocular surface symptoms. The blink rate while working on the computer has been reported to be significantly lesser than the normal, normal being 15-18 times per minute which ultimately leads to poor tear film quality. An interesting study documented that the blink rate went down from 22 per min in a relaxed state to 10 per min when reading a book and 7 per min on the VDT in a study on 104 office workers.[18]

ADJUSTMENTS HAVE TO BE MADE WHEN SITTING AT A COMPUTER TABLE AS FOLLOWS:

1. To make sure the monitor is at least one arm distance away.
2. The monitor is slightly downward than the eye level (the top level of the screen is at or below the eye level).
3. Use a proper chair that provides arm, back and neck support.
4. 4. Use the keyboard in such a position that the arms and wrist are in neutral position
5. Adjust the computer settings such as brightness, contrast, sharpness, font size to suit you. Can also use screen filters.

Increased evaporation and decreased blinking during computer use leads to ocular surface changes and thus was believed to result in ocular tiredness.

RECOMMENDATIONS

The recommendation is that spacing between characters and lines should allow one-half character space between words and one character space between lines. Dark characters against a light background display screen are better accepted compared to the opposite. Artificial tears may be useful; preferably preservative free drops or gel based depending on the severity of the dry eye. However, it is also important to seek advice from an ophthalmologist and to undergo a full eye examination before using these drops as there are so many other causes for dry eyes like rheumatoid arthritis, thyroid disease, allergy, drugs like anti-hypertensives, steroids, alcohol intake and much more. Bright illumination from large windows, room lighting, and table lamps can wash out screen character images and cause annoyance by inducing reflection and glare. Use of antiglare filters might help alleviate these symptoms. Another important factor for eye tiredness and dry eye is contact lens use. Contact lens wearers reported dry eye symptoms 12 times more frequently than their normal counterparts and five times more than

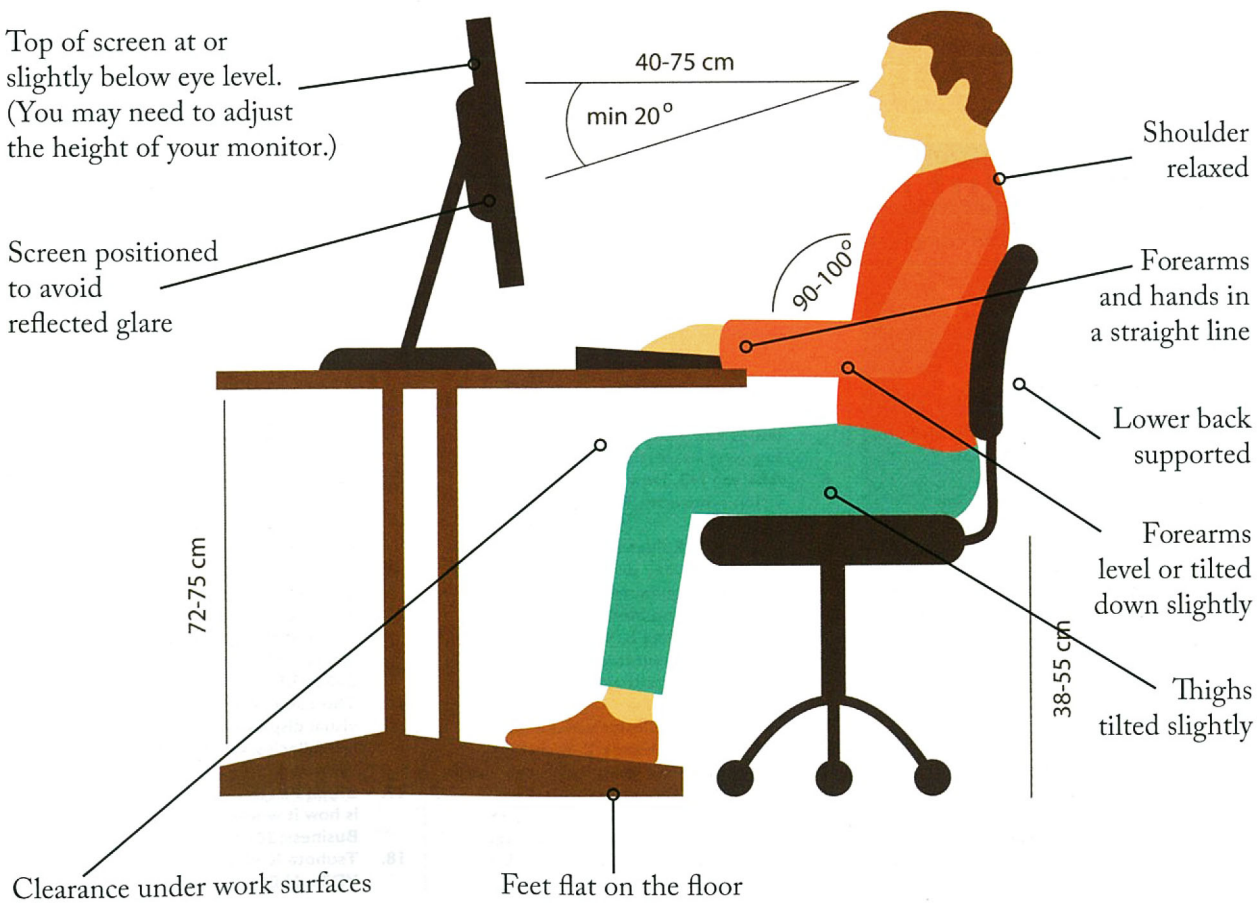
spectacle users which make them more vulnerable to ocular discomfort.

Limiting the computer and screen time is said to have a dramatic impact on symptoms of CVS, and that's where some researchers have recommended the 20/20/20 rule. After working on a computer for 20 min the computer user should gaze into the distance more than 20 feet for at least 20 s which is said to improve work efficiency and prevent eye strain. But hey, any break is good in this case.

Children often do not notice discomfort or other symptoms and hence their computer use should be regulated. In the USA, National Institute of Occupational Safety and Health (NIOSH) suggests that computer users should have a detailed ocular examination at the beginning of taking up the computing job and then repeat it annually. Ergonomic positioning is also important when at a computer desk.

One should avoid computer tables angled leading edges impacting a user's arm or wrist. The contact stress, affects soft tissues, nerves and blood vessels at the wrist and can result in carpal tunnel syndrome. To overcome it, pad the edges of the sharp edged furniture with pipe insulation or other such material. A soft padding at the wrist joint would be useful. Avoid turning the air conditioning too high or direct the air to the face. Individual with glasses, need customization taking into account the working distance. Bifocals or progressives if not properly customized may not be optimal for computer distances. The refocusing from screen to printed material like book or notes and vice versa should avoid by document holders attached to the screen. The concept of working distance is important since laptops

PREVENTIVE MEASURES FOLLOW COMPUTER ERGONOMICS



and mobile devices are held closer to us as compared to desktops.

Another important thing to note is to educate children about how far they should sit from the screens and for how long. Children are special because they tend to adapt to poorer working conditions and overlook somatic complaints.[13] Gaps in our knowledge are large and need addressing to understand the problem.

In the absence of large studies, it is only reasonable to assume that children should spend only as much time as is absolutely necessary before the devices. This discipline will address the epidemic of childhood obesity also. At a later date, we may realize that our fears were ill founded but until the time we have made technology safe for the children we should progress with caution.[13]

CONCLUSION:

Computer vision syndrome is a repetitive stress disorder characterized by a symptom complex of eyestrain, tired eyes, irritation, burning sensations, redness of eyes, dry eyes, blurred, and double vision, foreign body sensation apart from non-ocular complaints like the neck, shoulder, and lower back pain. It is multifactorial in nature. The literature describes several treatments. Treatment needs to be individually tailored. A comprehensive ocular examination and counseling regarding the good practices in computer use can go a long way in preventing loss of productivity and morbidity from the condition. Just like how automobiles have evolved from the twentieth century, making them safer and comfortable for the user, a lot of work needs to be done to make computers safer for its user. Ophthalmologists have a complex task ahead of them to approach the syndrome complex scientifically to educate patients to make best possible use of the digital systems, which are here to stay in a big way. ■

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