

Contact Lens Update

CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Digital eye strain: How should we be dealing with it?

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Our current visual world is unrecognizable from that which existed just 11 years ago. Few could have foreseen the technological revolution that has occurred following the introduction of the iPhone in June 2007. Since its launch, this handheld device has drastically altered the visual demands of our patients. These powerful, hand-held computers are used to get news (ranging from international politics to updates from friends and relatives on the social platforms of their choice), e-mail and text, shop, take photographs, watch videos, pay for purchases, check in for flights, listen to podcasts and occasionally make phone calls.

These devices are commonly held at closer viewing distances than conventional printed materials.^{1,2} Furthermore, they represent just one aspect of the contemporary technological world. The Vision Council of America estimated that 28% of individuals spend 10 or more hours per day viewing digital displays, including desktop, laptop and tablet computers and electronic readers. These may be positioned at distances between 20 and 80cm, and at a wide range of gaze angles.³ The small size of some portable screens may necessitate reduced font sizes, leading to close viewing distances which make high demands upon both ocular accommodation and vergence. But despite this revolution in visual demand, many eye care practitioners are still doing the same near-vision eye examination that they performed 15 to 20 years ago, with the patient viewing a printed card positioned in primary gaze at a distance of 40cm.

Digital eye strain

Digital eye strain, also known as computer vision syndrome (CVS), is the combination of eye and vision problems associated with viewing electronic displays. Digital eye strain has a significant impact on both visual comfort and occupational productivity,^{4,5} since around 40% of adults⁶ and up to 80% of teenagers⁷ experience significant visual symptoms (principally eyestrain, tired and dry eyes), both during and immediately after viewing electronic displays. Gaining an understanding of the physiology underlying digital eye strain is critical for the development of methods to ameliorate this highly prevalent condition. The first line of treatment should always be a comprehensive eye examination, not only to rule out ocular pathology, but also to ensure that the patient's refractive, oculomotor and binocular status is adequate to meet their visual demands. It will be apparent that this cannot be achieved without taking a full history, which must include a determination of the viewing distance(s), gaze angle(s), the type and number of devices being used, the number and position of the monitors, font size, target contrast and the type of tasks being performed. Merely asking the patient "if they use a computer" is clearly inadequate.

Treatment options

Potential treatment options include:

- altering working conditions,
- prescribing an appropriate refractive correction for the working distance being used,
- improving the accommodation and/or vergence responses,
- the use of filters, and
- achieving an optimal anterior ocular surface.

With regard to the task environment, the eye care practitioner should discuss factors such as:

- optimal ambient lighting so as to minimize glare and reflections from the screen,
- avoiding excessively close viewing distances, and
- emphasizing the need to take regular breaks.

The 20:20:20 rule⁸ (i.e., viewing a target at least 20 feet away for at least 20 seconds every 20 minutes) provides a valuable and easily memorized guideline.

With regard to providing the optimum refractive correction at both intermediate and near distances, it may be necessary to correct smaller errors (including astigmatism) than might be customary for printed materials. For example, just 0.50 to 1.00D of uncorrected astigmatism may produce a significant increase in symptoms.⁹ This may be relevant when considering a low astigmatic patient fitted with spherical contact lenses or a presbyopic individual wearing over-the-counter spherical reading glasses. Indeed, a presbyope may need multiple pairs of glasses to meet all of their visual demands.

The use of filters for the treatment of digital eye strain, particularly blue-blocking filters, is controversial, since there is very limited evidence to support the proposal that digital eye strain results from the blue light emitted by these devices.^{10,11} Indeed, a recent investigation from our laboratory found that a filter which eliminated 99% of the blue light emitted from a tablet computer was no more effective at reducing symptoms of digital eye strain than an equiluminant neutral density filter.¹² Clearly, further research is required before the use of these filters can be justified.

Digital eye strain and dry eye

Dry eye is commonly associated with digital eye strain. This may be environmental in origin, since computers are often located in excessively dry office environments, where the use of forced air heating or air conditioning may exacerbate evaporation of the tear layer. In addition, viewing digital screens has been shown to alter the pattern of blinks.^{13,14} While the older literature reported that computer use produced a reduction in the mean blink rate, this change is more likely to be related to the cognitive demands of the task being performed, rather than as a result of viewing a digital screen.¹⁵ However, viewing electronic screens does produce a significant increase in the number of incomplete blinks, i.e., where the upper eyelid fails to cover the entire cornea. This is likely to produce drying of the inferior corneal surface. Given the already high prevalence of dry eye, especially in females, contact lens wearers and older patients, any reduction in blink amplitude is likely to exacerbate existing symptoms.

Summary and conclusion

In summary, the use of desktop, laptop and tablet computers, smartphones and electronic reading devices has become ubiquitous.¹⁶ Back in 2011, the United States Department of Commerce reported that 96% of working

Americans used the Internet as an integral part of their work,¹⁷ and it is likely that this percentage has increased since the time of publication. Almost all patients today, irrespective of age, spend large amounts of time every day viewing digital screens. For example, a recent survey found that an “average user” touched their phone 2617 times per day (equivalent to once every 22 seconds over a 16 hour period) while a “heavy user” touched their phone 5427 times per day (equivalent to once every 11 seconds over a 16-hour interval).¹⁸ Accordingly, the time spent viewing both intermediate and near targets has increased dramatically when compared with the visual demands encountered when we only viewed hard copy, printed materials. Given this remarkable increase in near work, it is not surprising that the prevalence of symptoms has also risen sharply. As practitioners, we are now faced with the task of helping patients to meet these demands. Indeed, looking to the future, the use of even more complex technologies, such as spectacle- or head-mounted displays, smart watches and virtual reality displays will create even more complex visual environments. An inability to meet these ever-increasing visual requirements could present significant lifestyle difficulties for patients, resulting in marked dissatisfaction.

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