

Computer Vision Syndrome

Kendall Wills Sterling, ELS

Eye and vision problems are the most frequently reported health-related problem in computer workers, occurring in 70% to 75% of such workers¹; these eye and vision problems related to computer use have been termed *computer vision syndrome*.² The most common symptoms are eye strain, headache, blurred vision, and neck or shoulder pain, which generally increase in severity with the amount of VDT use.

Working at a computer is more visually demanding than reading printed documents. Such work requires frequent saccadic eye movements (ocular motility) and imposes continuous focusing (accommodation) and alignment (vergence) demands, all of which involve repetitious muscular activity. As with musculoskeletal disorders resulting from repetitive motion, computer users experience problems when the visual demands of the task exceed their ability to comfortably perform that task. (AOA, computer vision doc.)

Certain aspects of the computer video display, such as screen resolution and contrast, image refresh rate and flicker, and screen glare, along with working distances and angles that are different from those used for viewing a printed document, can also contribute to eye symptoms. Typically, vision difficulties are related to repetitive activity (eg, frequent eye movements from work documents to the computer screen, or from the screen to the keyboard and back again) or to disorders of muscles, tendons, bones, or nerves (eg, problems related to neuromuscular control mechanisms). Problems may also occur or be aggravated when some aspect of the eyes or visual system is repeatedly stressed, causing the vision system to break down, similar to the breakdown seen in muscles and tendons that are overused. These problems may be exacerbated or may occur more quickly in users who are more than 40 years old, as the flexibility of the lens within the eye decreases with age.¹

Work that is both visually and physically fatiguing can result in lowered productivity, increased error rate, and reduced job satisfaction.² Although vision disorders may initially occur as localized fatigue and subside after work has been discontinued, they often return when work is resumed. Unlike in other forms of localized fatigue, in which the muscles are able to accommodate, the visual system has less ability to adapt to the conditions that cause the fatigue.² As a result, some vision problems become more significant over time and may be further aggravated by poor VDT design or workplace ergonomics, improper workplace lighting, and uncorrected or undercorrected vision conditions (eg, farsightedness or astigmatism). Steps should be taken to correct these deficiencies and thereby reduce the potential for development of stress and related ocular discomfort in the workplace.

REDUCING OCULAR DISCOMFORT IN THE WORKPLACE

General Ergonomic Considerations

As mentioned in a previous article (see "Prevention of Repetitive Stress Disorder," *The BELS Letter*, [insert issue no.]), monitors should be positioned 20 to 28 inches from the eyes, with the eyes in a downward gaze of about 15 degrees when viewing the screen. The top of the screen should be below the horizontal eye level of the operator and tilted backward slightly²; users who wear bifocals should lower the monitor by 6 inches.³ Desktop reading material should be positioned at a 20-degree incline approximately 20 inches away from the eyes (the "20/20 rule").

Document holders should be positioned near the computer screen and in the same plane as the screen to avoid eye strain; they should also be frequently alternated between the left and right sides of the screen. Users should rest their eyes frequently by changing their focus from close to distance vision, and should keep both their eyeglasses and the VDT screen clean.

Lighting

Light reflected from the computer screen can reduce contrast and visibility of the display, leading to eye strain. Bright lights in the peripheral field of view, windows, overhead fluorescent lights, and desk lamps can all contribute to glare. A compromise must be struck between the amount of light needed to enhance computer screen visibility and reduce glare, and that needed for other office reading and work tasks. Generally speaking, older individuals require more light than younger individuals; for example, workers 50 years of age require twice the light levels of young adults for comfortable work.²

The brightness of the computer screen and that of the surrounding room should be balanced. Lower levels of light are needed for dim-background screens, and higher levels when viewing documents. Lighting levels of 200 to 700 lux (20 to 70 foot candles), as measured at the workstation, are recommended.² Additional lighting for reading poor-quality documents may be obtained through the use of a task light.

The monitor should be positioned at a 90-degree angle to strong light sources such as windows or bright lights. Computer users should avoid facing an unshaded window, as the difference in brightness between the monitor screen and the area behind it may be very stressful to the eyes. Users should also not face away from the window, as they can then cast shadows on the computer screen. Shades, curtains, or blinds can be used to adjust light levels during the day. Screen brightness and contrast can also be adjusted to balance with room lighting and provide maximum visibility; lowering screen brightness will enhance image stability and reduce character flicker.²

Anti-glare filters can be placed over the VDT screen to reduce glare and reflections, but these should be considered supplemental and are not a substitute for proper lighting and monitor placement. Furthermore, some filters are ineffective; only

those with the seal of acceptance from the AOA have been proven to reduce monitor glare.^{2,4}

The ideal color combination for viewing documents is a white background with black letters. Users should avoid using more than four colors on the screen at a time. Strain-producing color combinations include blue and green, and blue and red.

Correction of Existing Vision Deficits

Although VDTs emit radiation, the levels emitted have been found to be well within safe limits and are often unmeasurable.^{2,5} The American Optometric Association considers it unlikely that the use of VDTs causes permanent changes or organic damage to the eyes or visual system.^{2,5}

Despite these conclusions, a high percentage of computer users have been found to have uncorrected or undercorrected vision problems (eg, farsightedness or astigmatism).⁵⁻⁷ Often these deficits were present prior to beginning VDT work, but the demands imposed on the visual system did not exceed the system's ability to accommodate. After the individual begins VDT work, however, these un- or undercorrected problems can become major contributing factors in the development of eye strain. For this reason, all VDT operators should undergo an eye examination prior to or soon after beginning VDT work and periodically thereafter.²

If you think you are experiencing eye strain and have done all you can to enhance your work environment, see your eye doctor for an examination and talk to him or her about prescription eyeglasses designed specifically for computer users. Standard eye examinations do not simulate computer screens; new technology can enable your eye doctor to prescribe glasses that are designed for the way you read text on a computer screen. Special lens coatings can also reduce glare and maximize visual comfort.² Be sure to take frequent breaks to get your eyes focused off the screen and into the distance to relax the eye muscles. VDT workers who experience problems with eye focusing or eye coordination that cannot be adequately corrected with eyeglasses or contact lenses may require a program of optometric vision therapy designed to treat specific binocular vision dysfunctions.

SUMMARY

Eye and vision problems are the most frequently reported health-related problem in computer workers and can lead to lowered productivity, increased error rate, and reduced job satisfaction.² Steps should be taken to reduce the potential for development of stress and related ocular discomfort in the workplace. Such measures include frequent rest breaks, ergonomic alterations to the workstation, use of proper lighting, and correction of vision deficits.

REFERENCES

1. American Optometric Association. The relationship of computer vision syndrome to musculoskeletal disorders. Online document available at <http://www.aoanet.org/clinicare/environmental-relation.asp>. Accessed January 21, 2002.
2. American Optometric Association. The effects of video display terminal use on eye health and vision. Online document available at <http://www.aoanet.org/clinicare/environmental-effects.asp>. Accessed January 21, 2002.
3. King D. Computer ergonomic lesson. April 18, 2001. Slide presentation available online at http://www.sinc.sunysb.edu/Stu/dking/ergonomic_computer_inservice.ppt. Accessed January 28, 2002.
4. Edson R. Is your computer a hazard to your health? Online document available at <http://www.themedicalnews.com/computerhealth.html>. Accessed January 15, 2002.
5. Rosner M, Belkin M. Video display units and visual function. *Surv Ophthalmol*. 1989;33(6):515–522.
6. Sheedy JE. Vision problems at video display terminals: A survey of optometrists. *J Am Optom Assoc*. 1992;63(10):687–692.
7. Sheedy JE, Parsons SD. The Video Display Terminal Eye Clinic: Clinical report. *Optom Vis Sci*. 1990;67(8):622–626.