# Visual Ergonomics in the Workplace

*by Jeffrey R. Anshel, OD*

ABSTRACT

This article provides information about visual function and its role in workplace productivity. By understanding the connection among comfort, health, and productivity and knowing the many options for effective ergonomic workplace lighting, the occupational health nurse can be sensitive to potential visual stress that can affect all areas of performance. Computer vision syndrome—the eye and vision problems associated with near work experienced during or related to computer use—is defined and solutions to it are discussed.

Vision is the most precious human sense. People are visually directed and depend on their eyesight every waking minute of the day. The way they use their eyes can determine how well they learn, work, and perform throughout their lifetimes. Psychologists estimate that 80% of the information people obtain from their external environment is by means of visual pattern (Manas, 1952), indicating the important role vision plays in daily activities. The way employees use their eyes in daily routines has changed dramatically. More and more tasks are done at close viewing distance and employees work under a variety of workplace conditions. Their visual system must adapt to these changes to function optimally.

Eyes are dependent on light and lighting, one of the most overlooked and underemphasized components of workplaces. Whether work is being done at a computer or in a warehouse, the field of vision must be free of reflections and glare. Lighting is effective in the workplace when it allows the worker to see the details of a given task easily and accurately. Lighting and vision are interdependent and both must be considered when designing a working environment for maximum efficiency.

This article provides information about how lighting can affect workplace well-being, focusing on visual function and its role in workplace productivity. By understanding the connection among comfort, health, and productivity and knowing the many options for effective ergonomic workplace lighting, the occupational health nurse can provide input regarding worker-oriented lighting to ensure that work tasks can be easily and productively accomplished. Nurses can also be sensitive to potential visual stress that can affect all areas of performance.

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## THE EYE AND VISUAL SYSTEM

A complete eye examination is more than just reading letters on a chart 20 feet away. This is simply one test to measure the function of one part of the visual system. The eyeball is just the receiver of light. Visual processing is accomplished in the brain, where visual perception occurs. Eyesight is the process of properly focusing the incoming light to the correct area of the retina, whereas visual perception is the process of taking that information into the brain, making sense of it, and reacting appropriately (Schapero, Cline, & Hofstetter, 1968).

Light travels through the cornea, the anterior chamber, the pupil, the lens, the vitreous body, and then to the retina, where the light energy is transformed into nerve impulses. It travels out of the eye via the optic nerve, a mass of approximately 1 million nerve fibers that extend from the retina to the brain. When the entire process works normally, the visual state is known as emmetropia. If the light comes to focus too soon (before striking the retina), this is called myopia or nearsightedness. If the light strikes the retina before it has come to a focus, this is called hyperopia or farsightedness. If any distortion in the shape of the cornea or other optical structures is present, astigmatism can occur. This is common and of-

ten requires an optical correction to compensate for the distortion.

A discussion of the fundamentals of binocular vision, with emphasis on the computer-viewing environment, should be included. The process of coordination between binocular vision (using striated muscles) and the accommodative or focusing system (using smooth muscles) is unique, occurring only in the visual system. Studies have found that convergence, where the eyes turn in toward each other as an object moves closer, plays a significant role in vision stress (Jaschinski-Kruza, 1988). The eyes turn down, as well as in, when viewing a close object. This results in a normal near viewing posture, duplicated optimally with book reading. The viewing of a near object at a raised or at eye level, as is often the case in computer environments, is awkward and unnatural.

The history of visual demands puts current viewing conditions in perspective. When homo sapiens first appeared, approximately 40,000 years ago, they were hunters and gatherers, limiting time to survival. These individuals predominately engaged in hunting, making weapons, and cooking. Currently, humans live longer and lead more active lives, so the effects of aging on the eye must be addressed. In 1900, the average life expectancy of a U.S. male was 47 years. Now, just more than 100 years later, it is approximately 76 years (Centers for Disease Control and Prevention, 2002). Humans have effectively outlived many of the useful functions of their eyes. The Bureau of Labor Statistics predicts that by 2012, approximately 20% of the labor force will be 55 or older (Toossi, 2004). Aging in the workplace needs to be addressed, especially regarding vision.

## COMPUTER VISION SYNDROME

Computer use has increased significantly in the past 20 years. The first computer, occupying an entire room, was developed around 1950. Computers are now as commonplace as telephones in workplaces. Currently, more than 175 million Americans use computers regularly in the workplace, and the growth of the Internet has ingrained computer use as a way of life.

Symptoms of physical problems are increasing among computer users. The eye care community has also seen an increase in the number of clients requesting eye examinations due to symptoms they experience at the computer. This has led to the American Optometric Association (AOA) diagnosis of computer vision syndrome.

According to the AOA, computer vision syndrome consists of the eye and vision problems associated with near work experienced during or related to computer use. The symptoms that most often accompany this condition are eyestrain, headache, blurred distance or near vision, dry or red eyes, neck ache or backache, double vision, and light sensitivity. The factors that most often contribute to computer vision syndrome are a combination of improper workplace conditions, poor work habits, and existing refractive errors. Lighting, vision, and posture are interrelated concepts. Workers are visually directed and will alter their posture to alleviate stress on the eyes. Therefore, alterations in body posture may be indicative of a visually stressful situation. Some of the symptoms of computer vision syndrome actually involve the head, neck, and shoulders.

### Common Workplace Lighting Problems Among Computer Users

Display is placed on a desk in front of a window.

Windows should be off to the side, not in front of or behind the employee.

Image of overhead ceiling light is visible on screen.

Use a parabolic louver to direct the ceiling light straight down, or cover the screen with an anti-glare filter.

Task light is used but shines into the employee's eyes.

Proper task lighting is directional and should be directed to the hard copy, being careful not to spill onto the display screen or into the employee's eyes.

Employee uses a new liquid crystal display flat panel display and gets headaches.

Liquid crystal displays are capable of extreme brightness. Display should be dimmed slightly to match surrounding room illumination.

## WORKPLACE LIGHTING

An important factor that affects workers' ability to see well in the workplace is the quality of light. Quality lighting, created by attention to brightness, contrast, quantity, and color of light, results in visibility and visual comfort. Contrast between a task object and its immediate background must be sufficient to enable the worker to clearly view the task. Contrast ratios should be established to maximize productivity without increasing eyestrain. In general, a 1:3:10 ratio is ideal; that is, the task area should be less than 3 times as bright as its immediate surroundings (within 25° of the visual target) and 10 times brighter than the peripheral area (past 25°) (Illuminating Engineering Society of North America [IESNA], 1988).

Too much or too little light can inhibit the worker's ability to effectively see the task. Comfortable light levels will vary by individual. For example, a 60-year-old worker needs 2 to 3 times as much light as a 20-year-old worker to achieve the same visual performance (K. Toomey, Director of Communications, Lighting Research Center, personal communication, July 14, 2000). Comfortable light levels will also vary by task. The more rapid, repetitive, and lengthy the task, the more important it is to have enough light. With these types of tasks, the eye is more vulnerable to fatigue and the worker to declining productivity (Sidebar).

## Workplace Lighting Evaluation

Use a luminance meter, a general lighting meter, a tape measure, and possibly a camera.

Consider the general room illumination and placement of luminaries in relation to workstations.

Look at monitor position on the desk and sources of glare around the display.

Check lighting on desk and determine whether task lighting might be appropriate.

Talk to employees to determine if any subjective complaints exist.

If possible, include pictures in a report to effectively demonstrate visual stress concerns to management.

Different colors of light create different moods or atmospheres, affecting a worker's sense of well-being and level of productivity. Full spectrum fluorescent lights come closest to nature's light, imitating the color rendition of the noonday sun and adding a sense of well-being to the office environment. Altering lighting sources, or installing a special filter placed between the lens and the lamp of a fixture or fit as a sleeve over each lamp, can achieve this condition (Dutson, Yardley, & LaMotte, 2003). Currently, companies are re-lamping in favor of compact fluorescent bulbs. Although this type of lighting has several advantages, computer use may dictate softer or dimmer light. Again, control of the lighting is the key point.

Lighting for the current workplace is distinctively different from what was acceptable in the past. Most offices were designed to illuminate paper-based tasks, instead of the self-illuminated computer display. The average ambient light levels in most offices are too high, inefficient, and costly. The trend now calls for reduced ambient lighting supplemented by adjustable task lighting. Recommended light levels for current computerized workplaces are closer to 40 to 50 foot-candles for ambient light, as compared with 100 foot-candles or more in previous non-computerized offices (IESNA, 1988). Many offices have no task lighting, yet task lighting systems are advanced, versatile, and available to illuminate work surfaces and tasks without creating veiling reflections or glare on computer screens or work surfaces. Task lighting can create a productive workstation for older employees who need additional light, and for younger employees who prefer a dimmer environment.

Supervisors may inquire about the best colors for computer work. Because computer displays are capable of approximately 16.7 million colors, some workers will vary the color just for the sake of change. However, according to most authorities, the human visual system can see only approximately 350,000 colors, so this concept appears to be more marketing than real science. The actual colors of the letters and background on a display are a secondary consideration in this respect. The contrast between the letters and the background is more significant. The combination offering the maximum contrast is black letters on white background, similar to paper. Pale letters (poor contrast) or very dark backgrounds in a bright environment may exceed the recommended 1:3:10 contrast ratio.

Lighting a workplace for maximum efficiency may be the goal, but in the real world of budgets and bottomlines, cost-effectiveness is also a major consideration. The costs of energy, new lighting fixtures, retrofitting, and remodeling must be balanced to achieve the most return for the money spent. Approximately 86% of the cost of lighting is energy consumption, with only 3% of the cost being the price of the fixture (Busch, 2000). Therefore, purchasing less expensive fixtures does not necessarily translate to cost savings. A more prudent method is to purchase fixtures that consume power more efficiently.

Lighting control is critical. For example, are the light fixtures equipped with standard prismatic or grid-type lenses (parabolic louvers) that project the light out and down in the most efficient manner? The occupational health nurse can create checklists to ensure that all lighting is ergonomically supportive of workers' productivity before they begin work. Helpful reminders and current options should focus on the ultimate goal: achieving worker-oriented lighting, which will ensure that tasks can be comfortably and easily seen so workers are productive and their vision is protected (Sidebar).

Recommendations regarding workplace lighting should be offered, with attention paid to constructive and realistic problem solving. The focus is threefold: (1) learning to observe the types of lighting available to workers and developing ongoing awareness of how this may be contributing to worker productivity; (2) identifying risk factors such as glare and reflections and options for correcting them; and (3) developing solutions that involve worker responsibility, administrative cooperation, and realistic cost-effective improvements.

### GENERAL EYE CARE TIPS

Some practical eye care recommendations regarding computer viewing include the following:

- Regular, routine eye examinations, emphasizing the computer environment and working distances, are important.
- Optical companies are introducing lenses designed for intermediate distance viewing. The newest versions of these are called occupational progressive addition lenses. Eye care professionals can guide employees to lenses most effective for particular viewing situations.
- Many types of anti-glare screens are made for computer monitors. The glass models tend to be the best and most expensive. The AOA offers a list of those screens that have passed qualification standards for effectiveness (www.aoa.org). The circular polarized models are the best type of screen for cathode ray tube (CRT) monitors. Mesh screens should be avoided.

- Eyes must adapt to the viewing environment. A poorly designed workspace can lead to visual fatigue and eyestrain. All items in the work area should be easily seen without excess glare or ineffective lighting.
- Taking visual breaks is easy and effective in reducing eyestrain. The "3-B" approach is recommended: blink, breathe, and break! For breaks, a good rule of thumb is the 20/20/20 rule: every 20 minutes, look 20 feet away for 20 seconds.

Eye health hazards have been touted for many years as a potential concern. Currently, research has not shown a link between computer use and eye health. The electromagnetic radiation from a CRT computer monitor is well below all international standards and recommendations. Actually, the radiation emanating from the sides and rear of the monitor is more of a concern. The newer LCD flat panel displays emit less radiation than the older CRT models (Elliott, Gies, Joyner, & Roy, 1986). Some eye care professionals recommend ultraviolet protection for safety while working at a computer. However, research has failed to confirm that ultraviolet radiation has any effect on the computer user. Most ultraviolet radiation is reduced approximately 4 inches from the front of the screen.

A study in Japan indicated possible excessive computer use among myopic or nearsighted individuals can lead to visual field defects, most often associated with glaucoma (Tatemichi et al., 2004). Although many individuals participated in the study, the sample was mostly male and the number of glaucoma cases related closely to the number that often go undetected in the general population.

Concern has also been raised among contact lens wearers who work at computer stations; however, those concerns can be easily addressed. Blinking is particularly important for contact lens wearers. Studies have shown that individuals blink less while performing visually intensive tasks, and especially while viewing a computer. This is probably due to concentration on the task and the position of the monitor. Most often monitors are higher in the visual field of view, requiring the eyes to be open wider. This is not a natural reading posture and the eyes dry out faster with less blinking, which is more critical for contact lens wearers. The use of lens re-wetting drops is recommended periodically during the day while using a computer. If an eye care professional recommends wearing contact lenses, then lens wear should be fine during computer use. However, if the lenses feel uncomfortable during computer use, an eye care professional should be consulted and a resolution discussed.

The information presented is difficult to obtain for most employee populations. Eye care professionals generally do not have the time, technical knowledge, or inclination to discuss these issues while examining a client in an office setting. Additionally, performing eye examinations in an office setting bears little resemblance to the working environment of the current office employee. A software program that performs vision screenings on users' own computer screens is now available (Anshel, 2007).

Worker productivity is dependent on adequate visual function, and visual function is dependent on appropriate lighting. The two areas are essentially inseparable and critical to workplace performance. Knowledge is still growing in theses areas and many professionals have limited information essential for workplace effectiveness and productivity.

## PROVIDING EYE CARE FOR EMPLOYEES

The visual symptoms that computer workers experience are the most obvious expression of the shortcomings in workplace ergonomics and worker visual characteristics. Because of the high visual demands of computer tasks and the visual shortcomings of many operators, vision problems and symptoms are frequent among computer workers. Most studies indicate that visual symptoms occur in 75% to 90% of computer workers (Dain, McCarthy, & Chan-Ling, 1988; Smith, Cohen, & Stammerjohn, 1981). By comparison, a study released by the National Institute for Occupational Safety and Health showed that only 22% of computer workers have musculoskeletal disorders. A large survey of optometrists (Sheedy & Parsons, 1990) indicated that 10 million primary care eye examinations are conducted annually in the United States primarily because of visual problems related to computer use. The most frequent problems reported in that survey were:

- Eyestrain.
- Headache.
- Blurred vision.
- Dry or irritated eyes.
- Neck ache or backache.
- Photophobia (light sensitivity).
- Double vision.
- After-images.

Workers who require bifocals or reading glasses (nearly everyone older than 40) often have special problems at computers because the optical prescription and spectacle design they wear to meet their everyday visual needs does not work well at the computer. Nurses have observed the awkward position that workers with bifocals adopt to read print above eye level (e.g., a book on a library shelf). These postures also occur at a computer because the screen is located higher in the field of view and farther away from the eyes than common reading tasks for which most bifocals are designed.

Numerous aspects of the computer and the work environment make computer work a more demanding visual task than other tasks. Therefore, more individuals are beyond their threshold for experiencing symptoms. Visual symptoms can largely be resolved with proper management of the environment and provision of proper visual care for the employee. Key aspects of the work environment that should be investigated include (Sheedy, 1992):

- Lighting quantity.
- Screen reflections.
- Glare from windows or overhead lights.
- Higher viewing angle of monitors.
- Dry office environment.

- Poor screen design (contrast or polarity).
- Poor visual arrangement of workstations.

Despite the greater frequency of vision and eye problems, more public and professional attention is usually paid to musculoskeletal disorders such as wrist (e.g., carpal tunnel syndrome), neck, shoulder, and back problems. One reason is that vision problems are primarily symptomatic in nature and have usually resolved by the next day, whereas musculoskeletal problems persist for a longer period. However, the main reason that musculoskeletal problems are given more attention in the corporate world is that they have greater workers' compensation costs associated with them.

## WHY SHOULD EMPLOYERS SOLVE THESE EYE AND VISION PROBLEMS?

Occupational eye and vision problems can largely be resolved through management of the visual environment and provision of proper eye care for employees. Employers should invest resources to resolve these problems because it is good business. Business executives are familiar with investing money in processes or equipment that improve efficiency. Although nurses may typically think of assembly lines and blue-collar workers when talking about work production, they must recognize that workers sitting before computers are a major part of current work production. The blue-collar assembly line worker of the past has become the current computer worker. It is important that business improve the efficiency of the current office worker, just as assembly line processes were streamlined in the past.

## VISION AND WORK EFFICIENCY

Even if humanitarian reasons for providing eye care are eliminated (i.e., focusing on vision and eye discomfort to improve employee well-being), eye care makes economic sense.

Because working at a computer is a visually intensive task, and the sense of vision is used to acquire the information needed for job performance, it is reasonable to expect that improvements in the computer display or in the visual capabilities of the user will improve performance efficiency.

Several studies show that better displays or better vision results in improved efficiency (Black & Boag, 1992; Holleran, 1992; Sheedy, 1992; Sheedy & Bailey, 1994). Many nurses are familiar with older video graphics array (VGA) displays, the most common display format used with disk operating system (DOS)-compatible equipment. These displays have a pixel density on the screen of approximately 75 dots per inch (dpi). It has been shown that increasing the pixel density on the screen from 75 to 115 dpi results in 17.4% faster reading for 30-minute reading sessions (Sheedy, 1992). Likewise, reading speed has been shown to improve 4.1% to 19.9% (depending on display type) by adding gray scale improvement of image quality (Sheedy & McCarthy, 1994). These findings argue for providing better monitors and resulting better vision for workers. If workers with adequate vision (all study participants had at least 20/20 vision) can read faster with a better-quality image, individuals with poorer vision will attain better performance by improving their vision.

A new set of circumstances surrounding visual performance has been manifested with newer liquid crystal display (LCD) monitor technology. The LCD has many advantages, including being lighter and smaller, being easier to position on the desk, using less electricity, generating less electromagnetic radiation, and having a finer pixel formation. However, the increased capability of brightness may be detrimental if not controlled correctly. Additionally, the pixels of the LCD are so crisp and clear that they are viewed more as a dot matrix pattern than as a smooth letter. Studies comparing computing performance on LCD monitors with that on CRT monitors have found LCD monitors to be at least as good, if not better (Ziefle, 1998). However, the performance still does not approach that of paper-based tasks. If an employee is experiencing difficulty with display viewing, simply switching to an LCD display is not necessarily the most effective way to resolve the problem.

Other studies have investigated the effects of different types of visual corrections on occupational task performance (Harris, Sheedy, & Gan, 1992; Sheedy, Harris, Bronge, Joe, & Mook, 1991; Sheedy, Harris, Busby, Chan, & Koga, 1988; Sheedy & Parsons, 1990). For example, instead of individuals older than 40 wearing bifocals, they can be fitted with various types of contact lenses that enable clear sight at distance and near. One example is to fit one eye with a distance prescription and the other with a near prescription, which is known as monovision. Another example is wearing lenses that have both the distance and the near power in each lens. Despite the known visual compromises that occur with these types of visual corrections, these correction modalities can be successful for many employees. Although these vision compromises are "acceptable," it has been shown that they result in 4% to 19% slower performance on occupational tasks. If these acceptable decreases in vision result in 4% to 19% productivity loss, the more common forms of uncorrected vision could be expected to result in greater loss of visual function and even greater productivity losses. A more recent study found that a favorable cost–benefit ratio is at least 2:3 for the visual correction of an employee (Daum et al., 2004). For every $2.00 spent on visual correction, the employee produced $3.00 worth of benefit to the company.

## DOES EYE CARE PAY FOR ITSELF?

Uncorrected vision problems in the work force create worse vision than those situations that showed 4% to 19% decreases in visual task performance. Although based on laboratory studies with tasks performed for durations considerably shorter than a full workday, it is likely that similar inefficiencies occur daily for workers with uncorrected vision disorders. It might even be expected that 8-hour productivity could be greatly reduced because of symptoms and fatigue accompanying vision problems.

If an employee's compensation is $30,000 (including benefits) annually, a 4% improvement in work efficiency

is worth $1,200. Eye care can be provided for considerably less than $1,200 and would likely result in more than a 4% increase in productivity.

## EYE CARE PROGRAMS FOR COMPUTER WORKERS

Many companies already offer vision care for their employees as a benefit of employment. Even if a company offers vision care to all employees, it may not be meeting the needs of its computer employees. Proper care of the computer employee's vision requires more than a simple refraction, dilated examination of the inside of the eyes, and provision of glasses. Also, many computer employees require two pairs of glasses, one for their computer work and another for other daily visual needs. Employees may be reluctant to use employee benefits for a pair of computer glasses; they may feel the benefit should be used to provide personal eyewear.

The backbone of any eye care program is the capability of the eye care professionals who provide program services. For proper computer eye care, it is important that the providers understand the eye and vision problems of computer users and be able to diagnose the underlying condition and implement proper care. The most common diagnosable vision conditions that can result in compromised visual function and symptoms of discomfort are:

- Accommodative (eye focusing) disorders.
- Binocular vision (eye coordination) disorders.
- Hyperopia (farsightedness).
- Astigmatism.
- Dry eyes.
- Contact lens wear.
- Improper multifocal spectacle design.

A successful eye care program for computer workers will use a panel of providers skilled at diagnosing and treating these conditions.

The AOA has issued a list of recommended components of an eye examination for computer operators (www.aoa.org). In addition to those tests commonly part of all eye examinations, the AOA recommends examinations of computer users include a detailed history (symptoms, nature of computer work, position and working distance of the screen and other materials, and other visual characteristics of the work environment such as lighting and reflections), assessment of accommodative (eye focusing) abilities, assessment of ocular coordination, determination of refraction for the required viewing distances at the computer workstation, design of occupational lenses if required, and counseling regarding the visual environment at the workstation. The panel of eye care professionals in a computer eye care program should provide these services in addition to a comprehensive eye examination.

Vision training for accommodative or binocular vision disorders should also be considered in an eye care program. Vision training is the treatment of choice in some situations, especially for convergence insufficiency. Treatment of dry eye should also be part of the eye care program.

## WHO PAYS FOR THE GLASSES?

In the interest of work efficiency, everyone who needs a visual correction should wear one. The best way to ensure this is for the employer to provide eyewear for all computer employees and others with visually demanding jobs. However, many employers feel that employees should be responsible for providing their own general eyewear, and it should be the employer's responsibility only if the glasses are different from general eyewear or if the eyewear would not otherwise be required. This can be accomplished, with cost savings, by establishing a list of diagnostic and treatment conditions (e.g., presbyopia, accommodative disorders, hyperopia, and binocular vision disorders) for which glasses will be provided. For glasses to be provided under the program, panel professionals would arrive at one of the listed diagnoses and determine that needed glasses are different in prescription or design from those required for other daily visual needs.

## OTHER COST CONTROLS

Establishing limitations on the frames and spectacle lenses provided can also control costs. Single vision and occupational lenses are a necessary program option. General progressive addition lenses should not be provided nor even allowed as employee options, as they do not function well for computer workers. Trifocal and specially designed occupational progressive addition lenses can be useful for many computer workers. Although it is desirable to provide these lens options, most users' visual needs can be properly managed with single vision lenses, resulting in cost savings. Tints and coatings offer little in solving the problems of computer users and are not necessary for the program. If only the basic lens options are covered, employees should be able to pay the difference if they want more expensive options.

Another important cost-control element is to provide ergonomic assessment and correction where indicated. It is clear that many of the eye and vision problems computer users experience can be resolved by evaluating and improving the visual work environment. Visual ergonomic evaluation and correction reduce the use of eye care services. It is important to recognize that many workplace evaluations are performed by some in the corporate structure who are not specifically trained to do so (e.g., information technology, human resources, or account managers). Even some ergonomic specialists may not have an adequate background in the visual system to make appropriate recommendations that will effectively reduce visual stress.

Vision screening can reduce overuse by identifying those employees who are most likely to benefit from an eye examination. Professionally managed vision screenings are costly and it is questionable whether the savings in use overcomes the costs of performing the screening. Self-analysis tools (Anshel, 2007) are available and may be more cost-effective as employees screen themselves for vision problems and are also educated about proper use of their eyes and their computer environment.

## IN SUMMARY

# Visual Ergonomics in the Workplace

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1. The human visual system is not inherently designed to be used in a near-viewing posture for extended periods. The most relaxed vision is distance viewing; computer work is a visually stressful task.

2. Workplace lighting also creates visual stress and glare and can disable comfortable viewing situations. Addressing lighting issues in the office can prove beneficial for most viewing tasks. Lighting control is the most important modification that can be offered to resolve visual stress.

3. Humans are living longer and their eyes are aging. Lighting becomes more critical as employees age. Focusing ability decreases with age, so adjustments must be made in near-point viewing.

4. Providing vision care for computer employees makes economic sense. Vision programs increase work efficiency and employee comfort.

## SUMMARY

Providing vision care for computer employees makes economic sense. Vision programs result in increased work efficiency and more comfortable employees. It is a win–win proposition for employers to provide eye care for computer workers.

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# Visual Ergonomics in the Workplace

This issue of the AAOHN JOURNAL contains a Continuing Nursing Education Module on "Visual Ergonomics in the Workplace." 1.1 contact hours of continuing nursing education credit will be awarded by AAOHN upon successful completion of the posttest and evaluation.

A certificate will be awarded and the scored test will be returned when the following requirements are met by the participant: (1) The completed answer sheet is received at AAOHN on or before September 30, 2008; (2) A score of 70% (7 correct answers) is achieved by the participant; (3) The answer sheet is accompanied by a $10.00 online or $15.00 processing fee. Expect up to 6 weeks for delivery of the certificate.

Upon completion of this lesson, the occupational health nurse will be able to:

1. Discuss the visual system and computer vision syndrome.

2. Identify workplace lighting factors that affect computer users.

3. Describe general eye care tips.

4. List the components of an eye care program for computer workers.

AAOHN is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

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Contact hour credits received for successful completion of the posttest and evaluation may be used for relicensure, certification, or re-certification.

*Directions:* Circle the letter of the best answer on the answer sheet provided. (Note: You may submit a photocopy for processing.)

**1. It is estimated that ____ of the information people obtain from their external environment is by means of visual pattern (Manas, 1952).**
A. 50%.
B. 60%.
C. 70%.
D. 80%.

**2. Visual perception occurs in the:**
A. Cornea.
B. Brain.
C. Retina.
D. Pupil.

**3. According to the American Optometric Association, computer vision syndrome is accompanied by all of the following except:**
A. Headache.
B. Blurred vision.
C. Strabismus.
D. Dry or irritated eyes.

**4. The ideal contrast ratio to maximize productivity without increasing eyestrain of computer workers is:**
A. 1:3:10.
B. 1:2:9.
C. 1:4:6.
D. 1:5:2.

**5. The occupational health nurse recommends this ambient light level for current computerized workplaces:**
A. 40 to 50 foot-candles.
B. 60 to 70 foot-candles.
C. 70 to 80 foot-candles.
D. 90 to 100 foot-candles.

**6. The computer display combination providing the maximum contrast between letters and background is:**
A. Blue letters, white background.
B. White letters, black background.
C. Black letters, white background.
D. White letters, blue background.

**7. An employee is afraid of the effect of ultraviolet radiation during computer use. The occupational health nurse advises that most ultraviolet radiation is reduced approximately ___ inches from the screen.**
A. 3.
B. 4.
C. 5.
D. 6.

**8. The occupational health nurse teaches computer users the "3-B" approach to reduce eyestrain. The 3-Bs include all of the following except:**
A. Break.
B. Blink.
C. Breathe.
D. Blur.

**9. All of the following are common vision and eye conditions causing symptoms at computers except:**
A. Accommodation disorders.
B. Binocular vision disorders.
C. Myopia.
D. Astigmatism.

**10. The occupational health nurse recommends which of the following lenses for inclusion in an eye care program for computer workers?**
A. General progressive addition.
B. Trifocal.
C. Tinted.
D. Coated.

# Visual Ergonomics in the Workplace
# October 2007

(Goal: To gain ideas and strategies to enhance personal and professional growth in occupational health nursing.)

**Mark one answer only!**
**(You may submit a photocopy of the answer sheet for processing.)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | A | B | C | D | **6.** | A | B | C | D |
| **2.** | A | B | C | D | **7.** | A | B | C | D |
| **3.** | A | B | C | D | **8.** | A | B | C | D |
| **4.** | A | B | C | D | **9.** | A | B | C | D |
| **5.** | A | B | C | D | **10.** | A | B | C | D |

## *EVALUATION (must be completed to obtain credit)*

Please use the scale below to evaluate this continuing education module.

| | 4 - To a great extent | 3 - To some extent | 2 - To little extent | 1 - To no extent |
|---|---|---|---|---|
| 1. As a result of completing this module, I am able to: | | | | |
| A. Discuss the visual system and computer vision syndrome. | 4 | 3 | 2 | 1 |
| B. Identify workplace lighting factors that affect computer users. | 4 | 3 | 2 | 1 |
| C. Describe general eye care tips. | 4 | 3 | 2 | 1 |
| D. List the components of an eye care program for computer workers. | 4 | 3 | 2 | 1 |
| 2. The objectives were relevant to the overall goal of this independent study module. | 4 | 3 | 2 | 1 |
| 3. The teaching/learning resources were effective for the content. | 4 | 3 | 2 | 1 |
| 4. How much time (in minutes) was required to read this module and take the test? | 60 | 70 | 80 | 90 |

*Please print or type: (this information will be used to prepare your certificate of completion for the module).*
*DEADLINE: SEPTEMBER 30, 2008. Allow up to 4 weeks for processing.*

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