THE ERGONOMIC ASPECT OF THE PREVENTION OF THE DISEASES RELATED TO THE WORK OF COMPUTER OPERATORS

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Abstract. *Workers who operate computers tend to hold their bodies in a fixed position for extended periods in order to maintain a consistent physical relationship with the equipment. For example, typists must maintain a fixed spatial relationship between their shoulders and the keyboard in order to strike the proper key each time without looking. In addition to maintaining a fixed shoulder position, they often maintain a rigid neck position necessary for looking for long periods at the copyholder or the computer monitor. Computer operators often complain of fatigue in the neck, upper back, shoulders, arms or wrists, especially when they use the computer for long hours. They also experience visual problems from long-term viewing of the computer monitor. The appropriate set-up and use of the computer workstation can help reduce these aches and pains. A successful ergonomics program should simultaneously improve health and enhance productivity. Exercises designed specifically to relieve physical stress and strain and conducted at the workstation may be helpful in reducing musculoskeletal discomfort.*

Key words: *Computer operators, ergonomics, prevention, occupational disease*

INTRODUCTION

Workers engaged in work with computers frequently complain of fatigue, they experience pain in the neck area, the upper spine region, shoulders, arms or wrists, especially when they use computers for a longer period of time. Also, they complain of vision problems due to looking at a PC monitor for a long while. A specialist in the field of occupational medicine has to take such discomforts seriously as they appear in workers who work with computers after a longer period, as diseases related to working with computers may occur. Adequate measures of prevention can be helpful in reducing the discomforts related to the occurrence of the manifesting form of a disease.

According to the definition of the World Health Organization Expert Committee, diseases related to work represent a broad spectrum of diseases, which are in a way, not always causally, associated with the profession or working conditions, and the etiology of these diseases is always multicausal. Their socio-medical significance results from the fact that they frequently occur in the working and general population, they are associated with a huge influence on health and the working ability of an individual and affect his family, firm and community in general. Out of that broad spectrum of diseases related to work, the World Health Organization (WHO) in its definition emphasizes the behavioral disorders and psychosomatic diseases, hypertension, ischemic heart disease, chronic respiratory tract diseases and locomotor disorders for their great socio-medical importance. The following risk factors are set aside as prevailing for the occurrence of these diseases: negative psychosocial factors at work, defects in ergonomic solutions for work tools, mental overload and numerous harmful conditions of the working environment. Individual sensitivity related to family factors as well as individual characteristics regarding health and habits play a significant role in the occurrence of these diseases. Static body position in workers using computers, i.e. the tendency to stay in a stiff position for a long time in order to maintain constant physical relation with computer equipment, presents a health risk for involved workers. For example, a worker who works with computers has to achieve a space relation between his shoulders and keyboard in order to press the right key every time, without looking, which brings about a stiff neck position, also unavoidable in looking at the monitor or reading the text that is to be entered. Considering this, apart from other measures, first and foremost, preventive health care measures, adequate ergonomic solutions are both necessary and of huge importance in positioning and using computer equipment.

SETING UP AND USING A COMPUTER WORKSTATION

Adjust the Chair First

The first step in adjusting a computer workstation is to adjust the seating. The seat height should be adjusted low enough so that the operator is on the floor but not so low that the operator′s weight is not evenly distributed over the seat. A large and solid footrest should be used only when the attempts to adjust the chair and workstation fail. The arm supports should comfortably support the forearms and remove the load from the neck and shoulders. Some computer operators prefer to switch from sitting to standing during the day to promote posture changes; these operators will require workstations that adjust to a wide range of heights. Employees with lower back problems will often benefit from the ability to alternate between sitting and standing.

Position Monitor and Documents

The monitor will usually be placed directly in front of the operator, with the display screen below eye level approximately an arm's length away. This works well for data acquisition, editing, and programming tasks in which the monitor is the primary source of information. The monitor should be positioned so that the glare is minimized.

For word processing and data entry, in which the monitor may not be the primary source of information, the workplace layout will vary. Operators of word processors may require primary visual access to a hard copy, and data entry clerks may look almost exclusively at the original data records they are recording. In this kind of situation, it is the copy stand or the pile of data records that should be in front of the operator, and the monitor should then be positioned to one side or the other. The continual looking to one side to view the copy may result in muscle stress and pain in the neck and upper back.

For word processors, the copy stand should be directly adjacent to the monitor, at about the same height (up to 30 degrees below horizontal) and at the same viewing distance. This will reduce head rotation (side to side and up and down) and eliminate the need for frequent accommodation.

For data entry clerks, manual handling is often required to turn pages, lay aside checks or invoices, etc. In this case, it is necessary to compromise between the optimal handing location and optimal viewing area.

Control of screen glare

Monitors provide their own illumination from the intensity of the cathode ray impinging on the phosphor

used in the display screen. Because of the technical limitations of this illumination, the brightness of the screen is often lower than that of a printed page, and the contrast may be much lower (about 3:1 for the screen compared with 10:1 for the printed page). In addition, the screen's characters consist of a matrix of tiny dots rather than continuous lines, and thus the characters may appear fuzzy to some computer operators.

Screens should refresh themselves at least 72 times every second, so those operators with sensitive vision are not bothered by the flicker.

The light from sources as bright as or brighter than the screen can cause a glare. Not only is this irritating to the eyes, but it also represents "visual noise" that interferes with perception of the information on the screen. The operator must either try to "read though" this glare by focusing behind it or try to ignore it.

There are several ways of reducing glare:

– Change the location of the monitor so that the light source is to the side of or above the operator, not directly behind or in front of the operator.
– Reduce the general illumination in the room to about 500 lux. This can be achieved by reducing the amount of overhead lighting (e.g., removing every other bulb or fluorescent tube); by installing parabolic louvers for the fluorescent lights to direct the illumination straight downward; or by controlling window illumination with shades, lowered blinds, and/or tinted window film.
– Provide more illumination where needed with desk lamps ("task lighting") directed at the appropriate visual target. The goal is to have lighting as uniform as possible with a maximum ratio of 1:3 between the brightness of the computer screen and its immediate surroundings.
– If steps 1 through 3 fail, use glare-reducing filters on computer screens. These filters are available in several designs, although the principle two are coated filters (e.g., polarized filters) and fine black nylon mesh filters. Polarized filters trap light reflections internally but should have treated surfaces to prevent their own reflections. Mesh screens reduce character resolution and tend to gather dust.

Another source of visual irritation is bright lights or unshaded windows. In addition to taking measures to reduce glare, employers should encourage computer operators to look up from the screen from time to allow the ciliary muscles to relax and thus prevent visual fatigue and pain. Computer operators who lean forward to see the screen may need their vision checked or the monitor moved closer.

Position input devices

The keyboard and pointing device (eg, mouse, trackball) should be positioned directly in front of and close to the computer operator to prevent sustained reaching to the front or the side. The input devices should be as low as possible without touching the legs, so that the shoulders are not elevated during use. The slope of the keyboard may have to be adjusted so that the wrists are not held in extension during keying; it may be necessary to tilt the keyboard away from the user by a few degrees to achieve a straight wrist posture. The use of wrist rests is some-what controversial. They can lead to pressure points at the wrist and promote wrist deviation to strike keys. One suggestion is to have operators use the wrist rests only between typing periods, not during typing. A computer operator should avoid resting the wrist or forearm on a sharp edge. Chair armrests whose height and width are adjustable are a better form of arm support than wrist rests.

People who use the computer for long hours and do not know how to touch type should take typing lessons. A good typist does not have to flex the neck forward constantly to see the keys and has learned to relax the fingers and arms during typing. To reduce hand motions during typing, keystroke shortcuts can be used for frequently repeated character sequences.

Alternative keyboard - pointing devices

Most computers have detachable keyboards, which allow more freedom in workplace arrangement, but most have linear keyboard layouts (keys in straight rows) that can cause ulnar deviation of the wrist, which may contribute to the development of tendinitis or carpal tunnel syndrome in long-term keyboard users. Modeled after the typewriter, these keyboards utilize the Schools (QWERTY) layout. A recent proposal to prevent wrist deviation and such problems as carpal tunnel syndrome and tendonitis is to arrange the keyboard in a V shape so that the keys operated by each hand are in rows perpendicular to the long axis of each forearm.

To prevent radial deviation of the right wrist, for clerks who work mostly with numbers, the keyboard should include a 10-key numeric keypad arranged in adding-machine format on the right side of the alpha-betic keys. The keypad may be part of the primary keyboard or may be on a separate keyboard off to the side but directly in front of the numeric shoulder. The keypad saves the clerk from having to reach a single row of numbers on the top row of a standard keyboard.

New keyboard designs that split the keyboard in half can reduce wrist ulnar deviation and full forearm pronation. Whether these designs prevent muskuloskeletal problems in the arms and hands is currently unknown. In addition, keyboards vary in the "feel" of their keys, and the "feel" may influence the comfort and productivity of computer operators. As with chairs, it has been suggested that employees evaluate the different keyboards while

performing their usual tasks for at least one week. A systematic evaluation by a group of employees can be used to identify an appropriate set of keyboards for use in the company.

Similar evaluations may be valuable for pointing devices. In some workplaces, such as engineering and graphics jobs, pointing devices are used more than the keyboard. There are a number of different types and styles of pointing devices: mice, trackballs, touch pads, short sticks, joysticks, etc. Devices that are comfortable and efficient to use can be identified by a systematic evaluation by the employees. Many computer users will benefit from using the pointing device with the left hand, or alternating between the right and left hand.

If frequent telephone calls must be placed while using the keyboard, a 10-key telephone keypad should also be included. However, since the adding machine layout differs from the telephone layout, the keypad chosen will probably depend on the relative frequency of data entry and telephone calls, operator preference, and other factors.

Task variation- the role of exercises

Designing alternative tasks that can be performed every 20-60 minutes of computer use can help break up static postures. These can be short tasks (eg, retrieving printouts, getting a new hard copy, returning reports, or performing other work), that involve a few minutes of walking or standing. It may be necessary to use a timer or reminder software to remind the operator to get up and out of the chair.

Exercises designed specifically to relieve physical stress and strain and which should be used at the workstation may be helpful in reducing musculoskeletal discomfort. Specific exercises chosen for a given area should be based on removing the static postures and using muscles contrary to those required to do the tasks. General guidelines based on a report by Sauter include the following:

- Exercises should be designed to relieve stress associated with awkard postures, highly repetitive tasks, and sedentary work or static effort.
- Exercises should target musculoskeletal stress in the upper and lower extremities, the shoulder girdle, the neck, and the lumbar and thoracic regions of the back.
- Exercises should be designed to be performed at the workstation. They should not be conspicuous that they call attention to the worker or cause embarrassment, not should they significantly disrupt task performance.
- Exercises should be performed during the times the musculoskeletal stress builds up, so that stress relief is timely and continuing. It is better to have many short exercise breaks than to have a few longer breaks; a scattering of micropauses as short as 90-120 seconds is considered healthy. If exercises are performed only at the beginning of the day or at lunchtime, there can be considerable stress buildup before relief.
- Exercises should not present any obvious biomechanical or safety hazards. In the absence of musculoskeletal disease, there should be no contraindications.

Conclusion

Taking into consideration the growing presence of computers in everyday work, not only in the workplace, where they represent the fundamental working device, but also in the organization of different basic activities, and home conditions as well, realizing possible unfavorable effects of such work on the health of computer users and the measures of prevention are of great importance to the specialists in occupational medicine, but in other fields as well. The ergonomic aspect of prevention is the most significant in this case; however, it is the least thought of when computer equipment is being installed both in the office and in the home. Among other things, the task of the specialist in occupational medicine is to educate both the workers and the employees, and to prevent and reduce consequent interfering conditions of the work-related diseases.

References

1. Rempel M, Janowitz L. Ergonomics & the Prevention of Occupational Injuries. In: Joseph La Dou: Occupational and Environmental Medicine. Stampford, 1997:41-63.
2. Keyserling W. Occupational Ergonomics promoting Safety and Health Through Work Design. In: Barry S. Levy, David H (Ed):Occupational Health. Philadelphia, 2000:195-209.
3. Cohen AL, Gjessing CC, Fine LJ, Bernard BP. Elements of ergonomics program: a primer based on workplace evaluations of musculoskeletal disorders. NIOSH publication no.97-117. Cincinnati, OH: National Institute for Occupational Safety and Health, 1997.
4. Maizlish N, Rudolph L, Dervin K, Sankaranarayan M: Surveillance and prevention of work-related carpal tunnel syndrome: An application of the sential events notification system for occupational risk. Am J Ind Med 2001;27(5):715.
5. Silverstein BA, Fine LJ, Amstrong Tj. Occupational factors and carpal tunnel szndrome. Am J Ind Med !999;11:343-358.

ERGONOMSKI ASPEKT PREVENCIJE BOLESTI U VEZI SA RADOM KOD RADA ZA KOMPJUTEROM

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Radnici koji rade za kompjuterom imaju sklonost da duži vremenski period svoje telo drže u prinudnom položaju kako bi održali stalni fizički odnos sa opremom. Na primer, radnik mora da zadrži prostorni odnos između svojih ramena i tastature kako bi svaki put upotrebio pravu dirku, bez gledanja. Zbog nefiziološkog položaja ramena, veoma često oni moraju da drže i vrat u prinudnom položaju što je posledica stalnog gledanja u tekst koji se kuca ili u monitor kompjutera. Ovi radnici često navode da osećaju umor i bolove u predelu vrata, gornjeg dela kičme, ramena, ruku ili zglobova, naročito kada kompjuter koriste duži vremenski period. Takođe navode da imaju problema sa vidom zbog dugog gledanja u monitor kompjutera. Uspešan ergonomski program bi trebalo da bude usmeren na poboljšanju zdravlja radnika i povećanju produktivnosti rada. Vežbe koje su osmišljene isključivo za opuštanje od fizičkog stresa i napetosti i koje se mogu primenjivati na radnom mestu, takođe mogu biti veoma korisne za umanjenje neudobnosti pojedinih položaja mišića i zglobova.

Ključne reči: *kompjuter, ergonomija, prevencija, profesionalne bolesti*