Reducing Musculoskeletal Disorders From the Use of Computer Workstations – An Employer or Therapist Guide

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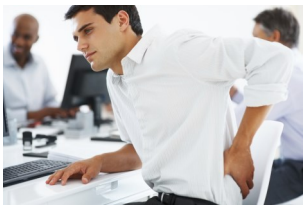
A variety of ill health symptoms have been associated with working with display screen equipment, including musculoskeletal disorders, mental stress and visual fatigue. A survey conducted by the United Kingdom health and safety executive, for example, found a high prevalence of headaches (52%), eye discomfort (58%), neck pain (47%), and shoulder pain (39%) in workers surveyed.

Explanation of musculoskeletal disorders from display screen work



It is important to realise that the risks are multifactorial, existing on a continuum ranging from work aggravating but not causing the underlying disorder, to the disorder actually being caused at work. To the employer it is immaterial because the first issue is to prevent symptoms from occurring at work.

One possible explanation is that the static nature of computer work, rather than any specific deficiency in the workplace, is a main contributor. Muscular fatigue while attempting to maintain a static posture is significant, and can result in pain from muscle or joint overload and compensatory poor posture. While some discomfort will tend to be more marked in adverse postures, even conventionally good postures will involve some muscle loading and unless loading is very low levels fatigue-related symptoms can occur.

Sitting posture, for example, poses a number of problems, as when one is sitting the lumbar region of the back flexes and may increase disc pressure by around 40%. Head position also changes with flexed (slumped) sitting and this increases neck stress and muscle activity, leading to a variety of disorders including headache, neck pain and thoracic pain.

Another explanation lies in the repetitive nature of the work, which puts musculoskeletal structures at risk through micro-trauma.

Common Disorders and their Risk Factors

Carpal Tunnel Syndrome

Carpal tunnel syndrome refers to a disorder where the median nerve is compressed in the carpal tunnel of the wrist. It causes pain in the hand with possible radiation into the forearm, pins and needles in the thumb and 2nd to 4th fingers and often worsens at night.

Occupational risk factors include wrist extension, wrist deviation, and abnormal mouse position (more than 40cm to the right of the shoulder or from the desk edge is a possible risk factor if it alters wrist position).

Neck and Shoulder Pain

Sitting can increase stress through the cervical spine (neck) and associated muscles. This can cause pain from a variety of structures including the cervical joints, discs, ligaments and muscles.

Occupational risk factors include observed head rotation away from the midline, keyboard height above elbow height, lack of rest breaks, inadequate computer

table size, keyboard less than 15 cm from the edge of the table, lack of forearm support, increased glare and reflections, and poor screen position.

Low Back Pain

Sitting can increase stress through the lumbar spine (low back) and associated muscles. This can cause pain from a variety of structures including the lumbar joints, ligaments, discs and muscles.

The primary risk factors for low back pain in sitting are related to poor seating or habits that result in the lumbar spine being flexed or slumped. There is some evidence that sitting with whole body vibration adds to the risks of injury, and any heavy manual handling after sitting for a prolonged period may have an increased risk associated with it.

All risks increase with longer exposure to this environment and with fewer reported breaks. All symptoms were increased among respondents who had indications of stress, anxiety and/or depression.

Optimal Workstation Design

Ergonomic workplace design aims to improve work performance through minimising the physical strain and workload of the working person, facilitating task execution, the optimisation of physical constraints, ensuring occupational health and safety, and achieving ease of use of various workplace elements.

In the ideal world, both sitting and standing workstations should be available. Standing is biomechanically safer to the spine but places stress on the feet, hips, and knees and requires more effort. Sitting requires less effort but increases stress throughout the spine. Time spent between the two postures would represent the biomechanical ideal; however, this is not practical in most workplaces.

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Height Adjustable Swivel Chairs

The chair should be stable and adjustable. The castors should be in good condition and allow for movement and stability. Controls should be logical and easy to find and interpret, easily reached and adjusted from the standard seated work position. Controls should provide immediate feedback. Where arms are used they should not interfere with freedom of movement.

One function of the chair is to support the low back in a slightly lordotic or neutral position. There are 3 complementary ways to achieve this:

- By using a thick lumbar support
- By reclining a backrest and
- By providing a forward tilt the seat.

Considering this, seats should include a backrest that can recline; the backrest should provide lumbar support; and the seat should provide a forward tilt option.

Body Weight Tolerance of Chairs

Chairs are typically constructed to a maximum of 120kg. Persons who weigh more that this may adversely affect the function, safety, durability and adjustability of the chair.

Chairs should be stable and adjustable.

Casters and Gliders

These are required to allow you to move in and out of the chair, however they should be stable. Castors should be in good working order. There should have at least 5 castors for stability.

Base

A larger diameter base provides for greater stability.

A wider base is especially important on chairs that

- Tilt back
- Are positioned at counters or higher workstations

Seat Height

Seat height should be adjusted to support a knee angle of around 90 degrees to prevent leg swelling. The seat height should allow the knees to be slightly below the hips and the feet should rest on the floor or a footrest.

Seat Pan

Seat Depth - recommended is 16.5" for fixed seats and 14-18.5" for adjustable seats. If the seat depth is greater than the buttock-popliteal length (fifth percentile woman is at 17") then the user won't be able to use the backrest.

Seat Pan Contours - Half body weight is supported by an 8% area under the "seat bones" (ischial tuberosities). If the seat is hard and flat the pressures can be 85 -100 p.s.i. Seat contouring and cushioning can be used to distribute pressure over a larger area and rotate the pelvis forward to promote better posture.

Seat Cushioning - The recommended thickness is at 1.5-2". Too much cushioning can cause the body to sink into a chair constraining movement. A soft chair may be comfortable at first, but as the body sinks blood circulation lowers, skin temperature rises in affected areas, and compression under thighs increases. These factors combine to increase discomfort. Cushion Compressibility - An ideal combination is a soft top layer over a firm bottom layer.

Seat Width - around 20 - 22" will accommodate most persons. If seat has armrests then elbow-to-elbow breadth may be more relevant.

Armrests - give additional postural support and aid in standing up and sitting down. Armrests should be padded and engage the fleshy part of the forearm. They should not engage the bony parts of the elbow where the sensitive ulnar nerve is close to the surface, so a gap of approximately 4" between the armrest and seat back is recommended. Cantilevered elbow rests should be 8-10" above the seat surface height. Armrests should be at least 17.2" apart to exceed thigh breadth of 95th percentile females.

You should be able to comfortably support your forearms or elbows on the armrest without bunching up your shoulders or leaning to the side to reach the armrest or slumping. Standard armrests should be at about the same height is the point of debate elbows. Arm support can reduce neck and back fatigue, facilitate body movements when seated and ease back and leg loads when the chair is entered and exited. However, arm support is not always necessary or desirable. Finally,

armrests shouldn't limit chair access if it is to be used at a table.

Backrests

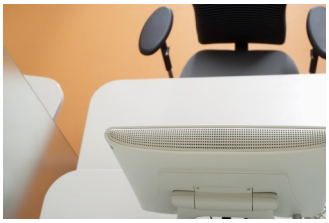
Higher backrests give better trunk weight support. Three categories are commonly described.

Low-level backrest - supports the lumbar region only. Depth of the lumbar curve of the backrest should be 1 – 4 cm. These are necessary when upper body and arm mobility are necessary.

Medium-level backrest - gives full shoulder support (e.g. car seat, office chair) and may need to be about 65 cm high to accommodate the 95th percentile man.

High-level backrest - full support of head and neck (e.g. plane seat) and may need to be about 90 cm for a 95th percentile man.

Backrest lumbar supports should match the spinal curves of the individual both in height and depth.



The seat to backrest angle has an effect on spinal posture. There is a great deal of individual variation in what is optimal here. Tight angles, for example about 115°, will provide more support by encouraging the person to lean into the seat. Large angles will tend to cause the person to slump forward more. If the body needs a tighter thigh to torso angle than the chair allows, people will sit upright and not use the backrest. Those who need a larger angle will slide forward of 5th to achieve this and lose some low back support.

Sitting posture and work surface height

The working surface should be at a height that permits a person to work with shoulders at the relaxed posture. The angle at the elbow should be approximately 90-100°, and wrists should be a straight as possible.

The visual display unit

Recommendations are based on research that a neutral head posture minimises muscle activity and joint stress. The center of the monitor should be at approximately arm-lengths distance. The center of the screen should be placed at an angle of 15° below eye level as the visual system prefers downward gaze angles. The screen should be ideally

- Antiglare
- Moveable
- Adjustable
- Stable

Easy-to-adjust screens on counter-balanced arms work best, if there is sufficient room for them.

A footrest

Should be supplied if needed, particularly for shorter workers.

Lighting

Should be adequate for the task and glare should be minimised from man-made

and natural sources with respectively well-diffused lighting and window coverings. A screen which can be tilted can assist in deflecting glare. Glare from other workstations can be shielded.

The keyboard

Should be easy to use, adjustable, detachable, legible, with a matte surface to reduce glare, and placed to provide support to the hands and arms of the operator. Keyboard should be separate to the screen.

Desk

Should be large enough to allow ergonomic positioning of equipment and logical ordering of tasks. Where possible it should be height adjustable.

Document holders or a second screen

These are recommended to enable the head and eyes to maintain a good position while typing from another document

The Pointer device (mouse or equivalent) and keyboard should be within close reach. Track pads are advised in preference to a mouse and where a mouse is used it should be in a position that allows the wrist to maintain a neutral posture with the elbows flexed

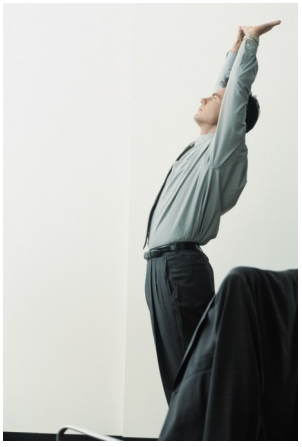
Breaks

Regular breaks are important for display screen equipment users. There is increasing evidence that prolonged sitting causes an increased risk of many diseases. How sitting time is accumulated is important. Breaks are taken regularly from sitting are important. For example people who perform activities every 20 min. reduce their blood glucose levels and improved insulin sensitivity by 30%.

Regular breaks are important in preventing an increased risk of disease and reducing discomfort, illness, and injury.

Therefore, reducing the amount of time sitting and taking regular breaks may be as important as regular activity. Some suggestions are:

- Standing/walking meetings
- Meetings with built-in standing breaks
- Desks attached to treadmills or walkers
- Using stairs lifts



Regular breaks have also been shown to reduce perceived musculoskeletal discomfort and reduce illness and injury by 50%, with no change from productivity.

Short frequent breaks are more satisfactory than longer breaks: for example a 5 to 10 min. break after 50 to 60 minutes of continuous screen and/or keyboard work is likely to be better than a 15 to 20 min. break or change of activity every 2 hours.

A number of break-monitoring software tools are marketed as aids to ensure users take regular breaks. They are by no means essential, but it may be worth considering such software packages in some situations. The most basic simply remind the user to take breaks at preset intervals regardless of how much they use the computer. More sophisticated packages monitor the number of keystrokes and/or degree of math activity and display a reminder when the user reaches a preset

threshold; for example, number of keystrokes. It is important that break monitoring software does not add to frustration and stress; for example software should not lock the user out of the job without adequate warning. The employee should assist the work in planning activities to incorporate breaks into their day.

Benefits of Good Practice

A 2007 survey undertaken in England indicated that, when these recommendations were followed, overall employee morale was reported by 20% of employers and that stress improvements were noted by 24% of employers. Productivity improvement was also noted to improve in 20% of the organizations surveyed. 20% more organizations also reported less absence due to sickness when compared to the same survey 10 years prior.

Working with a Portable Computer

Increasing numbers of people are using portable computers as part of their work. While research suggests that some aspects of using these is no worse than using full -size equipment, that is not true of every aspect. Portable computers can include features such as smaller keyboards, lack of keyboards, or screen separation that may make it difficult to achieve a comfortable working posture. To reduce risks to portable computer users, the following recommendations should be followed.

Following these recommendations can improve stress, reduce absence due to sickness, and increase productivity in employees.

- Look for as low weight as possible and keep accessories as low weight as possible.
- Choose as large and clear a screen as possible, so that it can be used comfortably the task to be done.
- When available, opt for a detachable keyboard and height-adjustable screen
- Specify as long a battery life as possible. Where practicable, provide extra transformer and cable length in each location to save the user carrying this equipment.
- Use a lightweight carrying case with handle and shoulder straps.
- Choose portables that can be used with a docking station.
- Check that the portable has friction pads underneath to prevent it from moving slowly across work surfaces when in use.
- Be sure that the portable has sufficient memory and speed for the applications used.