Office Workstation Design

No matter what industry you work in, computers are commonly used. Extended work with computers can lead to muscular fatigue and discomfort, usually in the back, arms, shoulders and neck. The risk of a muskuloskeletal disorder (MSD) is higher for computer operators than for other office workers. And the risk increases as the intensity of computer work increases.

This *Fastfacts* outlines how workstation layout, lighting and task design can affect the physical and visual demands on people who work with computers. It also provides a checklist to guide your company in what to look for when assessing computer workstations.

Workstation Layout

Keyboard Position

When working at a keyboard, the user should sit in an upright position with the upper arms hanging naturally from the shoulders. The elbows should be bent at about a 90 degree angle when the fingers are on the home row of the keyboard. If the keyboard is too high, the user must raise his or her arms and shoulders. This can cause fatigue and discomfort and may increase the risk of injury. If the keyboard is too low, the user has to stoop forward which can stress the arms and the back. In both cases, the wrists will also be strained. It is important that the equipment is positioned so that the wrists are straight and not bent. Typically, if the keyboard is at the appropriate height, the keyboard legs (if any) should not be raised.

The Mouse

Hand-held input devices such as computer mice are commonly used in computer work. A mouse should be placed as close to the user's side as possible and at a height that allows the arm to hang relaxed from the shoulder. The wrist should be in a "neutral" position (that is, so the hand is in line with the forearm). This position causes the least physical stress. The mouse should be able to move freely.

The size and shape of the mouse are also important. For example, to prevent cramped hand postures, different-sized devices may be required for different users. The mouse should also be shaped to minimize bent wrist postures. Buttons on the mouse should be located to avoid awkward finger and hand postures. Settings can be adjusted for left-handed users and to change the speed and distance of mouse travel and clicking actions required. Users should loosely hold the mouse and move it from the shoulder rather than just the wrist. This distributes muscular demands better and reduces wrist movements and static loading. Alternative input devices are also available such as trackballs, joysticks and digitizing tablets, and may be preferred by some users depending on task, application and/or personal preference.

Monitor Position

Proper positioning of monitors is essential to preventing neck and eye strain. Computer monitors should be placed so that the top of the screen is at, or slightly below, the user's eye level. The viewing distance between the user's eyes and the screen should be 40 to 74 centimetres (cm). If the screen is viewed continuously or frequently, it should be directly in front of the worker. The key is to keep the neck in a neutral position (i.e.,the monitor is facing the worker). For bifocal or trifocal wearers, the top of the screen should be slightly lower (or moved back further) to avoid awkward neck posture. An alternative is to obtain prescription lenses for computer work.

Chair

The purpose of well-designed seating is to provide stable support that allows movement, comfort and task accomplishment.

Height-adjustable chairs can help place the user at a proper height for typing, writing and viewing the monitor, especially when height-adjustable tables are not available. The height of the chair should allow the feet to rest flat on the floor with the thighs roughly parallel to the floor. To place shorter workers at a comfortable typing height, the chair may need to be raised. If a worker's feet cannot reach the floor, provide a footrest. The ankles are usually most comfortable at an angle close to 90 degrees, therefore, footrests can be inclined 0 – 30 degrees.

No single sitting posture can remain comfortable if maintained for prolonged periods of time. The workstation design, chair design and job organization should all allow for a change in posture. Movement is important to minimize fatigue and static effort of the muscles. Movement may include slightly altering the angles at the neck, shoulders, elbows, wrists, hips, knees and ankles. In chairs where computer use is the primary task, the seat height, seat angle, backrest height and backrest angle should be adjustable independently of each other. Workers must be made aware of the importance of adjusting their chairs correctly and know how to make the adjustments.

Phone

If the phone is frequently used, it is best not to cradle the phone on the shoulder. To prevent such harmful postures, workers who use a computer while on the telephone for long periods should wear head sets.

Desks

The best way to provide the proper screen and keyboard heights for all users is to use split level tables or desks that allow each height to be adjusted independently. This ensures that almost all users, large and small, can have proper postures as they work. Any table, desk or stand used for computer work must be deep enough for both the keyboard and the monitor to be in front of the worker. The Canadian Standards Association's Guideline on Office Ergonomics (CAN/CSA Z412-00) recommends a minimum of 76 cm. More space may be required for larger monitors, or less space for flat screens. Keyboard trays and/or monitor risers may also be used to achieve proper positioning. There should also be sufficient leg room: 43 cm of horizontal knee space and 60 cm of toe space. When choosing a work surface configuration, consideration should be given to the tasks performed, equipment and materials to be accommodated, the need to alter the layout due to changing needs and the presence of glare.

Document Holders

Computer work often involves entering information from source documents. These should be located beside the screen and in the same plane. This reduces the amount of head and eye movements between the document and the screen and decreases the risk of muscular and visual fatigue.

The best way to correctly position documents is to use an adjustable document holder. Make sure the holder is suitable for the size and type of documents used in your workplace.

Lighting

Lighting levels from 300 to 500 lux are generally considered to be the most appropriate. Glare is also an important aspect of lighting: it can cause visual fatigue and discomfort and it can force the user to adopt an awkward posture to avoid the glare.

There are types of glare: direct, indirect and masking. Direct glare occurs when there are bright light sources directly in the user's field of view. Windows are often a source of direct glare. Indirect glare occurs when light from windows or overhead lighting is reflected off shiny surfaces in the field of view, such as monitors, desks and other office equipment. Light from sources directly overhead causes masking glare on the screen, partly obscuring what the user is trying to focus on.

To reduce glare:

- use light absorbing curtains and blinds
- position terminals so the user's line of sight is parallel to windows and overhead fluorescent lights
- position workstations between rows of overhead lights
- use parabolic filters on overhead lights (these covers only allow light to travel straight down, not disperse at an angle)
- use indirect lighting (lighting that reflects off ceilings and walls into the work area)
- as a last resort, use glass or plastic antiglare screens

Task Design

Maintaining any posture over time is fatiguing, no matter how well the workstation is set up. As well, continual data entry or word processing are very repetitive tasks and can further contribute to discomfort and possible injury. The best remedy is to take frequent breaks from computer work. For example, schedule five minutes of work that does not use the computer for every hour worked. Computer-intensive jobs should be re-designed to include tasks other than computer work.

Quick Tips for Adjusting Your Computer Workstation

1. Set the height of the chair so that your thighs are roughly parallel to the floor, with your feet flat. If necessary, use a footrest to support your feet.
2. Use a fully adjustable chair (i.e., for seat height, backrest tilt and seat pan tilt). It should have a well formed lumbar (lower back) support to help maintain the lumbar curve.
3. Make sure the arm rests don't interfere with natural movements and/or are adjustable.
4. Ensure the chair does not put pressure on the back of the legs. There should be enough space between the front edge of the seat pan and the back of your knee/lower leg to fit one finger up to one fist.
5. Set your monitor at a height that allows you to keep your neck straight. The top of the screen should typically be at or slightly below eye level.
6. Your elbows should be at an angle of 90 degrees, with your arms hanging naturally at your sides.
7. Keep your hands in line with your forearms, so that wrists are straight, not bent up, down or to the side. The mouse should be directly beside the keyboard.
8. Use a document holder to hold source documents adjacent to the monitor.

Office Workstation Checklist

Use this checklist to assess your workstation for potential problems. A "No" response may indicate a problem which could lead to a musculoskeletal disorder. Make the necessary changes or adjustments for all potential problems identified. If discomfort persists, you may require advice of an Ergonomic Specialist.

Office Workstation Item to Check	Y	N	Comments/Possible Adjustments or Changes
1. Chair			
Chair height is appropriate for the individual and the work surface height (Thighs are parallel to the floor or knees slightly lower than the hips).			
Feet are fully supported on the floor or on a footrest.			
Chair has a stable base with five wheels or castors suitable for the floor surface.			
The angle of the backrest is adjustable (90-110 degreees).			
The backrest height is adjustable. If not, the backrest supports the inward curve of the lower back.			
If armrests are provided, they do not interfere with natural movements.			
Chair seat is the appropriate size for the individual.			
The seat pan tilt is adjustable (+3 or -4 degrees) for frequent computer users.			
There is a space between the front of the chair and the back of your legs (min: width of finger/max: fist).			

Office Workstation Item to Check	Y	N	Comments/Possible Adjustments or Changes
2. Monitor/Keyboard and Mouse			
The monitor is directly in front of you, if viewed or used regularly.			
When keying upper arms are hanging vertical, and lower arms are horizontal (elbows approximately 90 degrees).			
Work is performed directly in front of you, with elbows close to the body.			
The wrist is relaxed and not bent. Wrist rests are available.			
Mouse is placed on the same level as the keyboard.			
Mouse fits comfortably in your hand.			
Top of the monitor screen is at or slightly below eye level. Lower for bifocal wearers			
The monitor is at a comfortable distance away (40-74 cm).			
Screen is free of glare or shadows.			
Windows are not in front or behind the operator.			
Letters on the screen are sharp, easy to read, and do not flicker.			
3. Work Surface			
Work/writing surface height is about elbow level.			
Work surface is large enough to hold all work material.			
Frequently used items are within easy reach.			
Reaching behind the midline of the body is avoided.			
Writing space is available on the individual's dominant side, while on the computer.			
Legroom is sufficient to stretch out the legs and to swivel in the chair			

Office Workstation Item to Check	Y	N	Comments/Possible Adjustments or Changes
4.Lighting			
Adequate lighting is provided (typically between 300-500 lux).			
You are shielded from glare (i.e., sun or lighting).			
The workstation is located in between rows of overhead lights.			
5. Accessories			
A head set is provided if talking on the phone while keyboarding is regularly required.			
If provided, source documents are angled upwards with an appropriate document holder.			
Source documents are positioned close to your center of attention if viewed regularly.			
Adjustable task lighting is available.			
6. Work Practices			
You vary your viewing distance throughout the day by focusing on items further away.			
While keyboarding your hands float over the keys, not resting on the wrist rests.			
You are able to vary your tasks.			
You sit back in the chair properly, using the backrest for support.			
You know how to adjust your chair, and adjust it throughout the day.			
Shoulders are relaxed, not raised, hunched, or rounded.			
Head is relaxed over the shoulders.			
You take frequent micro breaks (5 min every hr.) to change posture and perform stretching exercises.			

Need More Information?

IAPA offers a variety of products, programs and services to help you understand and improve the design of workstations and jobs that involve computers.

We also have trained ergonomics consultants who will assess specific workstations in your workplace and make recommendations on how to improve them.

For more information, call 1 (800) 406-IAPA (4272) or visit our website: www.iapa.ca.

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IAPA (Industrial Accident Prevention Association)

Toll free: 1-800-406-IAPA (4272) Fax: 1-800-316-IAPA (4272)

Website: **www.iapa.ca**