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EXPECT MORE

Computer Workstation Ergonomics

Information from the Occupational Safety and Health Administration

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INTRODUCTION

Millions of people work with computers every day. This guide illustrates simple, inexpensive principles that will help you create a safe and comfortable computer workstation. There is no single "correct" posture or arrangement of components that will fit everyone. However, there are basic design goals, some of which are shown in the accompanying figure, to consider when setting up a computer workstation or performing computer-related tasks.

Consider your workstation as you read through each section and see if you can identify areas for improvement in posture, component placement, or work environment. This guide provides suggestions to minimize or eliminate identified problems, and allows you to create your own "custom-fit" computer workstation.

OSHA COMPLIANCE DIRECTIVE ON HOME-BASED WORKSITES

The Department of Labor strongly supports telecommuting and telework. Family-friendly, flexible and fair work arrangements, including telecommuting, can benefit individual employees and their families, employers, and society as a whole.

The purpose of the Occupational Safety and Health Act of 1970 (OSH Act) is to "assure so far as possible every working man and woman in the Nation safe and healthful working conditions…" (Section 2(b)). The OSH Act applies to a private employer who has any employees doing work in a workplace in the United States. It requires these employers to provide employment and a place of employment that are free from recognized, serious hazards, and to comply with OSHA standards and regulations (Sections 4 and 5 of the OSH Act). By regulation, OSHA does not cover individuals who, in their own residences, employ persons for the purpose of performing domestic household tasks.

OSHA respects the privacy of the home and has never conducted inspections of home offices.

Policy for Home Offices

- OSHA will not conduct inspections of employees' home offices.
- OSHA will not hold employers liable for employees' home offices, and does not expect employers to inspect the home offices of their employees.
- If OSHA receives a complaint about a home office, the complainant will be advised of OSHA's policy. If an employee makes a specific request, OSHA may informally let employers know of complaints about home office conditions but will not follow-up with the employer or employee.

GOOD WORKING POSITIONS

To understand the best way to set up a computer workstation, it is helpful to understand the concept of neutral body positioning. This is a comfortable working posture in which your joints are naturally aligned. Working with the body in a neutral position reduces stress and strain on the muscles, tendons, and skeletal system and reduces your risk of developing a musculoskeletal disorder (MSD). The following are important considerations when attempting to maintain neutral body postures while working at the computer workstation:



- Hands, wrists, and forearms are straight, in-line and roughly parallel to the floor.
- Head is level, forward facing, and balanced. Generally it is in-line with the torso.
- Shoulders are relaxed and upper arms hang normally at the side of the body.
- Elbows stay in close to the body and are bent between 90 and 120 degrees.
- Feet are fully supported by the floor or a footrest may be used if the desk height is not adjustable.
- Back is fully supported with appropriate lumbar support when sitting vertical or leaning back slightly.
- Thighs and hips are supported and generally parallel to the floor.
- Knees are about the same height as the hips with the feet slightly forward

Regardless of how good your working posture is, working in the same posture or sitting still for prolonged periods is not healthy. You should change your working position frequently throughout the day in the following ways:

- Make small adjustments to your chair or backrest.
- Stretch your fingers, hands, arms, and torso.
- Stand up and walk around for a few minutes periodically.
- Perform some of your tasks in standing: computing, reading, phone, meetings.

These four reference postures are examples of body posture changes that all provide neutral positioning for the body.

Upright Sitting

Upright sitting posture. The user's torso and neck are approximately vertical and in-line, the thighs are approximately horizontal, and the lower legs are vertical.

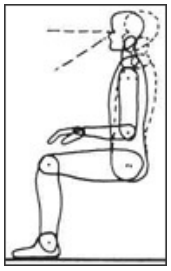


Figure 1. Upright sitting posture



Figure 2. The user's torso and neck are approximately vertical and in-line, the thighs are approximately horizontal, and the lower legs are vertical.

Standing

Standing posture. The user's legs, torso, neck, and head are approximately in-line and vertical with feet slightly apart. The user may also elevate one foot on a rest while in this posture.

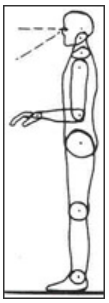


Figure 3. Standing posture



Figure 4. The user's legs, torso, neck, and head are approximately in-line and vertical with feet slightly apart.

Declined Sitting

Declined sitting posture. The user's thighs are inclined with the buttocks higher than the knee and the angle between the thighs and the torso is greater than 90 degrees. The torso is vertical or slightly reclined and the legs are vertical. This position should not inhibit the ability to easily reach the keyboard or view the monitor.

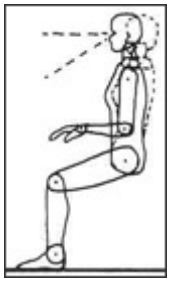


Figure 5. Declined sitting position



Figure 6. The user's thighs are inclined with the buttocks higher than the knee and the angle between the thighs and the torso is greater than 90 degrees. The torso is vertical or slightly reclined and the legs are vertical.

Reclined Sitting

Reclined sitting posture. The user's torso and neck are straight and recline between 105 and 120 degrees from the thighs.



Figure 5. Declined sitting position



Figure 8. The user's torso and neck are straight and recline between 105 and 120 degrees from the thighs.

WORKSTATION COMPONENTS

Appropriate placement of the components and accessories for the desktop computer workstation will allow you to work in neutral body positions, help you perform more efficiently, and work more comfortably and safe.

A laptop workstation creates special challenges due to its computer design, size, and the variety of areas in which it is used. While many aspects of this guide will be applicable to laptops, special considerations may be necessary when working with laptop units.

The following sections explain how to select and arrange specific workstation components:

Chairs

A chair that is well-designed and appropriately adjusted is an essential element of a safe and productive computer workstation. A good chair provides necessary support to the back, legs, buttocks, and arms, while reducing exposures to awkward postures, contact stress, and forceful exertions.

Increased adjustability ensures a better fit for the user, provides adequate support in a variety of sitting postures, and allows variability of sitting positions throughout the workday. This is particularly important if the chair has multiple users.

To ensure that the chair will provide adequate support, it is important that you try out different chairs before purchasing one.

The following parts of the chair are important elements to consider in creating a safe and productive workstation:

- Backrest
- Seat
- Armrest
- Base

You should adjust your chair along with appropriately placing your monitor, keyboard, and desk.

Potential Hazards
Backrest
HAZARD: Poor back support and inappropriate postures may result from inadequate backrest size, material, positioning, or use. Working in these postures may lead to back pain and fatigue. For example, a chair without a suitable or adjustable backrest will not provide adequate lumbar support or help maintain the natural S-shape curvature of the spine.

Possible Solutions:

- If your current chair does not have a lumbar support, use a rolled up towel or a removable back support cushion to temporarily provide support and maintain the natural curve of the spine.
- Use a chair with a backrest that is easily adjustable and able to support the back in a variety of seated postures. A backrest should have the following:
    - A lumbar support that is height adjustable so it can be appropriately placed to fit the lower back. The outward curve of the backrest should fit into the small of the back.
    - An adjustment that allows the user to recline at least 15 degrees from the vertical. The backrest should lock in place or be tension adjustable to provide adequate resistance to lower back movement.
    - A device enabling it to move forward and backward. This will allow shorter users to sit with their backs against the backrest without the front edge of the seat pan contacting their knees. Taller users will be able to sit with their backs against the backrest while still having their buttocks and thighs fully supported. NOTE: some chair designs provide this adjustability by adjusting the position of the seat pan.

Seat

HAZARD: Using a chair with a seat that is too high may force you to work with your feet unsupported or encourage you to move forward in the chair to a point where your back is unsupported making it more difficult to maintain the S-shape of the spine. These awkward postures can lead to fatigue, restricted circulation, swelling, numbness, and pain.

Possible Solutions:

- If the seat cannot be lowered (for example, it would make the keyboard or monitor too high), use a footrest to provide stable support for the feet.
- Provide a chair with a seat pan that is adjustable and large enough to provide support in a variety of seated postures. It is recommended that the seat should be:
    - Height adjustable, especially when shared by a number of users. The chair height is appropriate when the entire sole of the foot can rest on the floor with the back of the knee slightly higher than the seat of the chair.
    - Padded and have a rounded, "waterfall" edge.
    - Wide enough to accommodate the majority of hip sizes. Chairs with oversize seat pans should be provided for larger users.

HAZARD: An inappropriately sized seat pan can be uncomfortable, provide inadequate support to the legs, and restrict movement. One that is too short can place excess pressure on the buttocks of taller users, one that is too long can place excess pressure on the knee area of shorter users and minimize

back support. One that is too small can restrict movement and provide inadequate support. Prolonged use can restrict blood flow to the legs and create irritation and pain.

Possible Solutions:

- Seat pan should be "depth" adjustable to adequately support taller users while allowing shorter users to sit with their back fully supported. The seat pan should provide support for most of the thigh without contact between the back of the user's knee and the front edge of the seat pan.
- Provide a footrest, which may elevate the knee slightly to relieve pressure on the back of the leg.
- Provide a chair that is sized to fit small or large users. NOTE: this is especially important if the chair is to be shared by several users.

Armrest

HAZARD: Armrests that are not adjustable, or those that have not been properly adjusted, may expose you to awkward postures or fail to provide adequate support. For example armrests that are:

- *Too low* may cause you to lean over to the side to rest one forearm. This can result in uneven and awkward postures, fatiguing the neck, shoulders, and back.
- *Too high* may cause you to maintain raised shoulders, which can result in muscle tension and fatigue in the neck and shoulders.
- *Too wide* cause you to reach with the elbow and bend forward for support. Reaching pulls the arm from the body and can result in muscle fatigue in the shoulders and neck.
- *Too close* can restrict movement in and out of the chair.
- *Too large* or inappropriately placed may interfere with the positioning of the chair. If the chair cannot be placed close enough to the keyboard, you may need to reach and lean forward in your chair. This can fatigue and strain the lower back, arm, and shoulder.

Armrests that are made of hard materials or that have sharp corners can irritate the nerves and blood vessels located in the forearm. This irritation can create pain or tingling in the fingers, hand, and arm.

Possible Solutions:

- If your armrests cannot be properly adjusted, or if they interfere with your workstation, remove them, or stop using them.
- Position adjustable armrests so they support your lower arm and allow your upper arm to remain close to the torso. Properly adjusted armrests will be
- Wide enough to allow easy entrance and exit from the chair,
- Close enough to provide support for your lower arms while keeping your upper arms close to the body,

- Low enough so your shoulders are relaxed during use (Adjust your armrests so they just make contact with your lower arms when positioned comfortably at your sides.), and
- High enough to provide support for your lower arms when positioned comfortably at your sides. You may be able to add padding to the top of your armrests if they are too low and not adjustable.
- Armrests should be large enough to support most of your lower arm but small enough so they do not interfere with chair positioning.
- Armrests should be made of a soft material and have rounded edges.

Base

HAZARD: Chairs with four or fewer legs may provide inadequate support and are prone to tipping. Inappropriate choice of casters, or a chair without casters, can make positioning the chair in relation to the desk difficult. This increases reaching and bending to access computer components, which can lead to muscle strain, and fatigue.

Possible Solutions:

- Chairs should have a strong, five-legged base.
- Ensure that chairs have casters that are appropriate for the type of flooring at the workstation.

Chair Quick Tips

- The backrest should conform to the natural curvature of your spine, and provide adequate lumbar support.
- The seat should be comfortable and allow your feet to rest flat on the floor or footrest.
- Armrests, if provided, should be soft, allow your shoulders to relax and your elbows to stay close to your body.
- The chair should have a five-leg base with casters that allow easy movement along the floor.

Desks

A well-designed and appropriately-adjusted desk will provide adequate clearance for your legs, allow proper placement of computer components and accessories, and minimize awkward postures and exertions.

The clearance space under the work surface should provide adequate room for the users legs when in the upright seated posture and at least one other of the seated reference postures. This can be accomplished by using Method 1 or Method 2.

Method 1 - Upright and Reclined Seated Postures

The following dimensions represent clearances that accommodate the majority of users (5th percentile female to 95th percentile male) when in a seated posture where the top of the legs are about parallel with the floor.

Minimum Dimensions

- 20 inches (52 cm) wide.
- 17 inches (44 cm) deep at knee level.
- 24 inches (60 cm) deep at foot level.
- 4 inches (10 cm) high at the foot.

Variable Dimensions

- Height is adjustable between 20 and 27 inches (50 and 69 cm) near the user.

Method 2 - Upright, Reclined, and Declined Seated Postures

The following dimensions accommodate the largest operator clearance spaces (5th percentile female to 95th percentile male). Thus, specifications conforming with Method 2 will meet Method 1 requirements. This method also includes postures where the knee is slightly lower than the buttocks (declined-seated).

Variable Dimensions

- Adjustable between 20 and 28 inches (50 and 72 cm) high at the hip.
- Adjustable between 20 and 25 inches (50 and 64 cm) high near the user's knee.

Potential Hazards
Desk or Work Surface Areas
HAZARD: Limited space on the work surface may cause users to place components and devices in undesirable positions. This placement may lead to awkward postures as you reach for a pointer/mouse or look at a monitor that is placed to the side. **Possible Solutions:** • Work surface depth should allow you to: • View the monitor at a distance of at least 20 inches (50 cm). • Position the monitor to achieve the appropriate viewing angle, which is generally directly in front of you. • Using a corner rather than a straight run of desk may provide additional space and depth to accommodate large monitors or multiple items. • The location of frequently-used devices (keyboard, phone, and mouse) should remain within the repetitive access (primary work zone).

HAZARD: Some desks and computer equipment have hard, angled leading edges that come in contact with a user's arm or wrist. This can create contact stress, affecting nerves and blood vessels, possibly causing tingling and sore fingers.

Possible Solutions:

To minimize contact stress:

- Pad table edges with inexpensive materials such as pipe insulation.
- Use a wrist rest.
- Buy furniture with rounded desktop edges.

Areas Under the Desk or Work Surface

HAZARD: Inadequate clearance or space under the work surface may result from poor design or excessive clutter. Regardless of the cause it can result in discomfort and performance inefficiencies, such as the following:

- Shoulder, back, and neck pain due to users sitting too far away from computer components, causing them to reach to perform computer tasks.
- Generalized fatigue, circulation restrictions, and contact stress due to constriction of movement and inability to frequently change postures.

Possible Solutions:

- Provide, to the extent possible, adequate clearance space for users to frequently change working postures (see recommended dimensions). This space should remain free of items such as files, CPUs, books, and storage.
- Be sure clearance spaces under all working surfaces accommodates at least two of the three seated reference working postures, one of which must be the upright seated posture.
- Limit the number of items that are stored under the work surface. There should be no items stored that will limit the space needed for workers' legs and feet.

HAZARD: Desk surfaces that are too high or too low may lead to awkward postures, such as extended arms to reach the keyboard, and raised shoulders.

Possible Solutions:

- Raise work surfaces by inserting stable risers such as boards or concrete blocks under the desk legs if necessary.
- Remove center drawers of conventional desks to create additional thigh clearance if necessary.
- Lower work surfaces by cutting off desk legs if necessary. If the work surface cannot be lowered, raise the chair to accommodate the user. If needed, provide a footrest to support the user's feet.

- Provide height-adjustable desks. Clearance for the legs, under the desktop, should generally be between 20-28 inches (50-72 cm) high.

Desk Quick Tips
• Desk surface should allow you to place the monitor directly in front of you, at least 20 inches away. • Avoid storing items, such as a CPU, under desks. • Desks should be able to accommodate a variety of working postures.

Document holders

Document holders keep printed materials needed during computer tasks close to the user and the monitor. Proper positioning of document holders depends on the task performed and the type of document being used. Appropriate placement of the holder may reduce or eliminate risk factors such as awkward head and neck postures, fatigue, headaches, and eye strain.

The position of the document holder is also related to the placement of the monitor, keyboard, and a well-adjusted chair.

Potential Hazards
Source Document Position
HAZARD: Documents positioned too far from the monitor may require awkward head postures or frequent movements of the head and neck to look from the monitor to a document. Those awkward postures can lead to muscle fatigue and discomfort of the head, neck, and shoulders. **Possible Solutions:** • Document holders should: o Allow you to place documents at or about the same height and distance as the monitor screen o Be stable when loaded with heavier documents such as a textbook. • A document holder can be positioned directly beneath the monitor. This provides a sturdy writing surface, if written entries are necessary, and reduces frequent movement of the head, neck, or back. • Task lighting on the document should not cause glare on the monitor.

Document Holder Quick Tips
• Documents should be at the same height and distance as the monitor.

Keyboards

Proper selection and arrangement of the computer keyboard helps reduce exposure to awkward postures, repetition, and contact stress. Consider the following factors when evaluating your computer workstation.

- Keyboard Placement - Height
- Keyboard Placement - Distance
- Design and Use
- Left Hand Key Usage

You should choose a keyboard and consider its placement in conjunction with other components of the computer workstation, including the pointer/mouse and wrist/palm rests.

Potential Hazards
Keyboard Placement - Height
HAZARD: Keyboards, pointing devices, or working surfaces that are too high or too low can lead to awkward wrist, arm, and shoulder postures. For example, when keyboards are too low you may type with your wrists bent up, and when keyboards are too high, you may need to raise your shoulders to elevate your arms. Performing keying tasks in awkward postures such as these can result in hand, wrist, and shoulder discomfort. **Possible Solutions:** • Adjust the chair height and work surface height to maintain a neutral body posture. Elbows should be about the same height as the keyboard and hang comfortably to the side of the body. Shoulders should be relaxed, and wrists should not bend up or down or to either side during keyboard use. • Remove central pencil drawers from traditional desks if you can't raise your chair high enough because of contact between the drawer and the top of the thighs. The work surface should generally be no more than 2 inches thick. • A keyboard tray may be needed if the work surface or chair cannot be properly adjusted. The keyboard tray should: o Be adjustable in height and tilt. o Provide adequate leg and foot clearance. o Have adequate space for multiple input devices (for example, a keyboard and pointer/mouse). The tilt of the keyboard may need to be raised or lowered using the keyboard feet to maintain straight, neutral wrist postures while accommodating changes in arm angles.

Keyboard Placement - Distance

HAZARD: A keyboard or pointer/mouse that is too close or too far away may cause you to assume awkward postures such as reaching with the arms, leaning forward with the torso, and extreme elbow angles. These awkward postures may lead to musculoskeletal disorders of the elbows, shoulders, hands, and wrists.

Possible Solutions:

- Place the keyboard directly in front of you at a distance that allows your elbows to stay close to your body with your forearms approximately parallel with the floor.
- A keyboard tray may be useful if you have limited desk space or if your chair has armrests that interfere with adequate positioning.

Design and Use

HAZARD: A traditional keyboard may cause you to bend your wrists sideways to reach all the keys. Keyboard tilt, caused by extending the legs on the back of the keyboard or by a steep design angle, may cause the wrist to bend upward. Smaller keyboards, such as those found on laptops, may also contribute to stressful postures. These awkward wrist postures can create contact stress to the tendon sheath and tendons that must move within the wrist during repetitive keying.

Possible Solutions:

- Reduce awkward wrist angles by lowering or raising the keyboard or chair to achieve a neutral wrist posture.
- Elevate the back or front of keyboards to achieve a neutral wrist posture. For example, if the operator sits lower in relation to the keyboard, slightly elevating the back of the keyboard may help maintain a neutral wrist. Similarly, raising the front of the keyboard may help maintain neutral wrist postures for users who type with the keyboard in a lower position. Do not use keyboard feet if they increase bending of the wrist.
- Consider alternative keyboards to promote neutral wrist postures. Alternative keyboards may be provided on a case-by-case basis. Users may need time to become accustomed to these devices. NOTE: alternative keyboards help maintain neutral wrist postures, but available research does not provide conclusive evidence that using these keyboards prevents discomfort and injury.
- Keyboards should be of appropriate size and key-spacing to accommodate most users. Generally, the horizontal spacing between the centers of two keys should be 0.71-0.75 inches (18-19 mm) and the vertical spacing should be between 0.71-0.82 inches (18-21 mm).

Left Hand Key Usage

HAZARD: Most keyboards are manufactured with a 10 key keypad permanently affixed to the right side of the keyboard. This arrangement can be limiting to left handed workers or right handed workers who are recovering from injury and are attempting to remain functional during their recovery. This arrangement is also a problem if one is attempting to create work-rest regimens by alternating principle hand usage during the work day or work week.

Possible Solutions:

- Alternative left hand keyboards which have the keypad permanently affixed to the left side of the keyboard are available as are keyboards with a detached keypad. These allow the user to switch positions for either left or right hand use. These may be especially useful for applications where workers share computers.
- Programmable stand alone keypads are available which can be programmed to facilitate either right or left hand usage.

Keyboard Quick Tips
• Put the keyboard directly in front of you. • Your shoulders should be relaxed and your elbows close to your body. • Your wrists should be straight and in-line with your forearms.

Monitors

Choosing a suitable monitor and placing it in an appropriate position helps reduce exposure to forceful exertions, awkward postures, and overhead glare. This helps prevent possible health effects such as excessive fatigue, eye strain, and neck and back pain. Consider the following issues to help improve your computer workstation:

- Viewing Distance
- Viewing Angle-Height and Side-to-Side
- Viewing Time
- Viewing Clarity

You should choose a monitor and consider its placement in conjunction with other components of the computer workstation, including the keyboard, desk, and chair.

Potential Hazards
Viewing Distance
HAZARD: Monitors placed too close or too far away may cause you to assume awkward body positions that may lead to eyestrain. • Viewing distances that are too long can cause you to lean forward and strain to see small text. This can fatigue the eyes and place stress on the torso because the backrest is no longer providing support. • Viewing distances that are too short may cause your eyes to work harder to focus (convergence problems) and may require you to sit in awkward postures. For instance, you

may tilt your head backward or push your chair away from the screen, causing you to type with outstretched arms.

Possible Solutions:

- Sit at a comfortable distance from the monitor where you can easily read all text with your head and torso in an upright posture and your back supported by your chair. Generally, the preferred viewing distance is between 20 and 40 inches (50 and 100 cm) from the eye to the front surface of the computer screen. NOTE: text size may need to be increased for smaller monitors.
- Provide adequate desk space between the user and the monitor (table depth). If there is not enough desk space, consider doing the following:
    - Make more room for the back of the monitor by pulling the desk away from the wall or divider.
    - Provide a flat-panel display, which is not as deep as a conventional monitor and requires less desk space.
    - Place monitor in the corner of a work area. Corners often provide more desk depth than a straight run of desk top.
    - Move back and install an adjustable keyboard tray to create a deeper working surface.

Viewing Angle-Height and Side-to-Side

HAZARD: Working with your head and neck turned to the side for a prolonged period loads neck muscles unevenly and increases fatigue and pain.

Possible Solutions:

- Position your computer monitor directly in front of you, so your head, neck and torso face forward when viewing the screen. Monitors should not be farther than 35 degrees to the left or right.
- If you work primarily from printed material, place the monitor slightly to the side and keep the printed material directly in front. Keep printed materials and monitors as close as possible to each other.

HAZARD: A display screen that is too high or low will cause you to work with your head, neck, shoulders, and even your back in awkward postures. When the monitor is too high, for example, you have to work with your head and neck tilted back. Working in these awkward postures for a prolonged period fatigues the muscles that support the head.

Possible Solutions:

- The top of the monitor should be at or slightly below eye level. The center of the computer monitor should normally be located 15 to 20 degrees below horizontal eye level.
- The entire visual area of the display screen should be located so the downward viewing angle is never greater than 60 degrees when you are in any of the four reference postures. In the

reclining posture the straight forward line of sight will not be parallel with the floor, which may increase the downward viewing angle. Using very large monitors also may increase the angle.

- Remove some or all of the equipment (computer case, surge protector, etc.) on which the monitor may be placed. Generally, placing the monitor on top of the computer case will raise it too high for all but the tallest users.
- Elevate your line of sight by raising your chair. Be sure that you have adequate space for your thighs under the desk and that your feet are supported.

HAZARD: Bifocal users typically view the monitor through the bottom portion of their lenses. This causes them to tilt the head backward to see a monitor that may otherwise be appropriately placed. As with a monitor that is too high, this can fatigue muscles that support the head.

Possible Solutions:

- Lower the monitor (below recommendations for non-bifocal users) so you can maintain appropriate neck postures. You may need to tilt the monitor screen up toward you.
- Raise the chair height until you can view the monitor without tilting your head back. You may have to raise the keyboard and use a foot rest.
- Use a pair of single-vision lenses with a focal length designed for computer work. This will eliminate the need to look through the bottom portion of the lens.

Viewing Time

HAZARD: Viewing the monitor for long periods of time may cause eye fatigue and dryness. Users often blink less while viewing the monitor.

Possible Solutions:

- Rest your eyes periodically by focusing on objects that are farther away (for example, a clock on a wall 20 feet away).
- Stop, look away, and blink at regular intervals to moisten the eyes.
- Alternate duties with other non-computer tasks such as filing, phone work, or customer interaction to provide periods of rest for the eyes.

Viewing Clarity

HAZARD: Monitors that are tilted significantly either toward or away from the operator may distort objects on the screen, making them difficult to read. Also, when the monitor is tilted back, overhead lights may create glare on the screen. This can result in eyestrain and sitting in awkward postures to avoid eye glare.

Possible Solutions:

- Tilt the monitor so it is perpendicular to your line of sight, usually by tilting the screen no more than 10 to 20 degrees. This is most easily done if the monitor has a riser/swivel stand. A temporary solution involves tilting the monitor back slightly by placing a book under the front edge. NOTE: Tilting the monitor back may create glare on the screen from ceiling lighting and a glare screen may be needed.
- Monitor support surfaces should allow the user to modify viewing distances and tilt and rotation angles.

HAZARD: Factors that reduce image quality make viewing more difficult and may lead to eye strain. These factors include:

- Electromagnetic fields caused by other electrical equipment located near computer workstations, which can result in display quality distortions.
- Dust accumulation, which is accelerated by magnetic fields associated with computer monitors and can reduce contrast and degrade viewing conditions.

Possible Solutions:

- Computer workstations should be isolated from other equipment that may have electrostatic potentials in excess of +/- 500 volts.
- Computer monitors should be periodically cleaned and dusted.

Monitor Quick Tips
• Put monitor directly in front of you and at least 20 inches away. • Place monitor so top line of screen is at or below eye level. • Place monitor perpendicular to window.

Pointer/Mouse

Pointing devices such as a mouse now come in many sizes, shapes, and configurations. In addition to the conventional mouse, there are trackballs, touch pads, finger tip joysticks, and pucks, to name a few. Selection and placement of a pointer/mouse is an important factor in creating a safe computer workstation.

Consider the following factors when evaluating your computer workstation.

- Pointer Placement
- Pointer Size, Shape, and Settings

Potential Hazards
Pointer Placement
HAZARD: If the pointer/mouse is not near the keyboard you may be exposed to awkward postures, contact stress, or forceful hand exertions while using the device. Working in this position for prolonged periods places stress on the shoulder and arm and increases the likelihood that you will assume awkward wrist and shoulder postures, which may lead to musculoskeletal disorders. **Possible Solutions:** • Position the pointer/mouse to allow you to maintain a straight, neutral wrist posture. This may involve adjustments in your chair, desk, keyboard tray, etc. • If the keyboard tray/surface is not large enough to accommodate both the keyboard and mouse, try one of the following to limit reaching: • Use a mouse platform positioned over the keyboard. This design allows the mouse to be used above the 10-key pad. • Install a mouse tray next to the keyboard tray. • Use a keyboard that has a pointing device, such as a touchpad, incorporated into it. • Use a keyboard without a ten-key pad, which leaves more room for the pointer/mouse. • Install keyboard trays that are large enough to hold both the keyboard and mouse. • Use a mouse pad with a wrist/palm rest to promote neutral wrist posture. • Substitute keystrokes for mousing tasks, such as Ctrl+S to save, and Ctrl+P to print.
Pointer Size, Shape, and Settings
HAZARD: Inappropriate size and shape of pointers can increase stress, cause awkward postures, and lead to overexertion. For example, using a pointing device that is too big or too small may cause you to increase finger force and bend your wrist into awkward positions. Using the left hand to operate a device that is designed for right-hand use can also create force and posture issues and may create contact stress to the soft tissue areas in the palm of the hand. Contact stress can create irritation and inflammation. **Possible Solutions:** • Select a pointing device designed to fit the hand that will normally operate it. Many devices are available in right hand/left hand models and also come in sizes to fit large and small hands. A device that is designed for either hand use may be desirable, since changing from right- to left-hand operation provides periods of rest for one hand. You should test a device prior to purchase and long term use to ensure proper fit and feel. • Select pointing devices that are appropriately sized and that require minimal force to generate movement. For example, a puck device must be small enough for single-handed operation (generally, 1.5 to 2.5 inches wide, 2.5 to 4.5 inches long, and 1 to 1.5 inches high). • Reduce the strain on hands by reducing pointing device use. Using keyboard functions, such as page down, may reduce mouse use and provide rest for hand and arm muscles.

- Use another type of device that fits the hand better or doesn't require bending the wrist while gripping. A fingertip joystick, touchpad, or trackball may be less fatiguing for certain tasks. Always try out any new product prior to selection and long term use.

HAZARD: When the sensitivity for the input device is not appropriately set, you may need to use excessive force and awkward hand postures to control the device. For example, a mouse that is too sensitive may require excessive and prolonged finger force to provide adequate control. A mouse that has insufficient sensitivity may require large deviation of the wrist to move the pointer around the screen. Exerting prolonged force or repeatedly bending the wrist can fatigue the muscles of the hand and arm and increase the risk of musculoskeletal injuries.

Possible Solutions:

- Sensitivity and speed (how fast the pointer moves on the screen when the pointing device is moved by the hand) should feel comfortable and be adjustable. The pointer should be able to cover the full screen while the wrist is maintained in a straight, neutral posture.
- Sensitivity should be set so you can control the pointing device with a light touch. Most current devices have sensitivity settings that can be adjusted through the computer control panel.
- Avoid tightly gripping the mouse or pointing device to maintain control.
- A trackball's exposed surface area should be at least 100 degrees. It should feel comfortable and rotate in all directions to generate any combination of movement.

Pointer/Mouse Quick Tips

- Keep the pointer/mouse close to the keyboard.
- Alternate hands with which you operate the pointer/mouse.
- Use keyboard short cuts to reduce extended use.

Telephones

Many office tasks today are centered around telephones and computers as key workstation components. For example, employees making reservations may take information from customers and transfer it into the computer. They may also receive information from the computer and relay it to customers by telephone.

Telephones add to the convenience of a workstation; however, telephones have cords that can get tangled up, and can cause the user to assume awkward postures. Consider the following to help prevent musculoskeletal disorders.

Potential Hazards
Placement and Use
HAZARD: Placing the telephone too far away can cause you to repeatedly reach, resulting in strain on the shoulder, arm, and neck. **Possible Solutions:** • Place the telephone in the primary or secondary work zone, depending on usage patterns. This will minimize repeated reaching, reducing the possibility of injury. • Keep the telephone cord out of working areas so it does not create a tripping hazard.
HAZARD: Prolonged conversations with the phone pinched between your shoulder and head may cause stress and neck pain. **Possible Solutions:** • Use a "hands-free" head set if you plan to spend a lot of time on the phone. Speaker phone options may also be appropriate, provided the volume of this feature does not annoy your co-workers.

Telephone Quick Tips
• Use a speaker phone or head set for long conversations. • Keep it close enough to avoid repeated reaching.

Wrist/Palm supports

Proper arrangement of the keyboard and mouse help create a comfortable and productive workstation. Wrist or palm rests can also increase your comfort.

Although opinions vary regarding the use of wrist/palm supports, proper use has been shown to reduce muscle activity and to facilitate neutral wrist angles.

Potential Hazards
Design and Use
HAZARD: • Performing keying tasks without a wrist rest may increase the angle to which users' wrists are bent. Increasing the angle of bend increases the contact stress and irritation on tendons and tendon sheathes. This is especially true with high repetition or prolonged keying tasks. Keying without a wrist rest can also increase contact stress between the users wrist and hard or sharp workstation components. • Resting the wrist/palm on a support while typing may inhibit motion of the wrist and could increase awkward wrist postures.

Possible Solutions:

- Your hands should move freely and be elevated above the wrist/palm rest while typing. When resting, the pad should contact the heel or palm of your hand, not your wrist.
- If used, wrist/palm rests should be part of an ergonomically-coordinated computer workstation.
- Reduce bending of the wrists by adjusting other workstation components (chair, desk, keyboard) so the wrist can maintain an in-line, neutral posture.
- Match the wrist support to the width, height, and slope of the front edge of the keyboard (keeping in mind that the goal is to keep wrist postures as straight as possible).
- Provide wrist/palm supports that are fairly soft and rounded to minimize pressure on the wrist. The support should be at least 1.5 inches (3.8 cm) deep.

Wrist Rest Quick Tips

- Use a speaker phone or head set for long conversations.
- Keep it close enough to avoid repeated reaching.

WORK PROCESS AND RECOGNITION

Even when the design of the workstations is correct and environmental factors are at their best, users can face risks from task organization which can intensify the impact of other risk factors, such as repetition. Additionally, failing to recognize early warning signs could allow small problems to develop into serious injuries. Addressing task organization factors and medical awareness can help minimize the risk of developing musculoskeletal disorders (MSDs) and stop the progression to injury.

Prolonged Periods of Activity

Potential Hazard:

Computer work, whether it's for a job or for fun, may appear to be a low effort activity when viewed from a total body perspective, but maintaining postures or performing highly repetitive tasks for extended periods can lead to problems in localized areas of the body. For example, using a mouse for a few minutes should not be a problem for most users, but performing this task for several uninterrupted hours can expose the small muscles and tendons of the hand to hundreds or even thousands of activations (repetitions). There may not be adequate time between activations for rest and recuperation, which can lead to localized fatigue, wear and tear, and injury. Likewise, maintaining static postures, such as viewing the monitor, for a prolonged period of time without taking a break can fatigue the muscles of the neck and shoulder that support the head.

Possible Solutions:

- Provide variation in tasks and workstations so there is time to recover from the effects of activity. There are several ways to provide recovery time for overused muscles.
    - Utilize an adjustable workstation so users can easily change their working postures. The use of easily adjustable furniture, for example, allows you to frequently change seated postures, which allows different muscle groups to provide support while others rest.
    - Ensure that there is enough work space so you can use each hand alternately to perform mouse tasks. This allows the tendons and muscles of the free hand to rest.
    - Substitute keystrokes for mousing tasks, such as Ctrl+S to save, Ctrl+P to print. Especially if your job is highly mouse intensive.
- High repetition tasks or jobs that require long periods of static posture may require several, short rest breaks (micro breaks or rest pauses). During these breaks users should be encouraged to stand, stretch, and move around. This provides rest and allows the muscles enough time to recover.
- Alternate tasks whenever possible, mixing non-computer-related tasks into the workday. This encourages body movement and the use of different muscle groups.

Medical Awareness and Training

Potential Hazard:

Employees who have not been adequately trained to recognize hazards or understand effective work practices designed to reduce these hazards are at a greater risk of harm. Without proper medical awareness, Musculoskeletal Disorders (MSD) signs and symptoms may go unnoticed and un-addressed. For example, users who do not understand the risk of bad body postures or techniques do not have the knowledge to actively participate in their own protection. Detection and reporting delays can result in more severe injury.

Possible Solutions:

Computer users should take the time to obtain general ergonomics awareness training on the following issues:

- Factors related to specific computer components that may increase discomfort or risk of injury.
- Being aware of discomfort (signs and symptoms).
- How to correctly use and adjust components and environmental factors.

WORKSTATION ENVIRONMENT

Appropriately placing lighting and selecting the right level of illumination can enhance your ability to see monitor images. For example, if lighting is excessive or causes glare on the monitor screen, you may develop eyestrain or headaches, and may have to work in awkward postures to view the screen. Ventilation and humidity levels in office work environments may affect user comfort and productivity.

Lighting

Potential Hazard:

Bright lights shining on the display screen "wash out" images, making it difficult to clearly see your work. Straining to view objects on the screen can lead to eye fatigue.

Possible Solutions:

- Place rows of lights parallel to your line of sight.
- Provide light diffusers so that desk tasks (writing, reading papers) can be performed while limiting direct brightness on the computer screen.
- Remove the middle bulbs of 4-bulb fluorescent light fixtures to reduce the brightness of the light to levels more compatible with computer tasks if diffusers or alternative light sources are not available. NOTE: a standard florescent light fixture on a nine-foot ceiling with four, 40-watt bulbs will produce approximately 50 foot-candles of light at the desktop level.
- Provide supplemental task/desk lighting to adequately illuminate writing and reading tasks while limiting brightness around monitors.
    - Generally, for paper tasks and offices with CRT displays, office lighting should range between 20 to 50 foot-candles. If LCD monitors are in use, higher levels of light are usually needed for the same viewing tasks (up to 73 foot-candles).

Potential Hazard:

Bright light sources behind the display screen can create contrast problems, making it difficult to clearly see your work.

Possible Solutions:

- Use blinds or drapes on windows to eliminate bright light. Blinds and furniture placement should be adjusted to allow light into the room, but not directly into your field of view. NOTE: vertical blinds work best for East/West facing windows and horizontal blinds for North/South facing windows.
- Use indirect or shielded lighting where possible and avoid intense or uneven lighting in your field of vision. Ensure that lamps have glare shields or shades to direct light away from your line of sight.

- Reorient the workstation so bright lights from open windows are at right angles with the computer screen.

Potential Hazard:

High contrast between light and dark areas of the computer screen, horizontal work surface, and surrounding areas can cause eye fatigue and headaches.

Possible Solution:

- For computer work, use well-distributed diffuse light. The advantage of diffuse lighting is that:
    - There are fewer hot spots (or glare surfaces) in the visual field.
    - The contrasts created by the shape of objects tend to be softer.
- Use light, matte colors and finishes on walls and ceilings to better reflect indirect lighting and reduce dark shadows and contrast.

Glare

Potential Hazard:

Direct light sources (for example, windows, overhead lights) that cause reflected light to show up on the monitor make images more difficult to see, resulting in eye strain and fatigue.

Possible Solutions:

- Place the face of the display screen at right angles to windows and light sources. Position task lighting (for example, a desk lamp) so the light does not reflect on the screen.
- Clean the monitor frequently. A layer of dust can contribute to glare.
- Use blinds or drapes on windows to help reduce glare. NOTE: vertical blinds work best for East/West facing windows and horizontal blinds for North/South facing windows.
- Use glare filters that attach directly to the surface of the monitor to reduce glare. Glare filters, when used, should not significantly decrease screen visibility. Install louvers, or "egg crates", in overhead lights to re-direct lighting.
- Use barriers or light diffusers on fixtures to reduce glare from overhead lighting.

Potential Hazard:

Reflected light from polished surfaces, such as a keyboards, may cause annoyance, discomfort, or loss in visual performance and visibility.

Possible Solutions:

- To limit reflection from walls and work surfaces around the screen, paint them with a medium colored, non-reflective paint. Arrange workstations and lighting to avoid reflected glare on the display screen or surrounding surfaces.
- Tilt down the monitor slightly to prevent it from reflecting overhead light.
- Set the computer monitor for dark characters on a light background; they are less affected by reflections than are light characters on a dark background.

Ventilation

Potential Hazards:

- Users may experience discomfort from poorly designed or malfunctioning ventilation systems, for example, air conditioners or heaters that directly "dump" air on users.
- Dry air can dry the eyes (especially if the user wears contact lenses).
- Poor air circulation can result in stuffy or stagnant conditions.
- Temperatures above or below standard comfort levels can affect comfort and productivity.

Possible Solutions:

- Do not place desks, chairs, and other office furniture directly under air conditioning vents unless the vents are designed to redirect the air flow away from these areas.
- Use diffusers or blocks to redirect and mix air flows from ventilation systems.
    - Keep air flow rates within three and six inches per second (7.5 and 15 centimeters per second). These air flow rates are barely noticeable or not noticeable at all.
- Keep relative humidity of the air between 30% and 60%.
- The recommended ambient indoor temperatures range between 68° and 74° F (20° and 23.5° C) during heating season and between 73° and 78° F (23° and 26° C) during the cooling season.

Potential Hazard:

Exposure to chemicals, volatile organic compounds (VOCs), ozone, and particles from computers and their peripherals (for example, laser printers) may cause discomfort or health problems.

Possible Solutions:

- Enquire about the potential for a computer or its components to emit pollutants. Those that do should be placed in well-ventilated areas.
- Maintain proper ventilation to ensure that there is an adequate supply of fresh air.
- Allow new equipment to "air out" in a well-ventilated area prior to installing.

Environment Quick Tips
• Arrange your office to minimize glare from overhead lights, desk lamps, and windows. • Maintain appropriate air circulation. • Avoid sitting directly under air conditioning vents that "dump" air right on top of you.