

Michigan Municipal Workers' Compensation Fund

Safety and Health Resource Manual

Video Display Terminal Ergonomics

Risk Factors

Scientific research and various studies have provided a significant amount of information about office workers in their work environment. This information allows us to identify several ergonomic risk factors that may contribute to discomfort and eventually to injury if not avoided or corrected through workplace adjustments.

Awkward body positions, repetitive movements, and forceful exertions are the three risk factors most associated with soft tissue injuries. Of these factors, studies have determined that awkward body positions alone can significantly increase an individual's risk of experiencing fatigue, discomfort, and soft tissue injury. Therefore, focusing on the elimination or reduction of awkward body positions can have a significant effect on improving an employee's comfort while they perform their workstation activities.

Most individuals are stronger and are most comfortable in the "neutral body position." Understanding what the neutral body position is will assist you in being able to identify when an individual is performing an awkward body position. Comfort is frequently a subjective measurement that each individual determines differently. What may be comfortable for one may not be comfortable for another. If an individual is experiencing fatigue or discomfort, the first step is determining if the individual is in a neutral body position. Variations to the neutral body position guidelines may be necessary. Employers should determine these variations with input from the individual VDT user. The following are general guidelines for achieving a neutral body position during seated work at a video display terminal (VDT) workstation.

- Ears, shoulders, and hips in vertical alignment.
- Back supported by chair or backrest.
- Feet firmly supported on floor or foot rest.
- Thighs parallel to the floor and supported evenly on the chair.
- Shoulders in neutral position (that is, not elevated).
- Upper arms near sides of body.
- Forearms approximately parallel to floor.
- Wrist in neutral position (knuckles slightly higher than wrist).
- Shoulders relaxed (not elevated).

To achieve a neutral body position, check that the position of the workstation and equipment is correct for the employee's particular body size. A rule of thumb to configuring the workstation and equipment correctly for the operator is as follows:

- Top line of screen at or slightly below eye level.
- Monitor screen approximately 20" to 26" from user's eyes.
- Keyboard and monitor lined up in front of user (unless user refers to monitor only intermittently).
- Keyboard raised (height) so that home row (ASDF) is approximately at elbow level.
- Mouse (height) positioned at elbow level and adjacent to the keyboard.
- Document holder located near monitor at same height and distance from user as VDT screen.
- Work surface height allows for appropriate arm/wrist/hand position and adequate leg space.
- Chair/seat and backrest height and angle adjusted to allow comfortable posture.

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- Shelf height within comfortable reach.
- All frequently used equipment, manuals, etc., within comfortable reach.

Awkward Body Positions

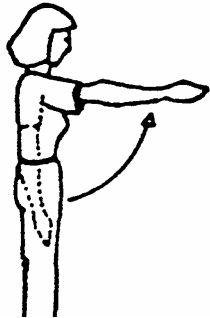
When an individual must perform an awkward body position, the risk of experiencing fatigue, discomfort, and soft tissue injury increases. Awkward body positions require more energy to perform, are generally uncomfortable, and increase the risk of a soft tissue injury. Awkward body positions most associated with seated work includes the following:



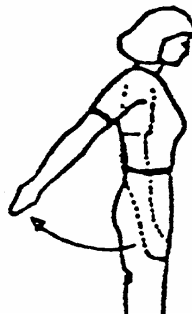
Neck Flexion



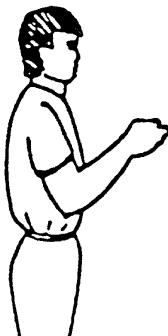
Neck Extension



Shoulder Flexion



Shoulder Extension

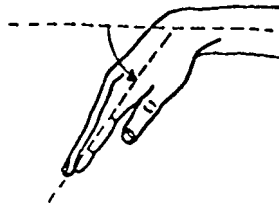


Elbow Flexion

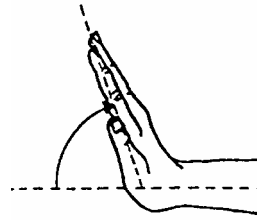


Elbow Extension

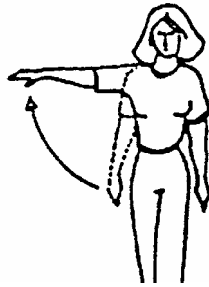
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Wrist Flexion



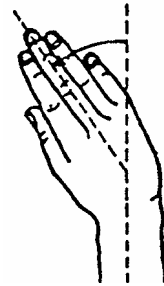
Wrist Extension



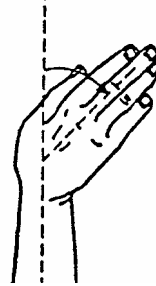
Shoulder Abduction



Shoulder Adduction



Radial Deviation



Ulnar Deviation

Noticeable deviation from the neutral position is of concern. As the severity of the awkward position increases, so does the risk of fatigue, discomfort and soft tissue injury. Once you identify that risk factors are present, the next step is to determine what is causing the risk factor to occur. Frequently risk factors are present because of poor workstation configurations or inefficient workflows. The following are some of the more common situations that cause awkward body positions to be present.

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Observation	*Possible Cause
Elbows away from the side of body.	Work surface too high. Keyboard too close to the body.
Feet on base of chair.	Chair too high.
Sitting on leg..	Chair too high. Seat pan angle incorrect.
Sitting forward on chair, away from back of seat.	Seat pan angle incorrect.. Chair too high. Keyboard too far away. Screen too far away.
Wrist resting on sharp edge or surface of desk.	Keyboard too far away. Work surface too high. Chair to low.
Wrist extension.	Wrist resting on work surface. Keyboard angle too steep. Keyboard to low. Chair to high.
Neck extension.	Screen too high. Chair too low. Bifocal or trifocal glasses used by employee.
Excessive turning/twisting of head, neck, or trunk.	Asymmetrical position of VDT or components. Poor chair support. Position of hard copy incorrect. Position of equipment/files incorrect.

* Causes can be one or any combination of the above.

Common Complaints	*Possible Causes
Neck/shoulder discomfort or pain.	Screen too high. Hard copy too far from screen. Screen off to side with keyboard central. Work surface too high. Elbows bump armrests. Keyboard or work too far away.
Back discomfort.	Chair too high or too low. Backrest not used.
Lower leg circulation cut off.	Feet not supported. Seat pan too deep. Chair too high.
General pain in back of wrist, top of forearm.	Excessive wrist extension. Keyboard too far away. Keyboard too high. Keyboard angle too steep.
Forearm pain or discomfort on palm side.	Wrist or forearm resting on work surface. Work surface too high or too low.
Wrist discomfort -- little finger, side.	Over-stretching to reach function cursor, enter keys. Striking keys with excessive force. Elbows away from body.
Numbness, tingling in little finger or little finger side of hand.	Pressure on elbow. Pressure on bottom of forearm. Resting elbow or little finger on work surface.
Pain through thumb or thumb side of wrist.	Repetitive space bar strike. Striking keys with excessive force. Folding paper -- using thumb to crease. Writing with excessive grip force. Writing with awkward thumb angle.
Eye strain.	Screen too high. Screen too far or too close. Poor resolution/clarity. Poor visual acuity. Reflection due to screen angle. Reflection due to screen position. Glare.

(This table is not exhaustive.) * Causes can be one or any combination of the above.

Once you identify that risk factors are present and determine what is causing the risk factor to occur, the final step is to identify possible solutions to correct the problem. One of the biggest obstacles to implementing potential solutions is resistance to change. Resistance to change can occur at many levels in an organization and can affect each employee differently. By including employees in the problem solving process, you will reduce resistance to change and increase the chance that they will implement potential solutions. The following are general guidelines to use when developing potential solutions.

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Adjusting the Chair

The chair is one of the most important parts of the workstation. Adjust the chair to the appropriate height for the employee's body style. If possible, adjust backrest position and angle, seat pan tilt, recline tension, and armrest position. The employees should experiment with his or her chair to identify the adjustment options of the chair. Doing so will enable the employee to make the chair fit his or her body and to work in comfort.

Adjust Equipment and Work Material

Workspace Arrangement: An organized workspace is important to reducing the effort and energy necessary to perform job functions and to improving productivity and comfort. Generally, employees should place frequently used items within comfortable reach. Unwieldy items such as heavy manuals or continually used service aids such as telephones should be close to the employee.

All components of the VDT should be in alignment, directly in front of the user. Placing either the monitor or the keyboard off center may cause the user to develop neck and back fatigue. If the employee only glances at the monitor briefly and intermittently, positioning it off center to accommodate the central placement of the source document is acceptable.

Monitor: Employees should adjust the position of their monitor to allow for ease of reading, to avoid eyestrain, and reduce glare. Most people are comfortable with the VDT monitor below eye level and at a distance of 20" to 26" from the eyes. This position prevents excessive extension or hyperextension of the neck and reduces the potential for eyestrain.

Monitor height is particularly important for individuals who wear bifocals or trifocals. It is crucial that users position their screens within their range of visual correction, for both distance and angle. For bifocal wearers, the angle is usually very low. It may be necessary for users to either take the monitor off the processing unit to lower it or raise their chairs.

To reduce eyestrain, employees should adjust the angle and/or position of the monitor to reduce light reflection and use the monitor's contrast and brightness controls to reduce glare and improve resolution. The employee can easily tilt an adjustable monitor or use a small book to tilt a non-adjustable screen. Positioning the monitor perpendicular to windows or bright light sources reduces the likelihood of glare. Other effective methods may be reducing overhead lighting and using glare filters. To improve the sharpness of the display, employees should keep their screens clean using anti-static cloths.

Keyboard: Positioning the keyboard as close to elbow level as possible allows the user to input with relaxed shoulders and neutral (straight) wrists. This reduces the potential for shoulder and arm fatigue.

Lighting: Adjust brightness and contrast controls to improve image clarity. Keep your screen clean. The levels of acceptable ambient lighting for VDT operation are lower than levels for clerical functions. The recommended standards are 30 to 50-foot candles for VDT environments; 75 foot candles for clerical functions. When job functions are both VDT and clerical, task lighting is appropriate to complement the lower levels of the ambient lighting.

Accessories: Accessory items, available from office supply sources, can help improve comfort in the workplace when employees use them appropriately. The costs for these items are reasonable for the relief they provide. Some examples are:

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- Document holder.
- Telephone cradle for frequent telephone use.
- Telephone headset for extensive telephone use.
- Anti-glare screen.
- Task lights.
- Wrist rest.
- Foot rest.

Accessories do not work for everyone or for every job function. Each situation requires an individual assessment to determine the possible effect of using an accessory. Sometimes a trial period is necessary. In any case, effectiveness depends on the appropriate use of any accessory item.

Exercise

Most people know that muscle tension can build up in parts of the body during a day of sitting in front of a VDT monitor. Exercise can relax tight muscles, reduce stress, and lessen the fatigue that can result from sitting and concentrating for extended periods. Although you have selected the right equipment and the employee has adjusted it properly, regular breaks are essential. Breaks allow the employee to keep muscles active thereby reducing fatigue. During these breaks, employees can perform some simple stretches and exercises. These might include:

wrist rotation	clench and fan	shoulder rolls	leg bends
wrist stretch	hand massage	back bends	neck stretch
thumb stretch	arm circles	hip rotation (hula hoop)	

Employees should rest their eyes by occasionally focusing on a distant object. Intentionally blinking the eyes helps to keep them moist, prevents itching, and aids in cleaning them. Another technique for relieving eye fatigue is to cup the hands lightly over closed eyes for a few moments. Encourage employees to follow through with routine eye care. Employees should provide their eye care professional with specific information regarding job functions and workstation configuration, including monitor distance and height.

Evaluating VDT Workstation Configurations

VDT ergonomics is similar to other safety and loss control processes. You need support and commitment from management for the program to be successful. After you gain support and commitment, you need learn how to identify the problems and take the appropriate corrective action. Once you are familiar with the neutral body positions and VDT workstation risk factors, you will be ready to evaluate VDT workstations. In addition to employee interviews, a workstation checklist may assist in identifying what primary cause is contributing to the issues you have identified. Attached is one example of a checklist you could use in your evaluation process. Many different styles are available.

After completing the workstation assessment, it is time to implement the best solutions that you identified during your workstation assessment process. Often times the best solution is the one that can have immediate results and does not involve a significant amount of time or money to initiate. Including the employees whom you expect to implement the proposed changes in the problem solving process will increase the chances that the implementation of is successful.

Changing routines and habits often takes time. Therefore, you should allow a minimum of two weeks as a trial period unless an implemented solution results in discomfort or pain for the employee. After the initial trial period minor adjustments may be necessary to further improve the employees comfort. However, within a relatively short time, significant improvement in how much more comfort the employee is experiencing while at their workstation should be noticeable.

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VDT Workstation Checklist

	<u>Yes</u>	<u>No</u>
Chair		
Is the individual sitting up straight?	<input type="checkbox"/>	<input type="checkbox"/>
When sitting are thighs parallel to the floor?	<input type="checkbox"/>	<input type="checkbox"/>
When sitting, are feet resting firmly on the floor?	<input type="checkbox"/>	<input type="checkbox"/>
Is seat pan adjusted so that front of seat pan is up?	<input type="checkbox"/>	<input type="checkbox"/>
Actions taken: _____		

VDT Screen		
Is the top line of the screen at or slightly below eye level?	<input type="checkbox"/>	<input type="checkbox"/>
Is video display screen glare free?	<input type="checkbox"/>	<input type="checkbox"/>
Is video display screen clean?	<input type="checkbox"/>	<input type="checkbox"/>
Actions taken: _____		

Keyboard/Calculator/Mouse		
Is keyboard as close to edge of desk as practical?	<input type="checkbox"/>	<input type="checkbox"/>
Is keyboard angle adjusted to middle or lowest position?	<input type="checkbox"/>	<input type="checkbox"/>
Is keying done without pen, pencil or other tool in hand?	<input type="checkbox"/>	<input type="checkbox"/>
Is mouse at keyboard height and adjacent to keyboard?	<input type="checkbox"/>	<input type="checkbox"/>
Actions taken: _____		

Body Position		
Are shoulders in a relaxed position?	<input type="checkbox"/>	<input type="checkbox"/>
While inputting:		
Forearms parallel to floor or slightly angled?	<input type="checkbox"/>	<input type="checkbox"/>
Wrists in neutral (close to straight) position?	<input type="checkbox"/>	<input type="checkbox"/>
Upper arms close to body?	<input type="checkbox"/>	<input type="checkbox"/>
Is body position changed throughout day?	<input type="checkbox"/>	<input type="checkbox"/>
Actions taken: _____		

General		
Are equipment, supplies, files, and manuals easily accessible?	<input type="checkbox"/>	<input type="checkbox"/>
Is the floor area free of clutter?	<input type="checkbox"/>	<input type="checkbox"/>
When talking on telephone, is telephone support by hand instead of neck?	<input type="checkbox"/>	<input type="checkbox"/>
Actions taken: _____		

Employee (Please print.	Ext	Supervisor's Name	Ext
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Date

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Optimal Position of Body and Equipment for VDT Users

The following are generic guidelines that can assist you in your efforts to improve the comfort of VDT users. Variations in specifications may be acceptable and should be determined individually.

Optimal position of body while seated at VDT:

1. Ears, shoulders, and hips in vertical alignment.
2. Arch in back supported by chair or pillow.
3. Feet flat on floor or stool.
4. Thighs supported evenly on chair.
5. Shoulders in neutral position (i.e., not elevated).
6. Upper arms near side of body.
7. Forearms approximately parallel to floor.
8. Wrist in neutral position (knuckles slightly higher than wrist).

Optimal equipment position:

1. Top line of screen slightly below eye level or lower.
2. Monitor screen at approximately 20 to 26 inches from user's eyes.
3. Keyboard and monitor positioned in alignment in front of user's eyes (unless employee only uses monitor intermittently).
4. Keyboard (height) positioned such that home row (ASDF) is at approximately elbow level.
5. Mouse (height) positioned at elbow level and as central as possible.
6. Document holder located near monitor at same height and distance from user as screen.
7. Work surface at height to allow appropriate arm/wrist/hand position while also allowing adequate leg space.
8. Chair, seat and backrest height and angle adjusted to allow comfortable posture.
9. Shelf height and location within comfortable reach.
10. All frequently used equipment, manuals, etc. within comfortable reach.

