



**CRISTA University**  
Workforce improvement through lifelong learning

## **ERGONOMICS**

This handout contains information on ergonomics, which is the science of maximizing workplace production while reducing the employee's fatigue and discomfort. The sources of information are Midwest Employers Casualty Company and the Washington Department of Labor and Industries.

When an employee has concerns about workplace safety or comfort:

- Concern should be immediately referred to the supervisor.
- For issues of workplace comfort, a Safety Committee Representative can be consulted.
- An Incident Report should be generated, to document the concern.
- For additional information or resources, contact the Human Resources Department at ext. 7506.

Alan Pryor, Human Resources  
Ext. 7323

## What is Ergonomics?

Derived from two Greek words:

“**Ergon**” meaning work

“**Nomic**” meaning natural laws

### ***American Heritage Dictionary***

The applied science of equipment design, as for the workplace, intended to **maximize productivity by reducing operator fatigue and discomfort**. Also called *biotechnology, human engineering, human factors engineering*.

## Types of Ergonomic Corrective Actions

### **Engineering Controls**

Example - provide a vacuum hoist for lifting the occasional heavy box.

### **Administrative Controls**

Example - job rotation plan where employees rotate into a different job every 1-2 hours.

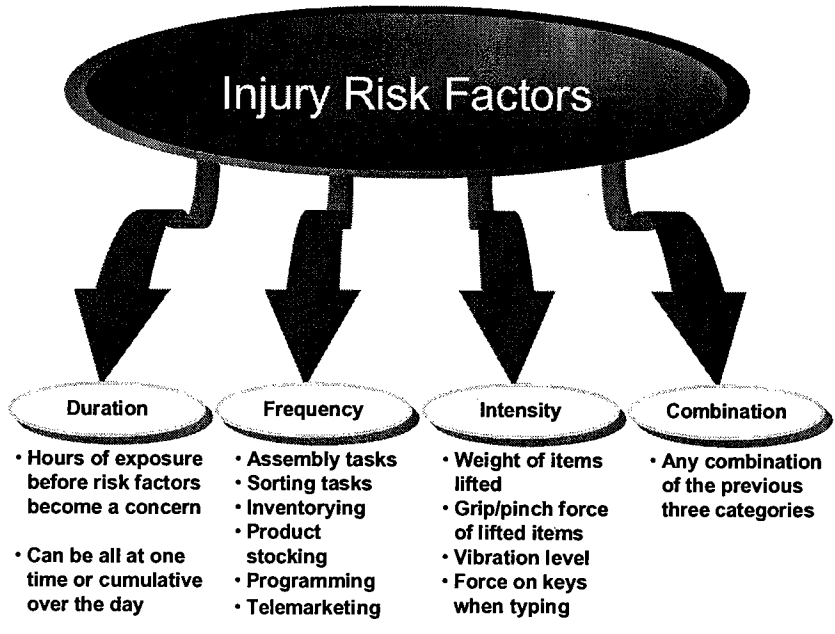
### **Work Practice Controls**

Example - instructing workers to use a whole hand grip instead of an inefficient pinch grip.

# OSHA is here to help!



- eTools**
- [Hospital eTool: HealthCare Wide Hazards Module - Ergonomics](#)
  - [Poultry Processing Industry eTool - Other Resources](#)
  - [Hospital eTool - Healthcare Wide Hazards - References](#)
- Publications, Posters, Forms**
- [Ergonomics Program Management Guidelines For Meatpacking Plants](#)
  - [Servicing Single-Piece and Multi-Piece Rim Wheels](#)
  - [Materials Handling and Storage](#)



**INNOVATION STRENGTH PARTNERSHIP SERVICE BEST PRACTICES**



## Injury Risk Factors Applied

Duration

Frequency

Intensity

Combination

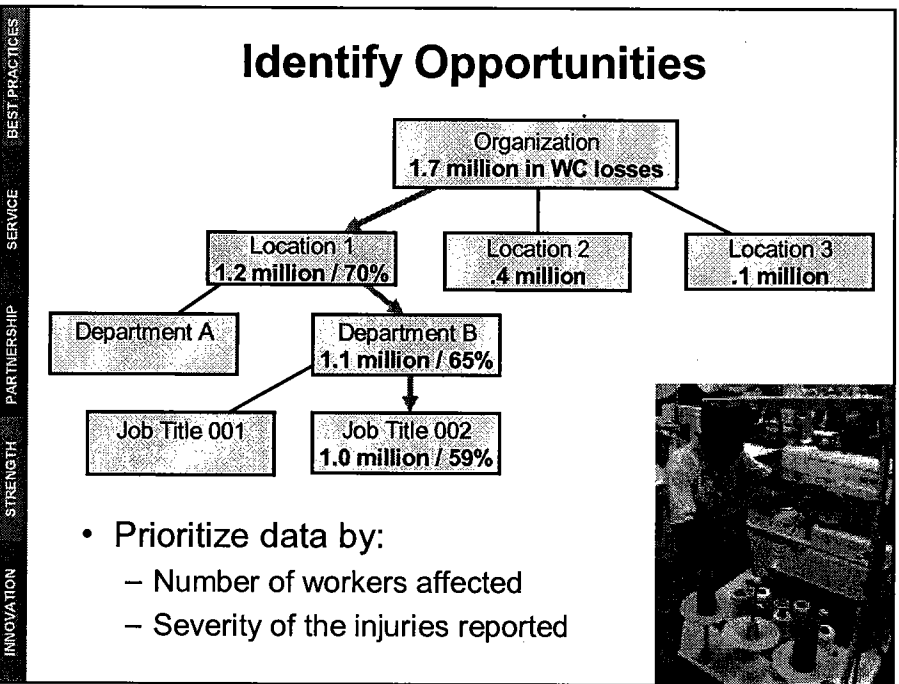
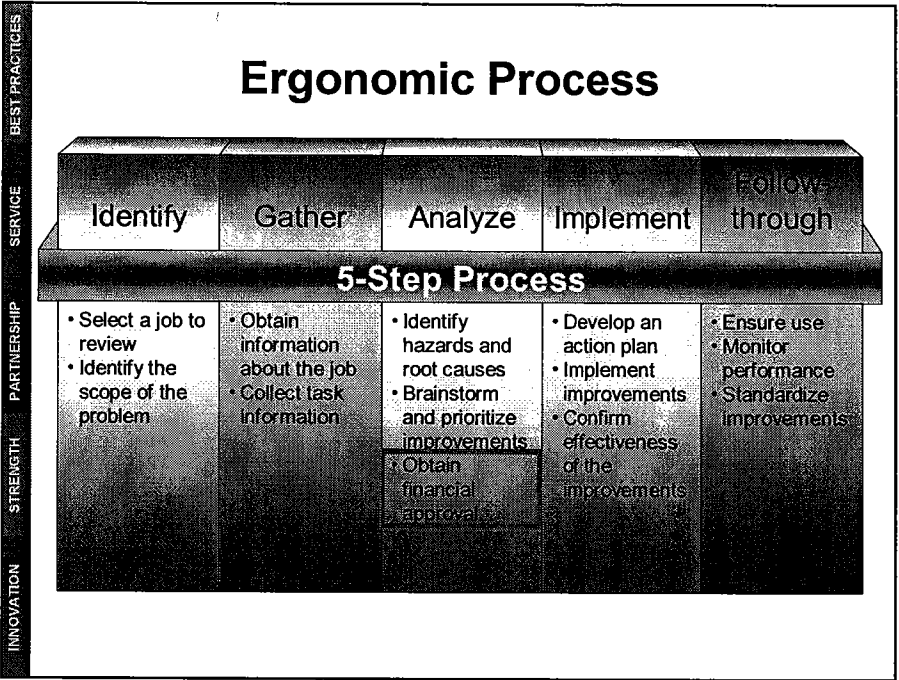


**INNOVATION STRENGTH PARTNERSHIP SERVICE BEST PRACTICES**

## Types of Ergonomic Injuries

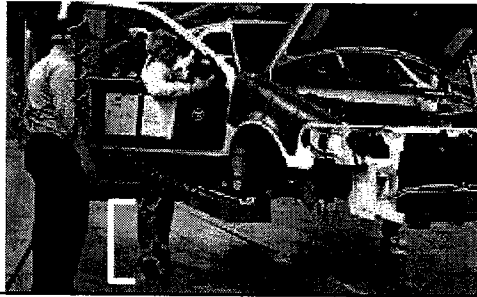
- CTD's (cumulative trauma disorder)
- RSI's (repetitive stress injuries)
- RMI's (repetitive motion injuries)

CTD's, RSI's and RMI's are all MSD's, musculoskeletal disorders which can affect muscles, tendons, nerves, joints and spinal disks



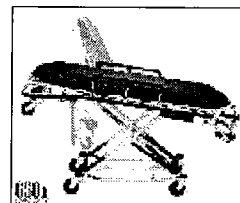
## Gather Information

- Talk to the operator(s)
  - Identify steps in job
  - Determine difficulties in the job
  - Discuss ideas for improvement
- Try the job yourself



## Analyze the Job

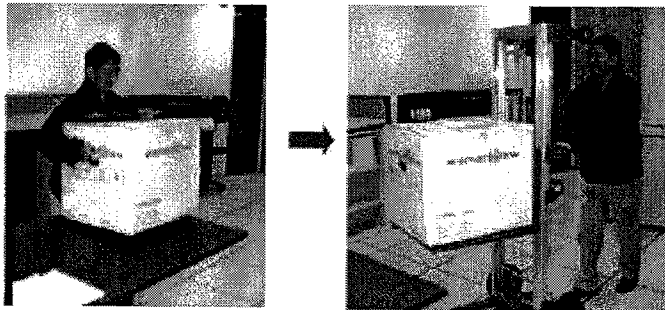
- Identifies work positions or motions that may put workers at risk of developing MSD
- Identify options to improve the job
- Provides simple solutions to musculoskeletal stressors (i.e., “quick fixes”)
- Obtain management support in terms of financial resources



## Basic Behavioral Based Safety Process Steps

1. Establish a core team to guide the process
2. Develop an inventory of at risk behaviors
3. Train coaches in the skills of observing, listening, and providing constructive feedback
4. Have coaches conduct observations and monitor results

## Mechanical Assistance



What reasons might the employee have for not using the portable lift?

## Why Employees Choose to Not Perform Critical Ergonomic Behaviors

- Employee is not fully unaware of the at risk behaviors
- Old habits are hard to break
- Peer Pressure
- Perceived short-term benefit of performing the incorrect behavior

### Key Point

An employee's behavioral choices are as important as the solution itself. **Without an employee's acceptance**, a good solution can be rendered ineffective by poor behavioral choices.



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## Definition

**Critical Ergonomic Behavior**  
A specific, observable behavior necessary for an employee to perform a job in a safe, productive, and ergonomically correct manner

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## Why Traditional BBS Efforts Fail with Ergonomics

- Are critical behaviors too “general”?
  - Don’t lift above your shoulders
  - Avoid reaching
  - Bend knees while lifting
- Observer/coach issues
  - Do not have ergonomic training
  - Unwilling to correct employees
  - Failure to believe in the program
  - Do not have time for another management initiative

## Risk factors for WMSD's

Ergonomists have examined a number of jobs where there have been a high incidence of WMSD's, and have found some common elements present in each of these jobs which are associated with these injuries. These elements are called *risk factors*, because exposure to them increases the chance that a worker will become injured. The following are examples of risk factors that are found in office work, some or all of which may be present at the same time:

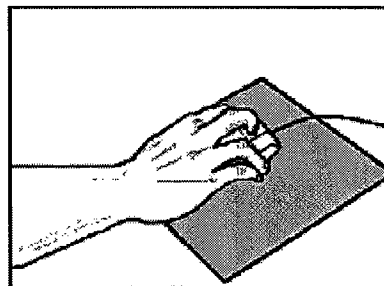
### Common Risk Factors

- Repetition
- Static Loading or Sustained Exertions
- Awkward Postures
- Mechanical Contact Stress

### FORCE

## Repetition

Performing the same or similar motions repeatedly can result in trauma to the joints and surrounding tissues. Without time for rest and recovery, repetition can lead to injury.



**Repetitive mouse use has been associated with WMSD's**

### Examples:

#### Computer Work

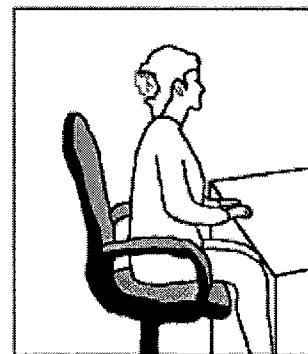
- typing at the keyboard
- moving and clicking the mouse
- looking back and forth between the monitor and source documents

#### Office Work

- flipping through files and paperwork
- using a calculator
- writing by hand
- stapling and three-hole punching by hand

## Static loading or sustained exertions

One of the risk factors that has increased in the computerized office is *static loading*, where the muscles must hold the body in a single position for a long period of time. This lack of movement reduces circulation and causes muscle tension, which can contribute to or aggravate an injury. *Sustained exertions* are a type of static loading where force is applied continuously for long periods of time.



**Avoid sitting without back support**

### Examples:

#### Computer Work

- holding the hands in place above the keyboard or mouse
- holding down the Shift key
- keeping the head still while reading from the monitor
- sitting still for long periods of time

#### Office Work

- looking down at documents laying flat on the desk
- sitting upright without back support
- holding the handset while talking on the telephone
- holding boxes in the hands while carrying them long distances

## Awkward postures

Postures that bend the joints into positions where they are more likely to become injured are termed awkward postures.

### Examples:

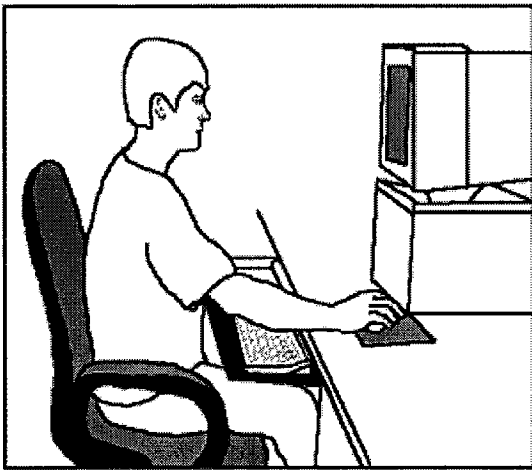
#### Computer Work

- typing with bent wrists
- turning the head to the side to view the monitor
- reaching up and over the keyboard to use the mouse
- leaning over to type in data from papers laying flat on the desk

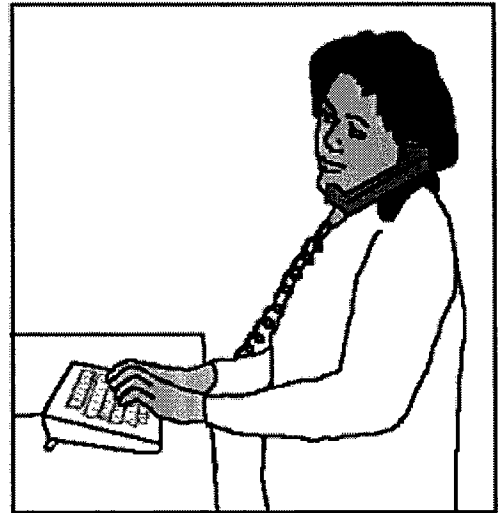
#### Office Work

- slouching or leaning forward in the chair
- cradling the phone between the ear and the shoulder
- elevating the arms when writing on a work surface that is too high
- bending at the waist to load copy machines

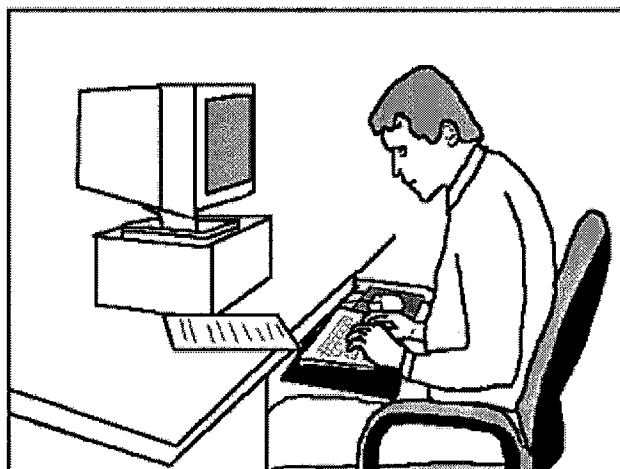
### Avoid awkward postures such as:



Reaching forward to use the mouse



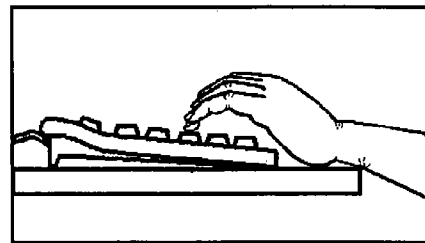
Hunching one shoulder to cradle the phone



Looking down at papers laying flat on the desk

## Mechanical contact stress

A hard or sharp surface or object pressing into the soft tissues -- the tendons, nerves and blood vessels -- can cause damage that over time can result in serious injury. This damage is termed *mechanical contact stress*.



**Sharp edges can damage soft tissues**

### Examples:

#### Computer Work

- resting wrists on the desk edge while typing or using the mouse
- leaning the elbows on hard chair armrests or work surfaces
- typing with palms resting on the hard lip of a keyboard tray

#### Office Work

- using rubber stamps with handles that press into the palm of the hand
- using scissors with hard, metal handles
- sitting in a chair that places pressure on the backs of the thighs

## Force

Many office tasks require a moderate amount of force to be applied by very small muscles, which may cause fatigue, swelling, muscle strains and ligament strains.

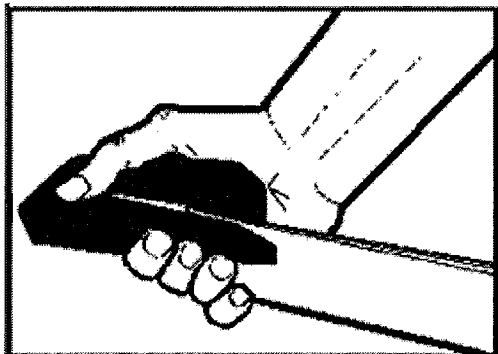
### Examples:

#### Computer Work

- "dragging and dropping" with the mouse
- gripping the sides of the mouse tightly
- "pounding" on the keyboard

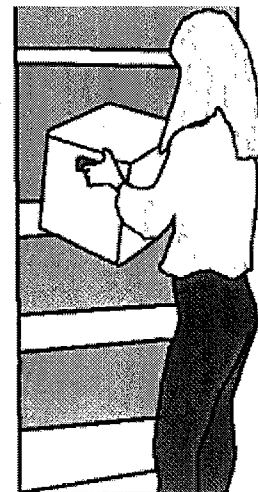
#### Office Work

- grasping thick file folders or manuals
- stapling or stamping by hand
- opening 3-ring binders
- lifting heavy manuals with one hand



**Stapling by hand can require high forces**

In addition, there is still the occasional need to lift items such as computer equipment and boxes of copy paper or files. Most office workers are not trained in proper lifting techniques. Also, seated work tends to weaken the stomach muscles, which would ordinarily help support the spine when lifting. Both of these factors place office workers at a greater risk for injury, even from the occasional lift.



## Ergonomics Tip

### Neutral posture at your workstation helps prevent injury

In order to understand the best way to set up a computer workstation, you first need to understand neutral posture. This is a comfortable working posture in which your joints are naturally aligned and your risk of developing a musculoskeletal disorder is reduced.

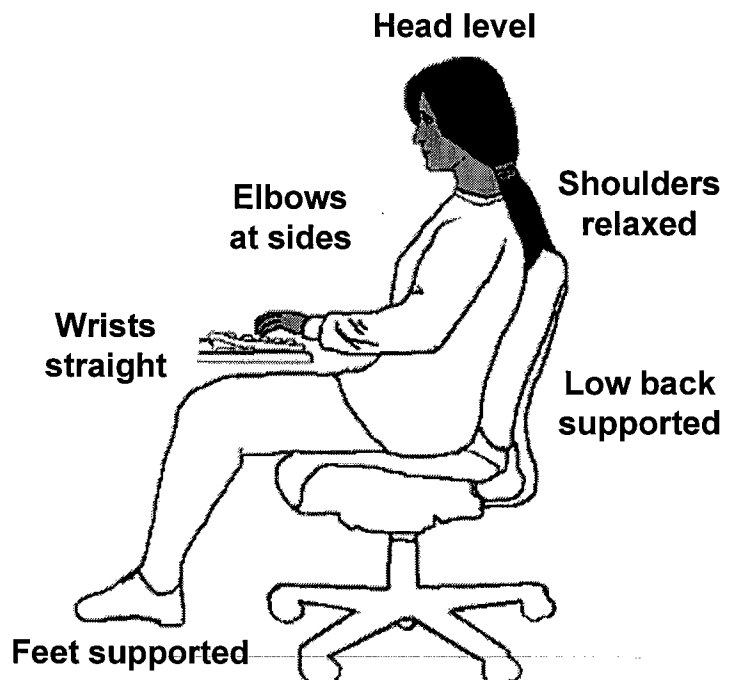
### Change postures frequently

Regardless of how good your posture may be, sitting still for long periods of time isn't healthy. You should make small adjustments to your posture about every 15 minutes, by changing the height of your chair slightly, or leaning back a little further into the backrest. Larger changes in posture are also important; stand up and stretch or walk around for one or two minutes every hour.

### Practice neutral posture while seated

The following are the important components of neutral posture while seated:

1. Keep your head level or tilted slightly downward. Place your work in front of you so that you are looking straight ahead.
2. Sit with your shoulders relaxed, not elevated, hunched or rotated forward.
3. Keep your elbows close to your sides and bent at about a 90° angle, not extended out in front of your body.
4. Use the chair's backrest to support your lower back, or lumbar curve.
5. Sit with your entire upper body upright or leaning slightly back.
6. Keep your wrists straight while you work, not bent up, down or to the side.
7. Sit with your knees at the same level or slightly below the level of your hips. There should be no pressure points along the backs of your thighs or at the backs of your knees.
8. Place your feet slightly out in front of your knees and make sure they are comfortably supported, either by the floor or by a footrest.

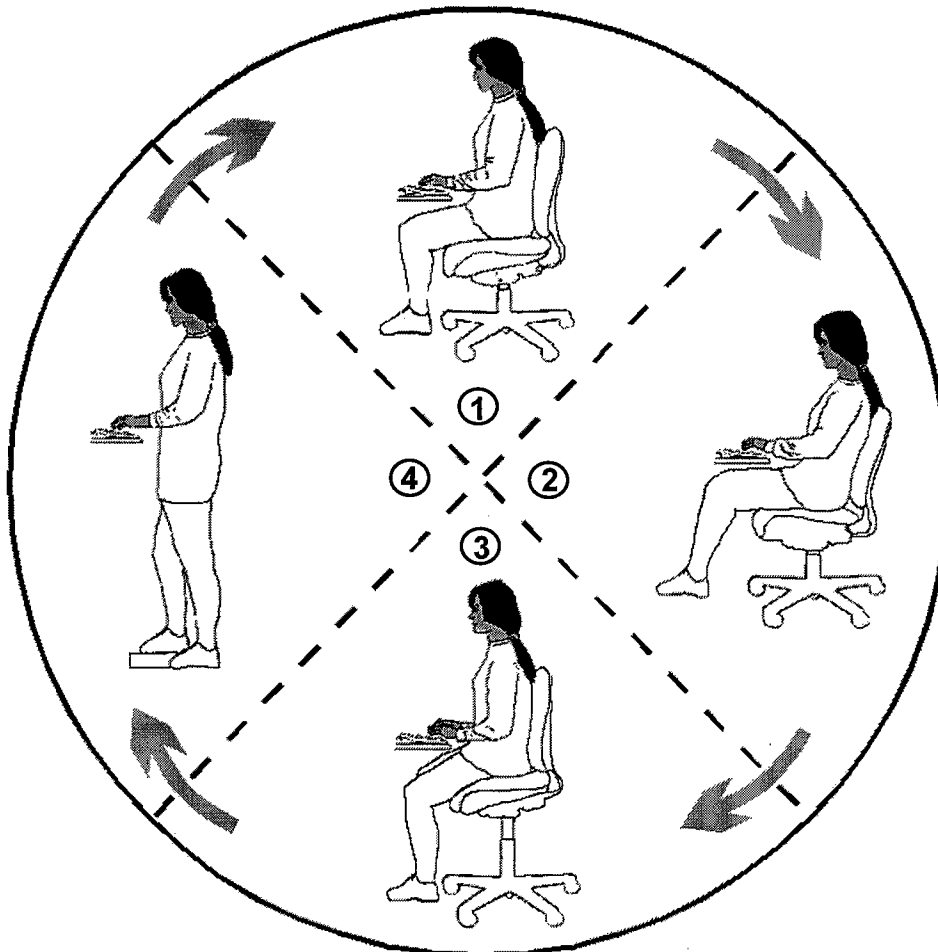


### Pay attention to overall posture

Although the components of neutral posture are listed individually above, it is really the posture of your body as a whole that is important. Having just one part of your body out of neutral can affect the rest of your posture. Try sitting with your feet hooked under your chair. You will notice that this tends to pull you forward in your seat, away from your chair's backrest. Now place your feet out in front of you and you will notice that it is much easier to lean back into the chair. Similarly, if you place your monitor too low on your desk, this will also tend to make you lean forward to view it. Practice adjusting your workstation to achieve a neutral posture for your whole body. It may help to have a co-worker take a look at you while you work and give you feedback on your posture.

## There is no single "correct" posture

There are many variations of neutral posture, and depending on what tasks you have to perform and the furniture in your workstation, you may find one of these alternatives to be more comfortable for you. These variations are also useful when changing postures throughout the day.



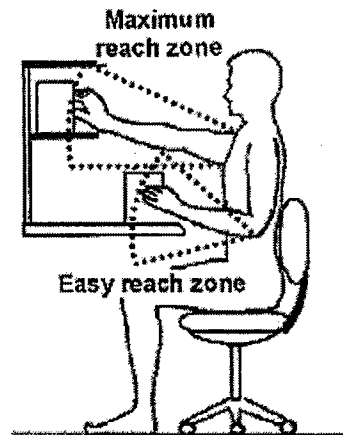
- ① **"90-degree" posture:** Sit upright with your elbows, hips and knees bent at right angles and your feet flat on the floor or on a footrest. This position is biomechanically correct, but it can fatigue your back muscles over time. Fatigue can lead to slouching, even on a chair with lumbar support.
- ② **Reclining posture:** Lean back  $10^{\circ}$  -  $20^{\circ}$  into the chair's backrest and put your feet out in front of you to open up the angle at your hips and knees. This helps relax your back muscles and promotes blood circulation. Leaning back too far can result in an awkward neck posture when trying to keep your head upright, however.
- ③ **Forward tilt posture:** Raise the height of your chair's seat a few inches and tilt the front of it downward about  $8^{\circ}$ . This will open up your hip angle and allow you to support some of your weight using your legs rather than having it all rest on your hips and the backs of your thighs. You may not find this posture comfortable if you have knee or foot problems, or if you feel like you are sliding off the front of the seat. A contoured chair seat can help to hold you in place.
- ④ **Standing posture:** Standing provides the biggest change in posture, and is a good alternative to prolonged sitting, which can aggravate low back injuries. It can be fatiguing, however, so have a counter height chair available at standing workstations, or use a height adjustable sit/stand workstation. Also, prop one foot up on a low footrest occasionally to help shift your weight.

## Ergonomics Tip

### Organizing your work area

The way you organize your work affects your body's position and the amount of reaching that you have to do. Long reaches to pick up heavy objects or items that you use frequently can contribute to discomfort and injury. This is because reaching puts your body in an awkward position and stretches your muscles beyond their normal limits, making them vulnerable to pulls and strains.

An important concept to think about is how far you can reach without straining your body (*reach zones*). You can determine your **easy reach zone** by moving just your hands and forearms with your elbows at your sides and your shoulders relaxed. For most people, this is an area about 16" to 18" in front of their body. The other zone you need to consider is your **maximum reach zone**, which is how far you can reach just by moving your arm at the shoulder, without leaning forward. For most people this is an area about 26" to 34" in front of their body.



Keep these items in your easy reach zone:

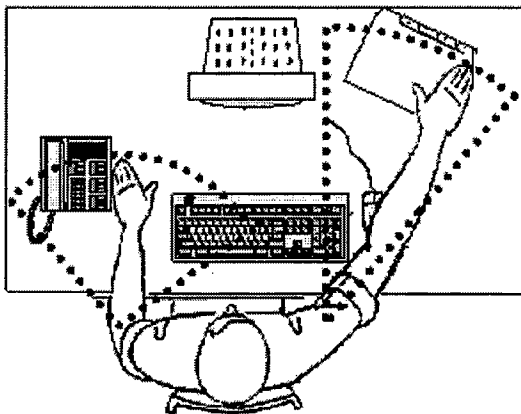
- Frequently used items
- Items that require finger dexterity to use (keyboard, mouse, telephone)
- Items that require hand force to use (stapler, 3-hole punch, staple remover)
- Heavy objects (large binders, manuals, telephone books)

Try to keep items that you use less frequently within your maximum reach zone.

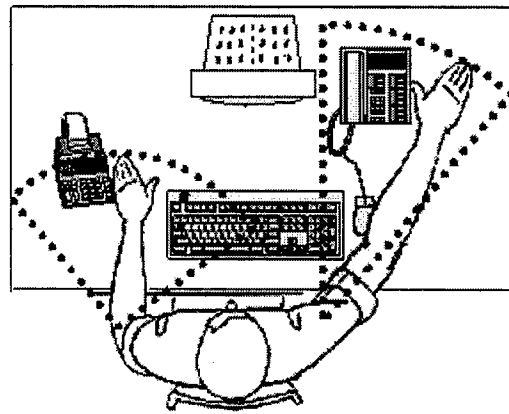
Stand up to reach items that are above your shoulder height or beyond your maximum reach zone.

### Customizing your work area

Depending on what your job requires, you might have a different layout than your co-workers. For example, a receptionist might need to have the telephone within easy reach, while an accountant might need to have the calculator closer than the telephone.



Receptionist's Work Area



Accountant's Work Area

You are the best judge of how to arrange your work area, since you know what you use the most often. If you take the time to bring everything into its appropriate reach zone, you'll not only be more comfortable as you work, but also more efficient.

### Avoiding eye strain at the computer

If you experience symptoms of visual discomfort, or eye strain, at the computer you are not alone; it's the most common complaint among computer users. The following will help you understand the causes of discomfort and what you can do about it:

#### Lack of blinking

A common complaint among computer users, especially those who wear contacts, are dry or itchy eyes. This is mainly due to the fact that we tend to blink only one-fifth as much when looking at a computer monitor when compared with reading from paper. Combined with the low humidity levels found in many offices, this results in a drying and irritation of the eyes. If you experience dry eyes, try lowering your monitor so that you are looking slightly down (see the **Monitor height** section below) in order to promote blinking. Make sure that exhaust fans from equipment and from the building's ventilation system aren't blowing directly on you. If dryness and irritation persist, see your eye care specialist.

#### Close work

Your eyes are adapted for distance vision; they are most relaxed when you are "staring off into space". However, most of the work that you do in the office, whether it's reading from papers or the computer monitor, is done relatively close to your eyes, and this can cause eye strain. This is because small muscles within your eyes have to work to turn your eyes inward and change the shape of the lenses to focus for near vision. When these muscles fatigue you can experience symptoms of tired, sore eyes the same way that your back muscles will feel tired and sore if you sit for too long in the same position.

#### Visual angle

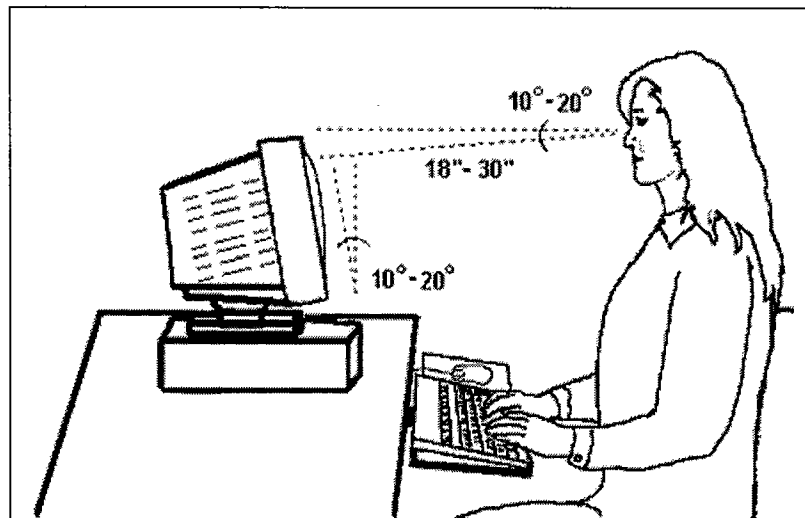
When you look down, your eyes have a natural tendency to turn inwards and focus for near vision, since objects that are lower in your field of vision tend to be closer to you. The opposite is true of looking straight ahead or upwards - your eyes tend to turn outwards and focus at a distance, and you will have to work harder to focus on close objects with your head in this position. This is why, when reading from a book or a newspaper, we tend to hold it below eye level. If you read from a monitor or document that is located at eye level or higher, it can contribute to eye strain.

#### Monitor location

While having your monitor too close or too high can increase your chances of having eye strain, having it too low or too far away can result in awkward postures as you lean forward to view it.

#### Symptoms of eye strain

- dry or itchy eyes
- tired eyes
- sore eyes
- blurred or double vision
- headaches



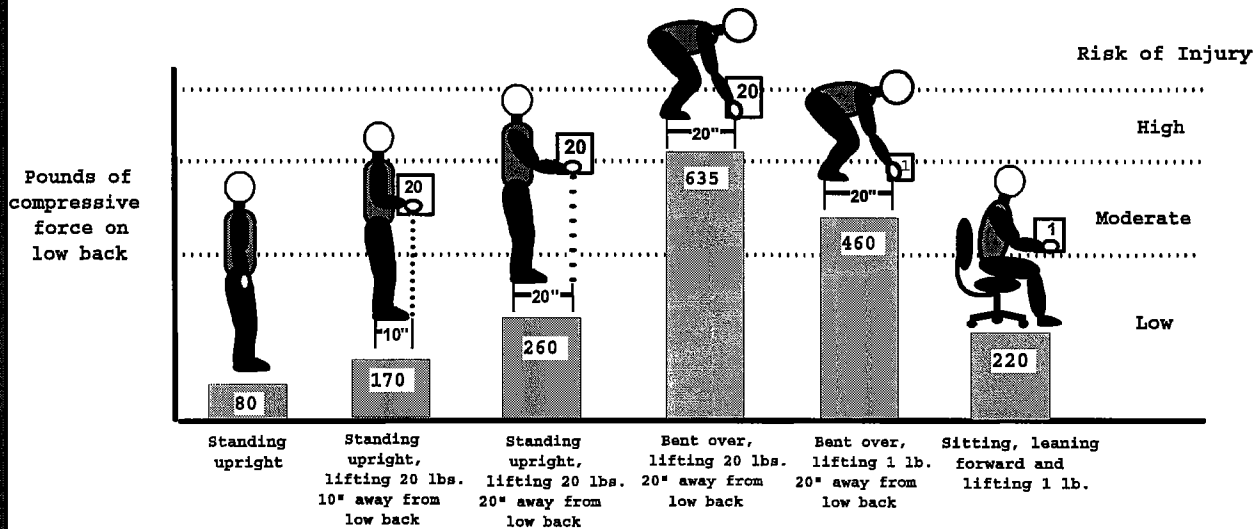
Proper monitor height and distance to prevent eye strain. **Place the monitor at least 18" from your eyes, but close enough so that you can easily read the text without squinting or leaning forward. Adjust the height of the monitor so that the top of the screen is about 10 to 20 degrees below your horizontal line of sight, and tilt it up about 10 to 20 degrees so that the screen remains perpendicular to your gaze. If you wear bifocals, trifocals or progressive lenses you may have to locate the monitor even lower to keep your head level.**



## Ergonomics Tip

### Your lifting posture affects your risk of injury

The weight of the objects you lift is an important factor in determining your risk of injury, and you will want to be especially careful when lifting heavy items such as storage boxes full of files and cases of copy paper. However, weight is not the only thing that determines your risk of injury. The figure below shows the effect that posture can have when combined with lifting different size loads:



Force estimates based on the Michigan 2-D Static Strength Model

### Remember the following when lifting:

- 1. Keep the load close:** Holding a 20 pound object with your hands 20 inches from the body creates more compressive force on your low back than holding it 10 inches away. This is because the muscles in your back have to work harder to counterbalance the weight when it is further from the body. **As the compressive force on your low back increases, so does the risk of muscle strains, ligament sprains and damage to disks in the spine.**
- 2. Avoid lifting from the floor:** Lifting from the floor can greatly increase your risk of injury for two reasons. Firstly, it is difficult to bring objects close to your body when picking them up from the floor, especially large objects where your knees can get in the way. Secondly, your low back must now support the weight of your upper body as you lean forward, in addition to supporting the weight of the item you are lifting. Lifting the same 20 pounds from the floor more than doubles the amount of force on your low back when compared with lifting it from waist height. Even a one pound object lifted from the floor increases your risk of injury if you use a bent over posture.
- 3. Plan ahead:** Decide how you will lift, carry, and place the item before you pick it up. Test the weight of the load by moving or tipping it before you pick it up. Figure out if you can break the load down by placing the contents of a large container into a number of smaller ones before moving them.
- 4. Get help when you need it:** Don't try to lift heavy or awkward loads on your own. Even though the muscles in your upper body may be strong enough to handle the load, the muscles, ligaments and disks in your low back may not be because of the additional forces they have to withstand. Get help from a co-worker, and whenever possible, use a cart, hand truck or other mechanical device to move the load for you.



# Training

## Carrying the Load

- Make sure you can see
- Hold the load close to your body to lessen the strain on your lower back
- Take small, stable steps
- Avoid turning or twisting while holding the load
- Turn by pivoting your feet, not your back
- Avoid lifting heavy loads above your waist