

# Office Ergonomics Program

**Safety & Security Services**

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## Glossary

**Adaptation:** The process by which an individual is able to tolerate small departures from the optimal design of objects and environments with which the person interacts. An example of adaptation is the process by which the eye adjusts to the brightness or dimness of a room. Another example is the tolerance of a chair that may be a little too high or a little too low, but is still considered acceptably comfortable.

**Administrative Controls:** Procedural control measures that when implemented will eliminate or reduce the severity of the musculoskeletal disorder (e.g., adjustment of work pace, use of rest periods and assignment to a different work station).

**Anthropometry:** The study and measurement of the dimensions of the body and other physical characteristics.

**Anthropometric Dimensions:** the dimensions of the human body, of which there are two main types: 1) static anthropometrics, the skeletal dimensions of the body; and 2) dynamic anthropometrics, the distances measured when the body is in motion or engaged in a physical activity.

**Awkward posture:** any position of the body while performing work activities that is associated with an increased risk for injury. (See **Musculoskeletal Disorders**)

**Biomechanics:** The study of the body's physical response to static or dynamic motion, and the effects of internal and external forces that affect that response.

**Carpal Tunnel Syndrome:** a chronic disorder of the hand and wrist, due to a compression of a nerve; usually caused by repetitive work that puts stress on the wrist joint and heel of the hand. Symptoms can include tingling and numbness in the hand, as well as a loss of dexterity and strength in the hand.

**Control:** a physical device that allows for a human operator to interact with a machine or perform a task. An example of a control is a keyboard, with which an operator can use to manipulate the functions of a computer. Another example of a control is a light switch.

**Control/Display Compatibility:** the degree to which relationships between controls and displays are consistent with user expectations. For example, a person may have expectations concerning the movement of a control and its expected effect on a display based on a previously formed stereotype of that movement.

**Deviation:** Movement of a body part towards the extreme in its range of motion; usually associated with risk of injury.

**Engineering Controls:** Mechanical measures such as the physical modification of the work station by providing adjustable chairs, tables and/or tools.

**Ergonomics:** (also called human factors) the scientific discipline concerned with the understanding of the interactions among human and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance. [Definition provided by IEA Executive Council 2000.]

**External stress:** stress on the human system caused by an aspect outside of the body, such as the task itself, the physical environment, work-rest schedules and social relationships.

**Fatigue:** A loss of work capacity that results when the body depletes its energy stores and is unable to maintain a steady level of performance.

**Focused attention:** attending to one information source, while disregarding other sources of information.

**Frequency of use principle:** the notion that the arrangement of equipment, displays, and controls should be laid out in such a way that the most frequently used components are in the most accessible positions.

**Glare:** Extraneous light from any source can affect visual performance. Glare may reduce contrast and cause a decrease in visual acuity.

**Grip span:** The distance a hand must span in order to grip an object.

**Human factors:** Considering design and engineering in order to better match the capabilities, limitations, and needs of people.

**User interface:** The user interface is the element of the control or system where the human and machine interact. It may be a visual display terminal, a control panel, or another mechanism. The human inputs information and the machine provides feedback. A transfer of information occurs through the user interface.

**Local fatigue:** Fatigue of one part of the body, such as the wrist, resulting from stress to that area.

**Lumbar:** The lower end of the spine, often known as the “small of the back”, is known as the lumbar spine. It is an area that may be strained or tired when an individual is seated for extended periods. Office chairs, backrests, or back pillows may be designed to provide lumbar support.

**Musculoskeletal Disorder (MSD):** Any physical disorder that results from or is aggravated by the cumulative effect of biomechanical stress to tendons, tendon sheaths, synovial lubrication of the tendon sheaths and related bone, muscles, the nerves of the hands, wrist, elbows, shoulders, neck and back. Some examples include carpal tunnel syndrome, pinched nerves, or sciatica.

**Neutral posture:** A posture aligning the body, minimizing physical stress, maximizing comfort, and reducing risk of musculoskeletal disorders.

**Occupational Injury:** An occupational injury can be any injury resulting from a work-related event. Some examples that may be related to ergonomic concerns are:

- Carpal tunnel syndrome (CTS)
- Sciatica
- Tendonitis
- Low back pain

**Performance specification:** Describes the ideal function of a system or tool. Indicates the functions necessary for the item to successfully meet objectives.

**Radial deviation:** A wrist posture characterized by an inward bend of the wrist.

**Risk Factors:** Factors contributing to an increased risk of problems. Some conditions of a work environment or system may increase physical stress, including awkward postures, repetitive strains, or poor lighting.

**Static Load:** When a body remains immobile for long period of time, physical stress may increase. The static load is the amount of stress occurring without movement.

**Tendonitis:** Inflammation of the tendons, which connect muscles to bones in some parts of the body, may result in a condition known as tendonitis.

**Usability:** Ease of use, or usability, is an important criteria when evaluating tools or controls from an ergonomic perspective. Many factors, including the location, size, shape, and adjustability may affect usability.

**VDT:** A computer monitor may also be called a Video Display Terminal.

**Workplace Ergonomics Program:** A program that may be instituted by a corporation or organization as a service to employees. Professional ergonomic evaluations may be used to evaluate, prevent and manage work-related musculoskeletal disorders. The main elements of an ergonomics program often include workstation analysis, training, and education.

**Work Practice Controls:** Modifications in the manner an employee performs the physical work activities of a job that decrease or control exposure to MSD hazards.

**Workstation:** The area where a worker completes tasks or jobs. May be an office, a desk, or other workspace. More than one type of work may happen at a single workstation.

**Wrist flexion:** A posture where the hand and the wrist are curved downward. Wrist flexion creates friction and tendon stress, leading to fatigue and injury.

## **What is Ergonomics?**

The word ergonomics is comprised from two Greek words; “*ergos*” (work) and “*nomos*” (laws).; therefore, we have the laws of work. Ergonomics can be defined as the science of matching work or tasks to the body.

Ergonomics can be further defined as the design of the workplace, equipment, machine, tool, product, environment and system taking into consideration a human’s physical, physiological, biomechanical and psychological capabilities.

## **What are the benefits of Ergonomics**

- Increased productivity
- Improved health and safety
- Increased job satisfaction
- Increased work quality
- Increase in overall employee morale.
- Decreased injuries, illnesses, and workers’ compensation costs.
- Decreased absenteeism and turnover.
- Less likelihood of WSIB or MOL fines

## **Reporting Procedure**

### *Known or Suspected Injury*

Any college employee who knowingly or suspects they have a musculoskeletal disorder should immediately have it diagnosed by Health Services or their personal physician. Employees must also alert their manager of the injury immediately. The employee and the manager will fill out an Incident /Accident Report and submit to OHS.

### *Worksite Analysis or Ergonomics Assessment*

Worksite analysis identifies problem jobs or job tasks and risk factors associated with them. This essential preliminary step helps employers determine what jobs and workstations are the source of the greatest problems. All employees who wish to have a worksite analysis or ergonomics assessment

A worksite analysis or ergonomics assessment shall be initiated by one of the following:

- Human Resources Accommodation ; or
- Contacting OHS at Ext 7142.

## **Workplace Ergonomic Related Injuries**

Workplace ergonomic-related injuries are defined as any physical disorder that results from or is aggravated by the cumulative effect of biomechanical stress to tendons, tendon sheaths, synovial lubrication of the tendon sheaths and related bone, muscles, the nerves of the hands, wrist, elbows, shoulders, neck and back. Workplace ergonomic-related injuries are also known as musculoskeletal disorders (MSDs), Repetitive Strain Injury (RSI), Cumulative Trauma Disorder (CTD) and Repetitive Motion Injury (RMI).

Some examples include but are not limited to:

- Tendonitis
- Carpal Tunnel Syndrome
- Tennis Elbow
- Neck and Back injuries
- Strains/Sprains
- Bursitis
- Thoracic Outlet Syndrome
- DeQuervain's Syndrome
- Trigger finger

Over the past fifteen years there has been a noticeable increase in amount of workplace ergonomic-related injuries. In fact these injuries are responsible for 42 per cent of all lost-time injuries, causing serious pain and suffering for workers in Ontario and economic loss for employers.

The following is a list of risk factors that are major contributors to workplace ergonomic-related injuries:

### ***Repetition***

- Occurs when the same or similar movements are performed frequently.
- Repetition can also occur when different tasks are performed if those tasks have the same movements.
- Injury may result from repetition when the tissues do not have adequate time to recover.

### ***Force***

- Force is the amount of physical effort required by a person to do a task or maintain control of tools or equipment.
- A pinch grip produces 3-5 times more force on the tendons in the wrist than a grip with the whole hand.
- With excessive force the muscles are contracting much harder than normal, this can lead to stress on the muscles, tendons and joints.

### ***Duration***

- Continuous tasks for long periods of time will contribute to muscle fatigue.
- This fatigue can lead to discomfort and even injury.

### ***Recovery time***

- It is important to have adequate recovery time, to avoid fatigue and injury.
- Employees are encouraged to alternate tasks or take micro breaks when they feel to onset of pain and fatigue.

### ***Awkward Posture***

- Is a deviation from the “neutral” body position?
- A “neutral” body position is safest and most efficient position in which to work.
- Awkward posture puts stress on muscles, tendons and joints.

### ***Static Posture***

- Static posture occurs when one position is held for a prolonged period of time.
- During a static posture the muscles will become fatigued from a lack of blood, oxygen, and nutrient, flow. This will cause lactic acid to build up.
- This fatigue can lead to discomfort and even injury.

### ***Contact Stress***

- Contact stress is caused by any sharp or hard object putting localized pressure on a part of the body.
- Contact stress will irritate local tissues and interfere with circulation and nerve function.

### ***Environmental***

- Environmental conditions such as extreme heat or cold can place stress on tissues.
- Extreme cold constricts blood vessels and reduces sensitivity and coordination of body parts.
- Excessive heat can result in increased fatigue and heat stress.

### ***Vibration***

- Exposure to vibration can occur while using power tools or while driving equipment.
- Vibration from power tools can place stress on the tissues of the fingers, hand and arms.
- Whole body vibration from driving puts stress on the spinal tissues.

### ***Psycho Social***

- Stress, boredom, job dissatisfaction and anxiety can contribute to the possibility of developing a MSD.
- Psycho-social issues can create increased muscle tension and reduce a person’s awareness of work technique.

### ***Increased computer use***

- Due to an increase in technology, we can now accomplish most of our tasks via the computer.

### ***Aging workforce***

- Now that the Ontario government has passed the bill to abolish mandatory retirement and the lack of succession planning we will continue to see an increase with an aging workforce.

### ***Leaner workforces***

- With globalization and the increasing competitiveness between countries to attract industries, management is constantly focused on doing more with less.
- When you combine leaner workforces with aging workforces, companies are initiating more and higher WSIB costs.

### ***More high-tech industry***

- High-tech industry has grown to exponential levels and although the industry has taken a dramatic hit, it continues to rebound back and flourish.
- With more high-tech jobs, comes the increased use of computers

### ***Non-work related issues***

- diabetes, increase in weight, Rheumatoid Arthritis, Crohn's Disease, Thyroid Disease, or had a prior joint injury, hobbies and sports are all potential contributing factors to workplace ergonomic-related injuries.

## **Common Symptoms of workplace ergonomic-related injuries**

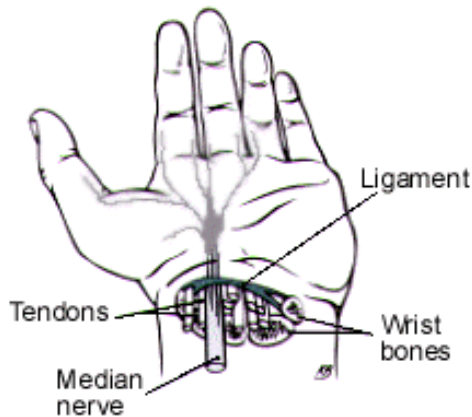
Common symptoms may include:

- Joint pain in the wrist, neck, shoulder, elbow, fingers, thumb, back or knees that occurs after activity or after a period of inactivity.
- Pain that reoccurs or that may last several days to weeks, or even months.
- Joint redness, warmth or swelling.
- Loss of joint motion.
- Loss of ability to perform daily activities.
- Constant need to shake and stretch a limb

## Some Common Workplace Ergonomic-Related Injuries in more Detail

### **Carpel Tunnel Syndrome**

Carpal tunnel syndrome is a painful disorder of the wrist and hand. The carpal tunnel is a narrow tunnel formed by the bones and other tissues of your wrist. This tunnel protects your median nerve. The median nerve gives you feeling in your thumb, and index, middle and ring fingers. But when other tissues in the carpal tunnel, such as ligaments and tendons, get swollen or inflamed, they press against the median nerve. That pressure can make part of your hand hurt or feel numb.



**Anatomy of the hand**

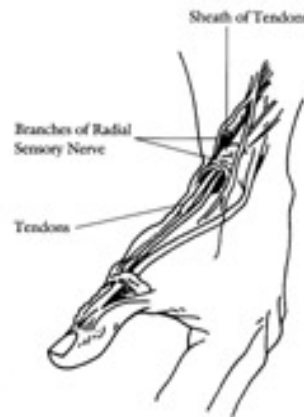
**Figure 1**

### **DeQuervain's Syndrome**

DeQuervain's Syndrome is a condition brought on by irritation or swelling of the tendons found along the thumb side of the wrist (Figure 2). The irritation causes the compartment (lining) around the tendon to swell, changing the shape of the compartment; this makes it difficult for the tendons to move as they should. The swelling can cause pain and tenderness along the thumb side of the wrist, usually noticed when forming a fist, grasping or gripping things, or turning the wrist.

**Figure 2**

Swelling about the tendons to the base of the thumb results in painful motion.



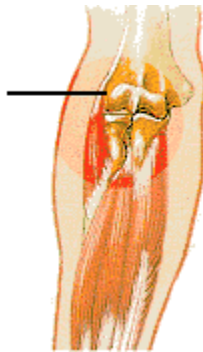
## Tendonitis

A tendon is the end part of a muscle that attaches the muscle to the bone. The normally very elastic and soft muscle tapers off at the end to form the much more dense and stiff tendon. While this density makes the tendons stronger, the lack of elasticity of the tendon and the constant pulling on its attachment to the bone with movement, makes it much more susceptible to a low level of tearing at a microscopic level. This tearing will produce the inflammation and irritation known as tendonitis.



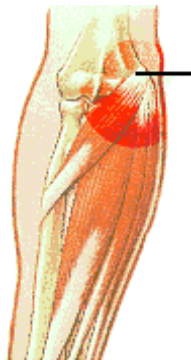
### **Tennis Elbow** (lateral epicondylitis) **Outside of Elbow** **Cause & Symptoms**

Tennis elbow is a degenerative condition of the tendon fibers that attach on the bony prominence (epicondyle) on the outside (lateral side) of the elbow. The tendons involved are responsible for anchoring the muscles that extend or lift the wrist and troublesome.



### **Golfer's Elbow** (medial epicondylitis) **Inside of Elbow** **Cause & Symptoms**

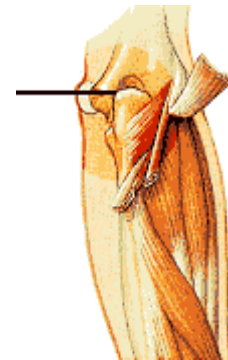
The causes of golfers elbow are similar to tennis elbow but pain and tenderness are felt on the inside (medial) of the elbow, on or around the joint's bony prominence.



### **Bursitis** **Back of Elbow** **Cause & Symptoms**

Often due to excessive leaning on the joint or a direct blow or fall onto the tip of the elbow.

A lump can often be seen and the elbow is painful at the back of the joint.



## **Adjusting the Workstation**

Many people spend thousands and thousands of dollars on their computers, software, and games and then completely disregard the workstation where they sit day in and day out. But that would be like buying a Ferrari and then buying the cheapest tires possible! It just won't work in the long run and it's the person who's going to end up hurting, literally.

By applying ergonomic principles to the office setting, risk factors are minimized, productivity is increased, and overall workplace quality is improved. The workstation must be adjusted to promote a neutral position while a person works. When adjusting a workstation, keep in mind that all of the equipment interacts. Making one adjustment may alter another.

The following is a list of items that are associated the workstation, which needs to be adjusted properly to accommodate the user:

- Chair.
- Keyboard.
- Mouse
- Monitor
- Adjust reach requirements.
- Environmental Factors
  - Lighting
  - Air Quality

## **The Chair**

### ***Can a chair solve all of the ergonomic problems of working in a sitting position?***

A well-designed chair allows the user to sit in a balanced position. Buying an ergonomic chair is a good beginning but it may not bring the benefits expected. The actual sitting position depends on an individual's personal habits; he or she has to learn and practice how to sit properly.

Also, remember that the chair is only one of the components to be considered in workstation design. All the elements such as the chair, footrest (if needed), keyboard, work surface, document holders, task lighting and so on need to have flexibility and adjustability to be "designed in."

## **How to Choose an Ergonomic Chair**

Open up any office furniture supplier's catalogue and you will find a wide range of chairs to choose from. The question is which chair should you buy and why? The following is a list of items that may help you make a more informed decision. When you are selecting your chair, keep in mind the chair should at least meet the following criteria:

- **Does the seat pan feel comfortable and fit your shape?**

When you sit in the chair the seat pan should be at least one inch wider than your hips and thighs on either side. The seat pan should not be too long for your legs otherwise it will either catch you behind the knees or it will prevent you from leaning fully back against the lumbar support. Most ergonomic chairs have a seat pan with a waterfall front that prevents the seat from catching you behind the knees. The seat pan should also be contoured to allow even weight distribution and it should be comfortable to sit on.

- **Is the seat chair height adjustable?**

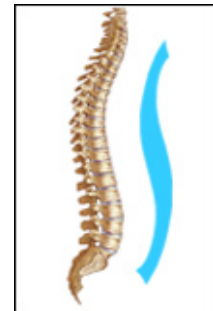
For preference the chair should be pneumatically adjustable so that you can adjust seat pan height while you are sitting on the chair. Some chairs have a mechanical height adjustment (spinning) mechanism that is also acceptable.

- **Is the range of height adjustment of the chair sufficient to meet the needs of all users?**

You should be able to adjust the height of the seat pan so that the front of your knees is level or slightly below level and your feet are firmly on the ground. In most cases there should be no need for you to use a footrest. The mechanism to adjust seat height should be easy to reach and operate when you are seated.

- **Does the chair have a comfortable lumbar (lower back) back rest?**

Many chairs have cushioned lumbar supports that can be adjusted up and down and forwards and backwards to best fit your shape. If the chair will be used by multiple users then this level of adjustment may be required. If the chair has a fixed height lumbar support and it feels comfortable when you sit back against this, and you will be the primary user of the chair then a fixed lumbar support may be acceptable. It is extremely important to keep the natural "S" curvature of the spine aligned.



- **Is the chair back rest large enough to provide good back support?**

Many chairs have back supports that are large enough to provide mid-back and upper-back support, in addition to good lumbar support.

- **When you sit back against the lumbar support is there ample space for hip room?**

Insufficient hip room can make you sit too far forwards on the seat pan so that you will not have enough thigh support.

- **Does the seat pan still feel comfortable after you've been sitting in it for 60 - 120 minutes?**

If the seat pan is made from low-density foam then continuous use can cause it to become permanently deformed and then it will not provide adequate cushioned support. Insufficient cushioning and inappropriate contouring can

cause discomfort, imbalance and hip and back fatigue.

- **Does the chair backrest recline and support your back in different positions?**

Movement of the back while you are sitting helps to maintain a healthy spine. Look for chairs that allow you to easily recline, that provide you with good back support in different recline postures, and that have a back that tracks where your back is. Locking the chair backrest in one position generally isn't recommended or beneficial to users.

- **Does the chair have a 5 pedestal base?**

If chair mobility is important to help you to do your work then the chair should have at least a 5 pedestal base with casters that glide freely over the floor surface. You may also want to choose a chair that swivels easily.

- **Do you need armrests on your chair?**

If so, are the armrests broad, contoured, cushioned and comfortable? While sitting can you easily adjust the height of the armrests and can you move the armrests closer together or further apart? Can you easily move the arms out of the way if you need to do this?

**Other considerations:**

- **Do you need a footrest?**

In the vast majority of situations you should not need a foot support to be able to sit comfortably on your chair? However, if you do need a foot support then choose a free-standing floor-mounted support that allows you to rest your feet out in front of you in a comfortable manner.

- **What chair covering is best?**

Chairs can be covered in a variety of upholstery materials, each of which has benefits and concerns. Vinyl and vinyl-like coverings are easy to clean and spill resistant, but they don't breathe and if the chair begins to heat up under the thighs uncomfortable amounts of moisture can accumulate. Cloth upholstery is the most common covering, but this is less resistant to spills and more difficult to clean. A cloth covered seat pan can also become warm and moisture laden, and cloth covered foam seat pans can be a significant source of dust mite allergen. When selecting your chair covering think about cleaning and maintenance issues and plan appropriately.

- **Do you need an adjustable tilt seat pan?**

In most situations this is not an essential feature. In some situations it can be helpful to change the tilt of the seat pan to help to maintain a balanced seated posture.

## Adjusting the Chair

You can have the best ergonomic chair on the market, however if it is not properly adjusted, you will not get the full benefit.

### 1. Adjust the Chair Height

Start with your seat at the highest setting and then adjust downward until your legs and feet feel comfortable, and the back of your knees is at an open angle (100 degrees or slightly greater, and not compressed).



### 2. Sit Back in the Chair

Adjust the height and/or depth of the lumbar support to provide comfortable lower back support.

### 3. Adjust the Recline

If the chair has a recline lock, set this at a comfortable position. Remember to unlock this periodically; this will allow the backrest to move with your back as you change posture. It's generally better to be slightly reclined, as this helps relieve tension from your lower back. If the chair allows you to, adjust the recline tension as you move back and forth so that the chair provides consistent support.



### 4. Adjust the Seat Pan

When sitting back, make any adjustments to the seat pan (e.g., seat pan tilt) to reach a comfortable position. The seat pan should extend about an inch on both sides of your legs, and should not apply pressure to the back of your knees.

### 5. Adjust the Armrest

If possible, adjust the height, width, and position of your armrests to one most comfortable for how you work. Keep in mind that armrests will be used only *between* typing sessions, not while typing or using your mouse. Consider lowering or swinging the armrests out of the way when not in use so as to not inhibit your movement.

## 6. Clear Obstacles

Make sure that the chair's casters (wheels) move smoothly, and that nothing obstructs your ability to position the chair in front of your desk and computer.

### Armrests

- Armrests can be an important aspect to properly adjusting your chair. Always remember when adjusting armrests ensure that they are not too high or too low, this will help to avoid awkward postures. If the armrests hinder the user from maintaining proper posture, have Physical Resources (Ext. 7710) come and remove them.



**Figure 3**

- **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 (Figure 3), which can result in muscle tension and fatigue in the neck and shoulders.
- **Too wide** (Figure 3) 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. The best armrests will allow you to rest the area of your forearm that lies halfway between your wrist and elbow, without compressing any part of the arm. Look for those with at least height and width adjustment features. Research studies have shown that armrests provide many benefits, such as:

- Reduced postural strain to the upper body
- Reduced muscle loads in the upper arms, shoulders, and neck

- Reduced loads on the spine (by redistributing the weight of your upper body)
- Reduced forearm exhaustion while typing (when your forearm gets tired, you tend to increase wrist extension)
- Reduced key forces while typing (the amount of force with which you hit the keys plays a role in CTD development)

## The Keyboard

In creating an ideal typing posture, it is essential to properly position your keyboard and mouse to ensure a comfortable workstation. Not only will a properly positioned keyboard and mouse help you with comfort but it will also help prevent potential musculoskeletal disorders such as tendonitis and carpal tunnel syndrome.

### Proper Positioning of the Keyboard

#### Placement

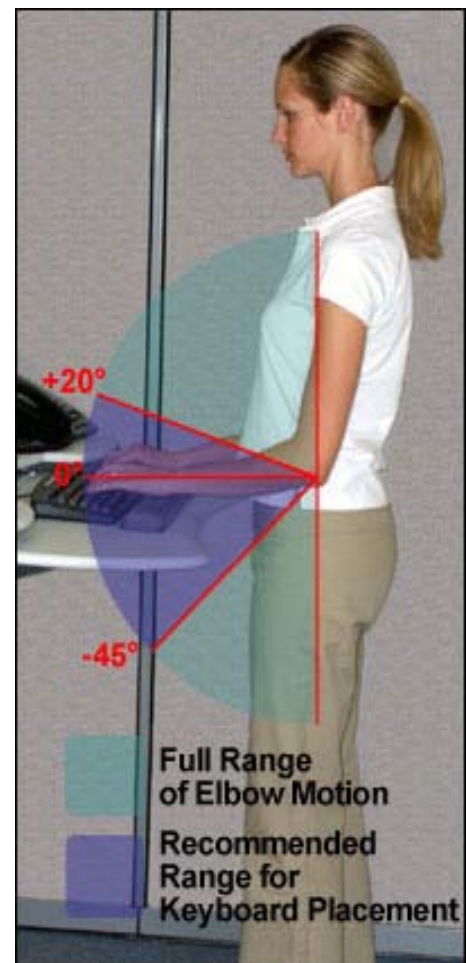
When placing the keyboard on your desk or keyboard tray, position it directly in front of you to avoid any twisting of your neck or torso. A keyboard tray may be needed if the work surface or chair cannot be properly adjusted. The keyboard tray should

- Be adjustable in height and tilt,
- Provide adequate leg and foot clearance, and
- Have adequate space for multiple input devices (for example, a keyboard and pointer/mouse).

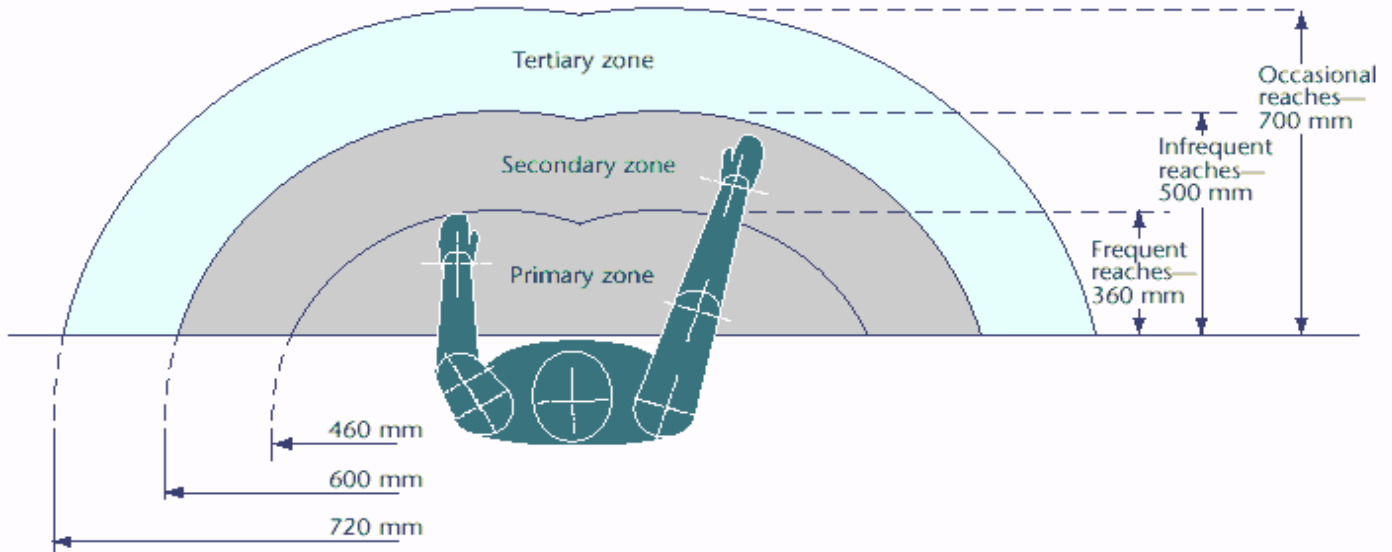
Keyboards or working surfaces that are too high or too low can lead to awkward wrist, arm, and shoulder postures. For example, when keyboards are too low you may type with your wrists bent up, and when keyboards are too high, you may need to raise your shoulders to elevate your arms. Performing keying tasks in awkward postures such as these can result in hand, wrist, and shoulder discomfort.

#### Height

The keyboard's vertical position should be maintained within the recommended range shown in Figure 4. 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.



(Figure 4)



**Figure 5 (Metric)**  
**Reach Envelope – General guideline for reaching.**  
**(Picture from CSA Z412-00 Guideline on Office Ergonomics)**

## **Distance**

Figure 5 clearly depicts reach areas in a horizontal plane.

### ***Primary Zone***

In this zone, the operator can comfortably reach objects pivoting at the elbows; typically within a radius of 5" to 7" from the center edge of the table surface. This reach zone requires the least amount of time to access and involves little, if any, muscle stress.

### ***Secondary Zone***

This reach zone requires arm extension, using the rotary joint and shoulder movement without any body or trunk movement. Normally within a radius of 15" to 18" from the CRP (Center Radius Point) of the operator's body

### ***Tertiary Zone***

In this zone, full arm and full trunk movement are needed to reach the area 24" to 30" from the operator's CRP. This zone represents a substantial reduction in efficiency over the first two as it requires more body and head movement.



**Figure 6**  
**Computer too close**

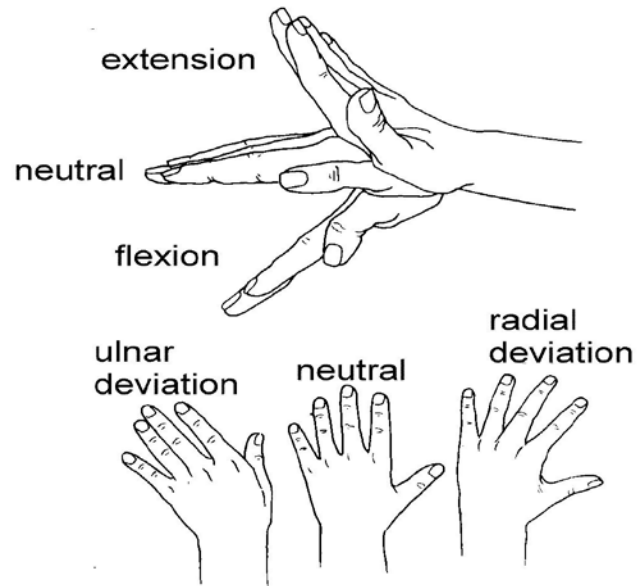


**Figure 7**  
**Computer too far away**

Figure 3 and 4 illustrate potential awkward postures that may help contribute to musculoskeletal disorders.

### **Deviated Hand Postures**

Repeated forceful movements made by the hands while in deviated postures (flexion, extension, ulnar radiation, and radial radiation) are known to dramatically increase the risks of developing musculoskeletal disorders, especially Carpel Tunnel syndrome. Ulnar and radial deviations contribute to CTDs, but it is flexion and, particularly, extension that are the real culprits.



When it comes to preventing deviated hand postures

- Keep their body and wrist posture in neutral positions while sitting and keyboarding.
- Have an appropriate workstation configuration.
- Take breaks at appropriate intervals.

## Neutral Keyboard Posture

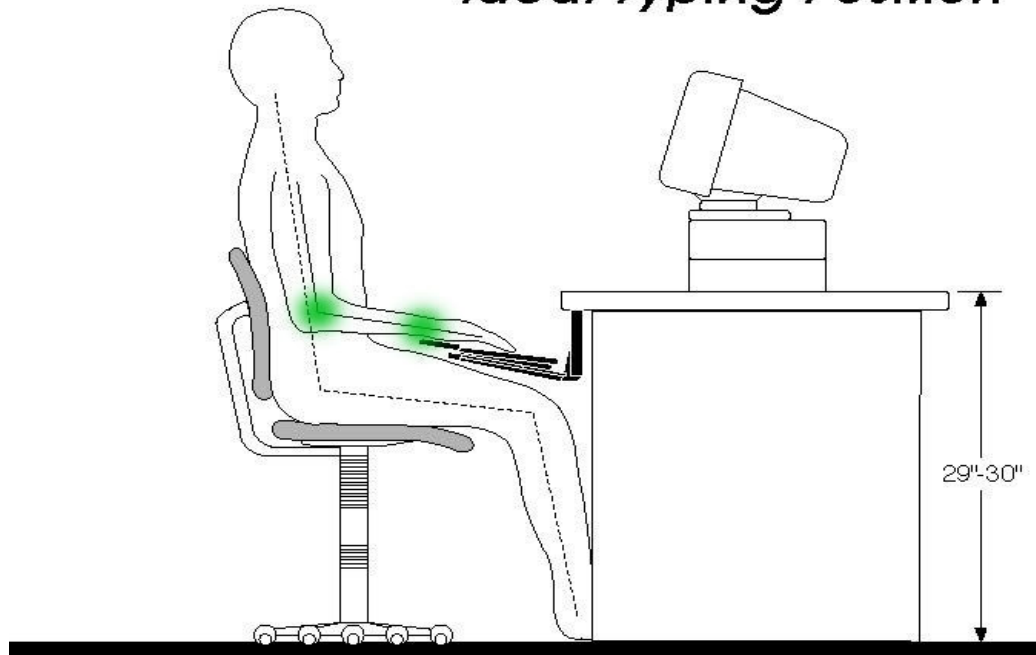
To ensure a neutral keyboarding posture is kept, conduct the following:

- Upper and lower back well supported by chair
- Chair height set so that the chair seat does not compress the back of the knees
- Feet firmly planted on a surface for support (floor or footrest)
- Head balanced on neck (not tilted back or too far forward)
- Upper arms close to body and relaxed (not abducted to the side or flexed forward)

Sitting so that the:

- Angle formed by the shoulders, hips, and knees is  $>90$  degrees
- Angle formed by the shoulder, elbow, and wrist is  $>90$  degrees
- Angle formed by the hips, knees, and feet is  $>90$  degrees
- Wrists at a neutral position, level with forearm ( $<15$  degrees deviation)
- Chair armrests not directly compressing any part of the forearms or elbows

### *Ideal Typing Position*



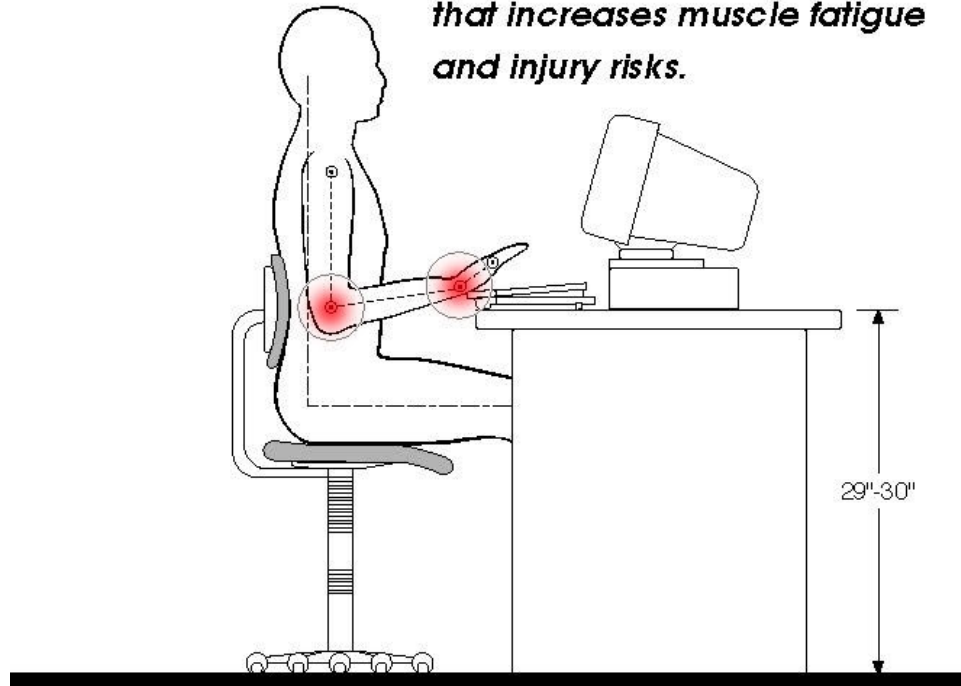
**Figure 8**  
**Ideal Typing Posture**

In the ideal typing posture both static and dynamic muscle loads are minimized. This posture is achieved when the keyboard is below seated elbow height and the keyboard base is gently sloped away from the user so that the key tops are accessible to the hands in a neutral posture. In this position the arms, shoulders, neck and back can relax, especially during brief rest pauses. Also, in this slightly reclined sitting position the low back rests against the lumbar support of the chair, the elbow angle is opened to promote circulation to the lower arm and hand, the abdominal angle, and

the popliteal angle (behind the knees) are opened to promote blood circulation. The feet rest firmly upon the floor

**Figures 9 & 10**  
**Less than Ideal typing postures**

*Typical desk top typing posture that increases muscle fatigue and injury risks.*



*Conventional keyboard trays can increase injury risks.*



## The Mouse

The mouse like the keyboard is a critical element to the computer workstation. The computer mouse is by far the most popular and widely used of all pointing devices. It is important to note that the computer mouse can cause users similar problems as a keyboard tray would. Similar symptoms may include:

- Sore fingers;
- Wrist problems;
- Arm and shoulder injuries

To avoid such problems, it is important to look at all aspects of the mouse and how it is used in the workplace.

## Selecting a Mouse

If you were to open up a computer catalogue and look for a new mouse, you would find a wide range of computer mice out there today. The question is which mouse should I choose, and why?

When selecting a mouse consider the following:

- **Size** – Choose a mouse that fits comfortably in your hand, ensure your fingers can curl around the mouse and the buttons are easy to use. People often don't realize that mice may come in different sizes. Companies commonly produce smaller mice as accessories for notebook users, who are constrained to small desks or tray tables - but these also work nicely for users with smaller hands.
- **Shape** – Find a mouse with a "contoured" or asymmetrical grip; recent studies have shown that symmetrical mice are a better choice. Mice with a slightly wider base may help improve your grip on the mouse and your comfort while using it. Try to avoid using mice that require you to place the heel of your hand on the desk.
- **Features** - Consider the use of a mouse with multiple buttons. This allows the user to perform certain keystrokes, decreasing the amount the user may have to do by hand, therefore lessening the risk of a Muscoskeletal disorder. Users that tend to spend long periods of time surfing the web or editing documents, you may want to try a mouse with a trackball. Scrolling with a trackball instead of the entire mouse can help reduce repetitive arm motions and their resulting discomfort, but beware-this may lead to discomfort in your fingers!

## Different Types of Mice

As previously mentioned there are several different models of mice available. Users should try the different model and choose the one that best fits their needs. The following is a few of the different models



**Figure 11  
Regular  
Mouse**



**Figure 12  
Trackball  
Mouse**



**Figure 13  
Joystick  
Mouse**



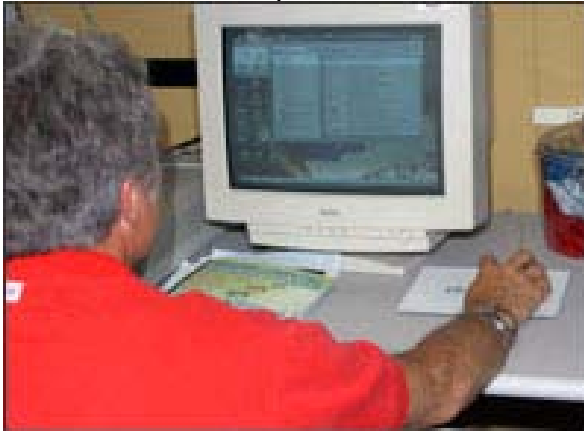
**Figure 14  
Foot Pedal Mouse**



**Figure 15  
Pen & Tablet  
Mouse**

### Placement of the Mouse

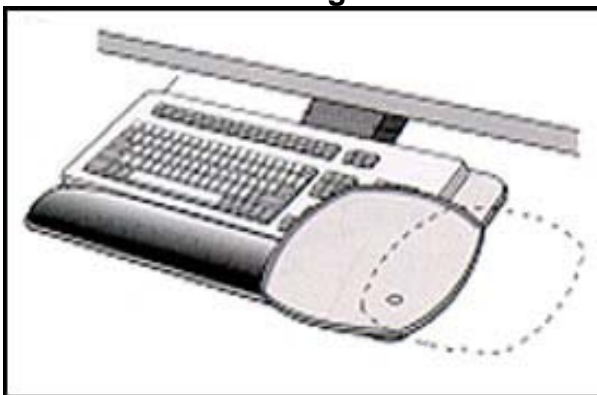
Placement of the mouse is very critical. When using a mouse ensure you position the mouse immediately on the right or left of the keyboard. Also, ensure the mouse is on the same level surface as the keyboard. Avoid scenarios like that in Figures 16 and 17. Users should strive to position their mouse as close to their body as possible, this will help minimize the development of musculoskeletal disorders.



**Figure 16  
User is reaching for mouse**



**Figure 17  
Unsuitable setup for mouse**



**Figure 18  
Rotating mouse platform**



**Figure 19  
Keyboard tray with side mouse platform**

The best arrangement for a mouse is a platform over the number keypad and just above the keyboard (Figure 18). If that is not possible then the next best would be to have the mouse directly next to the keyboard tray (Figure 19).

## Tips for Healthy Mousing

The following tips will help computer users avoid a mouse-related musculoskeletal injury. It should be noted that the most important thing to keep in mind when applying ergonomics is postural variation. By varying their posture a user can minimize their risk of injury. ***(The following tips have been taken from Cornell University's Ergonomics webpage, with the permission of Professor Alan Hedge).***

1. Mouse Grip - don't throttle your mouse (it's already dead)! Hold the mouse gently to move it over a mousing surface.
2. Mouse from the Elbow - don't skate or flick the mouse with your wrist. Make controlled mouse movements using your elbow as the pivot point and keep your wrist straight and neutral.
3. Optimal Mouse position- sit back in your chair, relax your arms then lift your mousing hand up, pivoting at the elbow, until your hand is just above elbow level. Your mouse should be positioned somewhere around this point. Don't use a mouse by stretching to the desk or out to the side of a keyboard. With a flat mouse platform, position this 1-2" above the keyboard and over the numeric keypad if you are right handed - you can easily move it out of the way if you need to access these keys. With a downward sloping mouse platform, position this close to the side of the keyboard so that you can use the mouse in a neutral wrist position. Position adjustable mouse platforms are commercially available (e.g. Humanscale, Proformix, Flexrest, 3M etc.)
4. Protect your wrist - if you look at the anatomy of the wrist it is curved away from any contact surface (you can easily see this by resting your hand/arm on a flat surface - you'll see light under the wrist and can probably even pass a thin pen under this). The forearm is shaped liked this for the wrist to remain free of surface pressure contact.
5. Avoid restricting circulation - For many people there are exposed blood vessels near the skin at the wrist, which is where the pulse is often taken. Any pressure in this region will disrupt circulation into the hand and this will increase the risks of injury.
6. Don't use a Wrist Rest - research has shown that using a wrist rest doubles the pressure inside the carpal tunnel, because the floor of the tunnel is a more flexible ligament that transmits external pressure changes directly into the carpal tunnel (the roof of the tunnel is bone so the pressure doesn't get transmitted on through the hand). Indeed, one test for carpal tunnel syndrome (CTS), known as Tinel's sign, simply involves tapping on the palmar surface of the wrist, which is enough to cause tingling and numbness in someone developing CTS.
7. Avoid Restricting Arm Movement - with a softly padded wrist rest, especially one that is rounded, or a soft chair arm rest the forearm becomes "locked" into position and this encourages people to make mouse movements by flicking the wrist, which also increases intracarpal pressure.
8. Keep the Mouse Free Moving - The base of the palm of the hand is the part of the body designed to support the hand when resting on a surface. For keyboard use a broad palm support is best. However, mouse use is different from keyboard use. With a keyboard the best posture is for users to float their hands over the keyboard when typing and then to rest on the palm support in

- microbreaks between typing bursts. You can use rest-breaking software (e.g. Magnitude ErgoManager, Break reminder etc) to help track and advise on your mouse use. With mousing this doesn't happen. A mouse is used by moving its position over a surface, and resting usually occurs when mouse movements stop but with the mouse still being held in the hand. Mouse movements should be made using the elbow as the pivot point, not the wrist. Anything that impairs free movement of the forearm/hand and mouse will increase injury risks.
9. Mouse shape - choose a mouse design that fits your hand but is as flat as possible to reduce wrist extension. Don't use a curved mouse. Use a symmetrically shaped mouse. Consider a larger mouse and there are several new interesting products on the market, such as the Whale mouse or the Perfit mouse, that encourage arm rather than wrist movements or that encourage postural variety and one or two-handed use. Pen-based mice designs also allow a more comfortable grip.
  10. Load sharing - if you want to load share between your right and left hands, that is using the mouse for some of the time with each hand. For this you need to **choose a mouse platform that can easily be configured to the left or/and right, and a symmetrical shaped mouse that can be used by either hand.**

## Wrist Rests

Wrist rests these were very popular a few years ago, but research studies haven't demonstrated any substantial benefits for wrist rests. In fact, a wrist rest can actually increase pressure inside the carpal tunnel by compressing the undersurface of the wrist, take a look at your wrist and you'll probably see blood vessels that shouldn't be compressed.

If you choose to use a wrist rest, ensure the following:

- using one with a broad, flat, firm surface design works best, and
- rest the heel of your palm on this NOT your wrist.
- Try not to rest while you're actually typing, but rest in between bursts of typing movements.
- Avoid soft and squishy wrist rests because these will contour to your wrist, restrict the freedom of movement of your hands, and encourage more lateral deviation during typing.
- Look at the surface of a typical wrist rest that's been used and you'll see that it gets eroded away, which means that the user has been sliding their wrists over the surface which also compresses the blood vessels often visible at the wrist.
- Remember, your hands should be able to glide above the surface of a wrist rest during typing, don't lock them in place on the rest while you type.

## The Computer Monitor

Similar to other types of equipment in a workstation, a monitor can contribute to the risk of musculoskeletal injuries. Proper setup and positioning is imperative to preventing eye strain, muscle fatigue in the neck, shoulders and upper back.

### Setup and Positioning

#### Center the Monitor

When the user sits down at their workstation they should be facing directly in front of the monitor. It is important to avoid scenarios where the user must look off to the side to view the monitor. These scenarios tend to cause neck and shoulder pain due to awkward postures.

#### Viewing Distance

When placing your monitor, it is recommended that you have a viewing distance of 13-28 inches. Sitting too close or too far from the monitor can cause eyestrain.

#### Height of Monitor

The ideal viewing height is to have your eyes level with an imaginary line across the screen, about 1 inch below the top of the monitor. This can be accomplished in one of two ways - either by lowering your monitor or raising your chair. If your screen is too low, you'll find yourself tilting your head forward to view the monitor (a common cause of neck pain). If it's too high, you may have to tilt your head back, leading to neck and shoulder pain.

#### Viewing Angle

Tilt the screen so that the base is slightly closer to you than the top. This enables you to view the entire screen and the display more clearly. Tilting the monitor downward is not recommended.



Figure 20



Figure 21

## Monitor adjustments for bifocal, trifocal, and progressive lenses

If you wear bifocals, trifocals, or progressive addition lenses, it's especially important to properly adjust your monitor height. Avoid tilting your head back to view the screen through the lower portion of your glasses; this could lead to muscle fatigue in you neck and back. Instead, try lowering your monitor. If that does not work, you may want to consider obtaining glasses that are specially made for computer use. Do not position your monitor too high that you have to tilt your head back to view the screen.

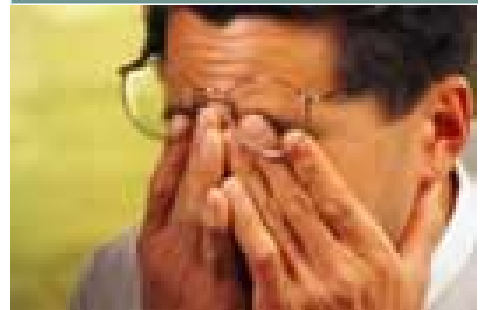


Figure 22

## Eyestrain

Eyestrain is when the eyes become irritated and fatigued due to prolonged use, uncorrected defects of vision, or an imbalance of the eye muscles. With the increase in dependency on computers eyestrain has become a more pronounced problem. The following is a list of eyestrain symptoms:

- Headaches
- Loss of focus
- Burning/tired eyes
- Double vision
- Blurred vision
- Neck and shoulder pains



To reduce eyestrain the following recommendations should be followed:

### 1. Ensure proper set up of your computer monitor

### 2. Take breaks.

Follow the 20/20/20 Rule, If you tend to work on your computer for prolonged periods of time, be sure to take a 20 second break every 20 minutes and look at least 20 feet away. This gives yours eyes a break and chance to adjust focus-and avoid visual fatigue.

### 3. Blink regularly.

We tend to blink less while viewing a computer screen than other types of near work. Remember to blink fully and often (a post-it note on the screen can help with reminders).

### 4. Keep a clean screen

Dust gathers easily on monitor screens. Be sure to periodically use a recommended solvent to remove any accumulated dust or fingerprints, ensuring a clean and visually consistent display.

## **5. Reduce Glare and Reflections**

If left uncorrected, glare and reflections can cause discomfort, eyestrain, and headaches. Try to reposition your monitor so that there's no glare on the screen (but avoid putting it in a position that's uncomfortable to view!). If you can't avoid the glare by readjusting your monitor positioning, consider a high-quality glass anti-glare screen.

## **6. Adjust your font size and color.**

The size of your text should be about two or three times the size of the smallest text that you can read. Black text on a white background is usually the easiest to discern when word processing.

## **7. Have your eyes checked.**

Be sure to have an annual eye examination. Measure your viewing distances and take those numbers to your doctor for the exam.

## **Lighting**

Improper lighting for computer offices can be a major contributing factor to the following visual discomfort:

- Eyestrain
- Headaches
- Irritated dry eyes
- Blurred and double vision

Not only does poor lighting affect the ocular system but it can also cause aches and pains in the neck and shoulder areas. This happens when users cannot see the monitor properly due to lack of light or too much glare reflecting. Ultimately, in an attempt to better read the monitor the user compromises their posture and sits awkwardly to view the screen.

The following is recommended when evaluating office space for lighting:

### **1. Whenever ambient lighting is used, ensure it has little to no glare.**

The best lighting for offices tends to be Indirect or direct/indirect light fixtures. These types of lighting fixtures usually found hanging from the ceiling and they tend to give off a better array of illumination.

### **2. Choose task lighting that can also be used for paper documents.**

Task lighting that is used for paper documents should be; glare free, have an asymmetric lens and be positioned in a way to avoid reflecting onto the monitor screen.

### **3. Ensure proper light levels for the task you are doing**

Too much ambient light can overpower the effects of your screen, causing a tremendous amount of glare, the screen will seem "washed out" which will make reading the monitor difficult.

### **4. Control direct window lighting.**

Offices with windows are sought after for their view and natural light, however that natural direct light can cause many problems for a user viewing a computer monitor. Use drapes and blinds to adequately control glare and reflection on your computer monitor.

**5. Fluorescent lighting plus task lighting, incandescent or halogen is highly recommended for the Office Environment**

If you find it too bright, call physical resources, they may be able to reduce the number of bulbs, fixtures, wattage on a trial basis. Make sure your fluorescent lamp doesn't flicker

**6. Optimize the color of your room.**

The room color can be optimized by:

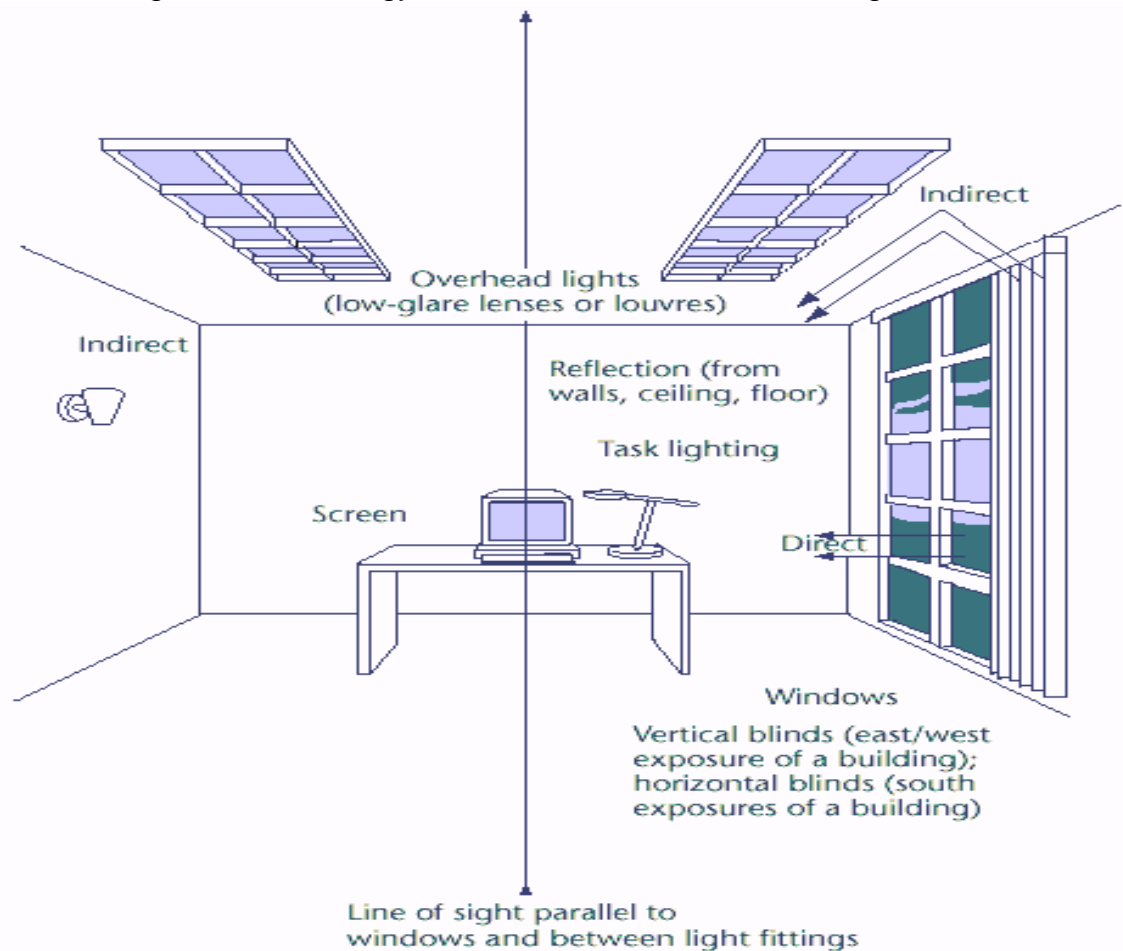
Painting or papering the walls in a neutral colors

Painting ceilings white or a light color (avoid dark ceilings)

Using a neutral floor covering (carpet, wood, tile) with a low reflectance

Choosing furniture (chairs, desks, file cabinets) with low range reflectance

Choosing office technology with a neutral color and low range reflectance



**Figure 23**  
**Picture from CSA Office Ergonomics**  
**Guideline**

## Posture

Good posture is the basis of good workstation ergonomics. Computer-related injuries usually occur gradually and often go unnoticed until there is significant discomfort. The single largest factor in office injuries is poor posture. While improper posture may not result in an injury after a week, a month or even a year, prolonged exposure to improper posture will greatly increase the risk of developing an injury. Although it is possible for these injuries to heal themselves when the ergonomic hazard is removed, cases do exist where individuals have done enough damage to require corrective therapy, in addition to removing the hazard. Good posture is the best way to avoid a computer-related injury.



## Work Habits

One of the biggest problems associated workplace related injuries is the poor work habits workers inherit. Even if a worker has the most ergonomically sound workstation, they are still prone to developing musculoskeletal disorders. There are a number of risks that help contribute to these injuries, the following are a couple of things that computer users should be conscious of:

## Stress

Whether it be stress outside of the workplace or caused by the workplace, stress can pose a significant risk in the development of musculoskeletal disorders. The human body resilience to stress is truly remarkable however it eventually catches up. Here's how it works, stress or stressful situations cause the user to work and think at a faster pace (i.e. I have to get this job finished before my deadline). This causes the user to use the muscle and body parts at a faster pace than what they are normally used to. This causes fatigue and lactic acid to build up more quickly. Given the fact that the user may have a limited time in which to conduct this task they tend to ignore fatigue and pain factors which ultimately cause significant problems down the road.

## Repetitive tasks for prolonged periods of time

How many times do users power through repetitive tasks for prolonged periods of time just to meet a deadline? The answer may surprise you. With leaner workforces and an overall mentality to do more with less, musculoskeletal disorders are on the rise. Workers routinely perform mundane and repetitive work for extended periods of time, ignoring pain caused by muscle fatigue. Compound the fact that when users feel this fatigue, they either choose to ignore it, or they change positions putting themselves in an awkward posture. Usually when the user stops what they are doing the fatigue and pain subside, however if the user does this on a continual basis over a couple of years, that is when the repetitive strain injuries (RSI's) and musculoskeletal disorders

present themselves. Whenever a user feels the signs of fatigue or pain of any kind, stop what you are doing and take a break

## **Breaks**

The risk of developing musculoskeletal disorders while using a computer for prolonged periods is well documented. In order to minimize the risk of developing a musculoskeletal disorder, users should ensure they take regular breaks. The following are a couple types of breaks that users may implement; just remember that breaks and exercises need to be combined with good workstation set-up and/or posture for them to be of most help!

**Eye Breaks:** Looking at a computer screen for a while causes some changes in how the eyes work, causes you to blink less often, and exposes more of the eye surface to the air. Every 15 minutes you should briefly look away from the screen for a minute or two to a more distant scene, preferably something more than 20 feet away. This lets the muscles inside the eye relax. Also, blink your eyes rapidly for a few seconds. This refreshes the tear film and clears dust from the eye surface.

**Micro-breaks:** Most typing is done in bursts rather than continuously. Between these bursts of activity you should rest your hands in a relaxed, flat, straight posture.

**Rest Breaks:** Every 30 to 60 minutes you should take a brief rest break. During this break stand up, move around, and do something else. Go get a drink of water, soda, tea, coffee, or whatever. This allows you to rest and exercise different muscles and you'll feel less tired.

**Ergonomic Software:** Working at a computer can be hypnotic, and often you don't realize how long you've been working and how much you've been typing and mousing. Look for software that will run in the background and monitor how much you've been using the computer. It will prompt you to take a rest break at appropriate intervals, and it will suggest simple exercises. You can purchase this software or you can download simple versions that get the job done just as well.

**Exercise Breaks:** There are many quick stretching and gentle exercises that you can do to help relieve muscle fatigue. These should be done every 1-2 hours, depending on your needs.

## **Workstation Exercises (to be done at least once an hour)**

1. **Deep Breathing:** Breathe in slowly through the nose. Hold for 2 seconds, then exhale through the mouth. Repeat several times.
2. **Head and Neck:** Turn head slowly from one side to the other, holding each turn for 3 seconds. Repeat several times



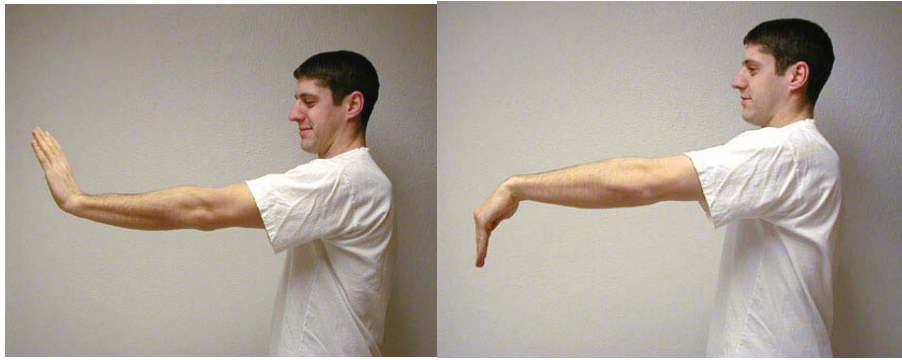
3. **Back:** Start with the arms bent, hands near chest area, and push elbows back. Hold for 5 seconds, then relax. Repeat several times. You can also raise arms in the same fashion, this time close to the shoulders, to work out the upper back.



4. **Shoulders:** Roll shoulders slowly in a circular fashion, while trying to make the circle as big as possible. Take about 5 seconds to complete one circle. Repeat several times.



5. **Wrists:** Hold your hands out in front of you. Slowly raise and lower your hands to stretch the muscles in the forearm. Repeat several times.



6. **Fingers and Hands:** Make a tight fist. Hold for a second. Then spread your fingers apart as far as you can. Hold for 5 seconds, then relax. Repeat several times.



7. **Tendon Gliding Exercises:** These relieve tension in the tendons. Do each of the following movements slowly, but do not force any of the positions. Go as far as you comfortably can.
- a) Starting Position: Raise your arm, with the hand extended (you can also rest the elbow on a table and extend the hand).
  - b) Roof: Bend your fingers down to a right angle. Return to starting position.
  - c) Straight Fist: Touch your fingertips to the base of your palm, keeping the thumb straight. Return to starting position.
  - d) Hook Fist: Gently make a hook. Return to the starting position.
  - e) Full Fist: Make a fist. Return to the starting position.



In addition to these exercises, encourage your children to take short breaks (microbreaks) and to do some gentle stretching “or stand up and move around during these brief pauses.

## Laptops

Laptops have seen a significant growth in popularity over the past couple of years. Unfortunately due to the design of the laptop, it makes them inherently problematic and contravenes almost all ergonomic principles. The following are some problems laptops may cause users:

- It usually turns out that when the screen is at a comfortable height and distance, the keyboard isn't and vice versa. The best way to avoid discomfort here is to place the keyboard at a comfortable distance and enlarge the font, which you can always reduce later.
- If you use your laptop for more than one hour at a time, consider obtaining an external keyboard and/or monitor.
- The fact that a pointing device on a laptop is almost always located in the middle may not allow you to keep your arm at a neutral position while using it. Consider purchasing a mouse or any other external pointing device.
- As in the case of a desktop keyboard, you may use a wrist rest to support your forearms while typing on the laptop keyboard.

Avoid using your laptop on a high surface. This will cause you to abduct your shoulders and lead to shoulder and back pain.

### Tips for Using a Laptop Computer

1. **Un-ergonomic Laptops** - the design of laptops violates a basic ergonomic requirement for a computer, namely that the keyboard and screen are separated. In the early days of personal computing desktop devices integrated the screen and keyboard into a single unit, and this resulted in widespread complaints of musculoskeletal discomfort. By the late 1970's a number of ergonomics design guidelines were written and all called for the separation of screen and keyboard. The reason is simple - with a fixed design, if the keyboard is in an optimal position for the user, the screen isn't and if the screen is optimal the keyboard isn't. Consequently, laptops are excluded from current ergonomic design requirements because none of the designs satisfy this basic need. This means that you need to pay special attention to how you use your laptop because it can cause you problems.
2. **Laptop User Type** - how do you use your laptop? Are you an **occasional user** who works on your laptop for short periods of time or are you a **full-time user** with the laptop as your main computer? Occasional users will have less risk of problems than full-time users. All users should pay some attention to how they use their laptop, but full-time users may have more problems.
3. **Laptop Posture** - as indicated above, laptops violate basic ergonomic design requirements, so using a laptop is a tradeoff between poor neck/head posture and poor hand/wrist posture.
  - **Occasional Users** - because the neck/head position is determined by the actions of large muscles, you are better off sacrificing neck posture rather than wrist posture. For occasional use:
    - find a chair that is comfortable and that you can sit back in

- positioning your laptop in your lap for the most neutral wrist posture that you can achieve
  - angling the laptop screen so that you can see this with the least amount of neck deviation
  - **Full-time Users** - Laptops are okay to use for short periods of time, however if users plan to use them for prolonged periods, they should consider the following:
    - purchase an external monitor, an external keyboard, and a docking station and then arrange your workspace to create a good workstation layout.
    - position the laptop or main screen in front of you, so you can see the screen without bending your neck. This may require that you elevate the laptop off the desk surface using a stable support surface, such as a computer monitor pedestal.
    - Follow the postural guidelines for working at a computer workstation
4. **Laptop dimensions** - many laptops offer large screens (15" plus) and can work as desktop replacements (giving the viewing area of a 17" monitor). However, think about where you will most use your laptop to help you choose the best size. The larger the screen the more difficult it will be to use this in mobile locations (e.g. airplane, car, train). There are a number of smaller notebook and ultra portable laptops on the market. Consider issues of screen size and screen resolution. A small screen (e.g. 12.1") will be useful in mobile settings, but if the resolution is high (e.g. XGA - 1024 x 768) make sure that you can read the screen characters and can easily use the input device to point to areas on the screen. The smaller the laptop, the smaller the keyboard, so make sure that you can comfortably type on a keyboard that may be only 75% the size of a regular keyboard.
5. **Laptop weight** - if you are a mobile professional who will be frequently transporting your laptop think about the weight of the system. By the word 'system' I mean the weight of the laptop plus the required accessories (e.g. power supply, spare battery, external disk drive, zip drive, CD\_RW etc.). Many lightweight portables can become as heavy as regular laptops when you add the weight of all of the components together. If your laptop + components weigh 10lbs or more then you should certainly consider using a carry-on bag that you can pull along. If you want a smaller bag and can comfortably carry your laptop consider a good shoulder bag design.

## Ergonomic Gizmos

If you were to open up a These days just about everything is labeled as being "ergonomically designed" and much of the time this isn't true. Unfortunately, right now there is relatively no regulation of the term "ergonomic." Some so-called "ergonomic" products can even make things worse!

If you're thinking about buying an "ergonomic" product , ask yourself the following 4 questions:

1. Does the product design and the manufacturer's claims make sense?
2. What research evidence can the manufacturer provide to support their claims? Be suspicious of products that haven't been studied by researchers.
3. Does it feel comfortable to use the product for a long period? Some ergonomic products may feel strange or slightly uncomfortable at first because they often produce a change in your posture that's beneficial in the long-term. Think of some products as being like new shoes that initially may feel strange but then feel comfortable after being used for a while. If a product continues to feel uncomfortable after a reasonable trial period (say at least a week), then stop using it.
4. What do ergonomics experts say about the product? If they don't recommend it, don't use it.

## Noise

Noise can cause stress and that tenses your muscles which can increase injury risks. Try to choose a quiet place for your workstation, to mask the hum of any fans or other sound sources.

- Work in an environment with a level of noise that is comfortable for you. Working in an uncomfortably loud environment stresses the body and, as a result, the muscles tense up. This tension accelerates injury.
- If using headphones, make sure they are at a comfortable noise level and that they fit properly.

### Noise levels commonly found in office environments.

Office	Equivalent noise level dB(A)
Very quiet, small offices and drawing offices	40-45
Large, quiet offices	46-55
Large, noisy offices	55-65

## Indoor Air Quality (IAQ)

Indoor air quality concerns ergonomics in the fact that it may affect the health, comfort and performance of office workers. Office buildings can contain a wide variety of contaminants, however the major air contaminant which are of most concern in an office environment are the following:

- Carbon monoxide
- Carbon dioxide
- Formaldehyde
- Allergens and Pathogens
- Respirable Suspended Particulates (RSP's)
- Moulds

- Asbestos
- Ozone
- Tobacco Smoke

There are a significant number of factors that can affect IAQ, as noted. The following table is an example of a few.

Factors that may affect IAQ:

Factor	Sources	Typical IAQ contaminants from identified factor
Emissions from indoor sources	Interior furnishings and finishes (wood products, carpets, fabrics, paints, adhesives, sealants)	Volatile Organic Compounds, and Formaldehyde
Microbial Contaminants	Plumbing leaks, pipe condensation, flooding	Airborne and surface fungi and bacteria, microbial, and VOC's
Poor Ventilation	Improper HVAC System, Poor maintenance	Carbon Dioxide, Fluctuations in temperature and RH
Office Equipment	Photocopiers, laser printers, air cleaners.	Ozone, Particulates, Ammonia, VOC's

### Optimum Conditions for Office Environment

Temperature Range:

Summer	22.6 to 27.2 °C	} ASHRAE
Winter	19.5 to 24.6 °C	

Relative Humidity: 20-60%

Carbon Dioxide: 600-800 ppm Recommended for Office Environment  
 Below 1000 ppm for comfort  
 OH&S Act TLV= 5000 ppm

Outdoor Air Requirement:

Office Space	10 litres/sec/person	} ASHRAE
Classroom	8 litres/sec/person	
Libraries	8 litres/sec/person	

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