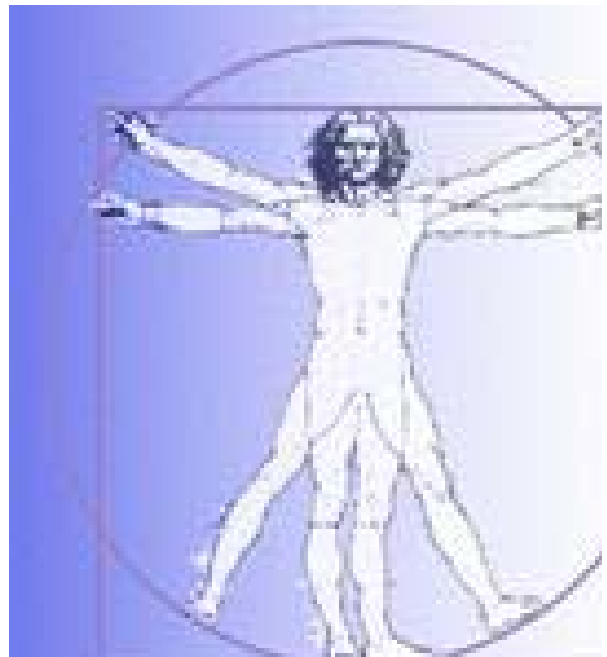




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# Ergonomics Toolbox

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## [Part 1 - Office Ergonomics](#)

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### [1. 4 Steps to Set Up your Computer Workstation](#)

Here is the ultimate manual on setting up your computer workstation. We'll take you through a step-by-step process that covers your chair, input devices, monitor, and documents.

### [2. Eye Strain](#)

Avoiding visual strain and discomfort

### [3. A Postural Guide to Working at your Computer Workstation](#)

If you are not into "step programs," try this approach to working at your computer more comfortably. Here we focus on how to set up your work and equipment to maintain a relaxed, neutral posture. Learn about neutral neck posture, proper spinal support, and arm and hand positions.

### [4. Tips for Computer Users](#)

General pointers to help harmonise you with your work environment. Topics discussed include: posture, work technique, and life style.

### [5. Selecting a Chair](#)

In this section we review all the options and what might be right for you.

### [6. Workstation Myths](#)

Many accepted guidelines that people follow when it comes to computer work are actually erroneous. Learn what to believe and what not to believe when it comes to commonly held ideas. Sitting posture, ergonomic chairs, and adjustable workstations are all included.



## 4 Steps to Setting Up Your Workstation

### STEP 1: Your Chair

- **Push your hips as far back as they can go in the chair.**
- **Adjust the seat height** so your feet are flat on the floor and your knees equal to, or slightly lower than, your hips.
- **Adjust the back of the chair to a 100°-110° reclined angle.** Make sure your upper and lower back are supported. Use inflatable cushions or small pillows if necessary. If you have an active back mechanism on your chair, use it to make frequent position changes.

**Adjust the armrests so that your shoulders are relaxed.** If your armrests are in the way, remove them.

### STEP 2: Your Keyboard

An articulating keyboard tray can provide optimal positioning of input devices. However, it should accommodate the mouse, provide leg clearance, and have an adjustable height and tilt mechanism. The tray should not push you too far away from other work materials such as your telephone.

- **Pull up close to your keyboard.**
- **Position the keyboard directly in front of your body.**
- **Determine what section of the board you use most frequently,** and readjust the keyboard so that section is centred with your body.
- **Adjust the keyboard height** so that your shoulders are relaxed, your elbows are in a slightly open position (100° to 110°), and your wrists and hands are straight.
- **The tilt of your keyboard is dependent upon your sitting position.** Use the keyboard tray mechanism, or keyboard feet, to adjust the tilt. If you sit in a forward or upright position, try tilting your keyboard away from you at a negative angle. If you are reclined, a slight positive tilt will help maintain a straight wrist position.
- **Wrist-rests can help to maintain neutral postures and pad hard surfaces.** However, the wrist-rest should only be used to rest the palms of the hands between keystrokes. Resting on the wrist-rest while typing is not recommended. Avoid using excessively wide wrist-rests, or wrist-rests that are higher than the space bar of your keyboard.



- **Place the pointer as close as possible to the keyboard.** Placing it on a slightly inclined surface, or using it on a mouse-bridge placed over the 10-keypad, can help to bring it closer.

If you do not have a fully adjustable keyboard tray, you may need to adjust your workstation height, the height of your chair, or use a seat cushion to get in a comfortable position. Remember to use a footrest if your feet dangle.

### STEP 3: Monitor, Document, and Telephone

Incorrect positioning of the screen and source documents can result in awkward postures. Adjust the monitor and source documents so that your neck is in a neutral and relaxed position.

- **Centre the monitor directly in front of you** above your keyboard.
- **Position the top of the monitor approximately 2-3" above seated eye level.** (If you wear bifocals, lower the monitor to a comfortable reading level.)
- **Sit at least an arm's length away from the screen** and then adjust the distance for your vision.
- **Reduce glare by careful positioning of the screen.**
  - Place screen at right angles to windows
  - Adjust curtains or blinds as needed
  - Adjust the vertical screen angle and screen controls to minimize glare from overhead lights
  - Other techniques to reduce glare include use of optical glass glare filters, light filters, or secondary task lights
- **Position source documents directly in front of you, between the monitor and the keyboard, using an in-line copy stand.** If there is insufficient space, place source documents on a document holder positioned adjacent to the monitor.
- **Place your telephone within easy reach.** Telephone stands or arms can help.

**Use headsets and speaker phone** to eliminate cradling the handset.



#### STEP 4: Pauses and Breaks

Once you have correctly set up your computer workstation use good work habits. No matter how perfect the environment, prolonged, static postures will inhibit blood circulation and take a toll on your body.

- **Take short 1-2 minute stretch breaks every 20-30 minutes.** After each hour of work, take a break or change tasks for at least 5-10 minutes. Always try to get away from your computer during lunch breaks.
- **Avoid eye fatigue by resting and refocusing your eyes periodically.** Look away from the monitor and focus on something in the distance.
- **Rest your eyes by covering them** with your palms for 10-15 seconds.
- **Use correct posture** when working. Keep moving as much as possible.



Visual discomfort is a frequent complaint of computer workers. Eyestrain and headaches blurred vision are the most common problems reported. Other problems include double vision, burning and dry eyes, eye fatigue, light sensitivity, and after-images. Neck shoulder and back pain can also be related to viewing the computer keyboard and/or screen.

Lighting and vision are inter-dependent. Workplace lighting and visual ability both play a significant role in work posture. Workers alter postures to relieve stress on the eyes. Complaints of neck, shoulder and back pain can frequently be alleviated if visual ergonomics are addressed. For more information on workplace lighting, see "[Preventing Visual Discomfort](#)" article.

### **Vision and Eye Problems:**

Difficulties with focusing and eye alignment can result in eyestrain, neck pain and headaches during computer work. To avoid problems, have your vision checked by an eye doctor aware of problems that can interview with computer vision. Make sure you measure the distance you sit from your computer before seeing a doctor. He will need this information to evaluate your need for computer glasses. Your doctor should check for the following:

- Visual acuity - the ability to see clearly and efficiently at various distances.
- Binocular vision - ability to coordinate eyes by integrate the image recorded by each eye into a single vision.
- Accommodation - the ability of the eyes to shift focus between varying distances. This skill becomes more difficult over the age of 40 due to reduced lens flexibility.
- Oculomotor skills - the ability of the eye muscles to position the eyes correctly to locate and scan text.
- Hyperphoria - tendency of each eye to see objects at different levels. Presence of this disorder results in a tendency to tilt the head to line up things visually, resulting in neck strain.
- Dry eyes – some individuals do not produce enough tear flow to the eyes because of tear duct problems.



### Use of Corrective Lenses for Reading or General Activities:

- Contact lenses - Individuals who wear contact lenses blink less than people who have normal vision or wear glasses. Contact wearers must be educated to blink often and use artificial tears to reduce eye irritation. If your eyes are worse using artificial tears, contact your eye doctor to determine if you have a sensitivity or allergy to the product you use.
- Use of glasses designed for reading - Regular glasses are not always suited for computer work. Most monitors are positioned in the intermediate visual zone, rather than in the near or far zones. Reading glasses correct for the near zone, and bifocals correct for only the near and far zones. Trifocals and progressive lenses have only a small portion of the lens corrected for the intermediate zone. This portion is generally not large enough for comfortable computer work.
- Awkward postures - Use of inappropriate glasses can result in blurred vision. Attempts to compensate for blurred vision can encourage awkward postures such as leaning forward. Bifocal users often tilt their necks and heads up to see through the bottom of their glasses. Both of these actions can result in neck aches and backaches.

### Monitor Issues:

The type and location of the monitor you use plays a significant role in visual comfort.

Remember that the location of the visual target plays a major role in determining sitting posture. Visual requirements result in the user positioning the body so that the face is parallel to the viewing surface. This principle should be remembered when determining placement of a monitor.

Visual acuity determines the optimal viewing distance to the monitor. Although standards require a minimum viewing distance of 12 inches, research studies have shown a preferred viewing distance of 30 to 40 inches from the screen.

Standards also require that the user's viewing area should be located between 0 and 60 degrees below the horizontal plane. Recent studies have demonstrated that it is easier to look downward rather than horizontally or upward. Lower targets may be more comfortable for users, especially when preferred viewing distances are considered.





These findings suggest that VDU monitors should possibly be located lower and further away from the user than previously thought to offer greatest visual comfort.

Lowering the monitor without angling it up toward the user's face encourages a forward-thrust head posture. Awkward shoulder, arm, wrist postures result from this compensation. Concern has resulted about the effect of this forward head position and tilted neck. Make sure you adjust the tilt of the monitor to match the height for optimal sitting posture.

- **Placement** – Follow these guidelines:
  - The screen should be at least 20 to 26 inches distance. Adjust this distance for your visual acuity needs and comfort. The farther away the better in most cases. Distances of 30-40 inches are frequently preferred.
  - You should be able to view the screen with a slight downward gaze without tilting your head up or down. The top of the screen should be about at mid-forehead level. If you have a screen larger than 17", the top of the screen may need to be a little higher.
  - Your face should be parallel to the screen. Setting the tilt will help to adjust the height. Be sure to test for excessive glare when tilting the screen. If you can see your image in the screen, reflections and glare will strain your eyes while working.
  - Your documents should be positioned close to the monitor, either close to the side or directly in front between the keyboard and the screen.
- **Brightness and Contrast** – The monitor's brightness should match the room brightness. Begin making adjustments by reducing glare from sources in the room such as windows and overhead lights. Use light switches, blinds, curtains, filters or remove bulbs as necessary. Then adjust the brightness control on the monitor somewhere close to the monitor's mid-range if possible. After adjusting the brightness, set the contrast to a comfortable level. Usually, the higher the contrast the better.
- **Display Quality** – The clarity of your screen depends upon refresh rate, resolution and dot pitch.
  - Refresh rate refers to how often your monitor redraws the screen. Slow rates can cause a noticeable flicker. People vary in their sensitivity to flicker. Your refresh rate should be at least 70 Hz (hertz) or higher.



- Resolution refers to the monitor's pixel density and determines the level of detail. The higher the resolution, the better the detail. 800 x 6000 is recommended. Make sure you don't sacrifice the refresh rate for resolution. They are related to each other and should both be high for good quality.
- Dot pitch determines sharpness of the display. The lower the dot pitch number, the sharper the image. Select a monitor with a dot pitch or .28 mm (millimetres) or lower. (If your dot pitch is listed as horizontal or stripe pitch, divide it by 0.866 to determine the equivalent regular dot pitch.)

Check your refresh rate and resolution for adjustment if necessary. They can be adjusted using the Settings tab in the Display properties dialog box in Windows. Dot pitch is not adjustable.

### Computer Glasses:

Computer glasses correct your vision in the intermediate zone, the distance you normally sit from your computer screen. If you also require correction in the near and/or far zones, you will need to consider multiple focusing options.

- **Lens design** - There are several types of computer lenses available. They range from occupational progressive lenses and trifocals with larger than normal intermediate zones, to single-vision (intermediate) lenses. Specially designed bifocals or computer prescriptions that clip-on to your regular eyeglasses are also available. Your eye doctor can help you decide which lens design you need.
- **Tints and coatings** - Computer lenses can be tinted to help with reducing eyestrain from excessive glare from windows or fluorescent overhead lights. Antireflective coating or ultraviolet coatings and amber tints can all help relieve eyestrain.



## Postural Guide to your Workstation

Always check your working position when using a computer. To avoid unnecessary discomfort, make sure the following key principles are in place.

### **Neutral Neck Position:**

- When looking at your work, keep your neck in a neutral or aligned position. Position the monitor directly in front of you to avoid turning your neck to the side.
- Position the monitor screen so that you do not have to bend your neck up or down to see the screen. The top of the screen should be approximately 2-3" below seated eye level.
- Place the monitor at least 20 to 30 inches away from you (slightly more than an arm's length). Adjust as needed for your visual comfort.
- If you must use a telephone simultaneously with the computer, use a headset. Never try to hold the handset between your shoulder and ear. If you chose to use a telephone handset, position the telephone close to you to avoid over-reaching.

### **Supported Spine:**

- Place your feet flat on the floor or on a footrest if necessary.
- Your chair should provide you with good back support. Maximize the contact of your back with the chair back using chair adjustments or cushions as needed.
- Set the back tilt in a slightly reclined position, approximately 100-110 degrees.
- If your chair has an active recline mechanism, use it to change your position throughout the day.
- It is often useful to have armrests. However, they should be adjustable in height and width to allow for resting the arms with your shoulders in a relaxed position.
- The chair seat depth should be sufficient to support your thighs while providing a small space between the edge of the chair and the back of your knees.

### **Arm/hand Positions:**

- The keyboard and pointing device should be positioned at a height to allow for a slightly open elbow angle. Elbows should be at a 100 to 110 degree angle. If you cannot adjust your



- keyboard height, raise your chair and use a footrest, or elevate your table on blocks as necessary.
- If you sit in an upright position, your keyboard should be placed in a slight negative tilt so that the wrists can be placed in an aligned or neutral position. Your hands should be slightly lower than your elbows with your fingers pointing toward the floor. (Note: If you recline back in your chair, you might not need to tilt the keyboard. Check the alignment of your wrist, and then set the angle of the keyboard as needed. Your sitting posture will affect how you adjust your keyboard and pointing device.)
- If you use a keyboard tray, it should be wide enough for your pointing device.
- If you use a wrist-rest, use it to support your palms only when pausing between keying. Do not place your wrists on the rest and turn your wrists from side to side to key. This increases the strain on your wrist.
- Your pointing device should be positioned within easy reach. Over-reaching can result in shoulder and/or arm discomfort. If you are reaching out to use your pointer, elevate it on a mouse-bridge, platform or small book to bring it within closer reach.



**Repetitive and prolonged use of a computer keyboard and/or mouse can lead to muscle aches and discomfort. Posture and positioning are important. Try to incorporate the following tips into your work style to avoid problems.**

**Maintain good posture when working.** Sit all the way back in the chair against the backrest. Keep your knees equal to, or lower, than your hips with your feet supported.

**Keep your elbows in a slightly open angle (100° to 110°) with your wrists in a straight position.** The keyboard tilt can help you attain the correct arm position. A negative tilt (front of keyboard higher than back) helps when working in upright sitting positions. If you recline, a positive tilt (front of the keyboard lower than the back) might be necessary.

**Avoid overreaching.** Keep the mouse and keyboard within close reach. Centre the most frequently used section of the keyboard directly in front of you.

**Centre the monitor in front of you** at arm's length distance and position the top of the monitor 2" to 3" above seated eye level. You should be able to view the screen without turning or tilting your head up or down.

**Place source documents on a document folder** positioned between your monitor and keyboard. If there is not enough space, place documents on an elevated surface close to your screen.

**Use good typing technique. Float your arms above the keyboard** and keep your wrist straight when keying. If you use a wrist-rest, use it to support your palms when pausing, not while keying.

**Hit the keyboard keys with light force.** The average user keys four times harder than necessary.

**Keep your wrists straight and hands relaxed** when using your pointer. Don't hold the pointer with a tight grip or extend fingers above the activation buttons. Avoid moving the pointer with your thumb or wrist. Movement should originate at your shoulder and elbow.

**Limit repetitive motions.** Reduce keystrokes with macros and software programs such as voice recognition. Reduce pointing device movement with scroll locks and keystroke combinations.



**Customise your computer settings.** The screen font, contrast, pointer size, speed, and colour can be adjusted to maximize comfort and efficiency.

**Reduce glare.** Place your monitor away from bright lights and windows. Use an optical glass glare filter when necessary.

**Take eye breaks** and intermittently refocus on distant objects. Try palming your eyes in your hands to reduce eye fatigue.

**Work at a reasonable pace and take frequent stretch breaks.** Take 1 or 2 minute breaks every 20-30 minutes, and 5 minute breaks every hour. Every few hours, try to get up and move around.

**Use of non-prescribed medications, or wrist splints, can often be more harmful than helpful.** If you begin to develop symptoms, seek help. Early intervention can prevent future problems.

**Your life style and physical fitness affect how you feel at work.** Stay in shape by stretching and exercising regularly.



Consider your work tasks, and your body size and shape, when choosing a chair. A single size or type of chair is not appropriate for all tasks, and cannot suit all body shapes and sizes.

When you sit to perform a task, your spine is most comfortable when it's in "neutral posture", a slightly reclined sitting position. The following adjustment options can help you maintain "neutral posture".

### **SEAT:**

- **Height:** Seat height should adjust to fit the height of the user and/or the work surface.
- **Tilt:** The seat should adjust at a variety of angles to allow for changing positions and postures for different tasks. A rocking mechanism can provide continuous active repositioning while working.
- **Depth:** The seat should support your hips and legs, and provide a 1-2" space between the front edge of the seat and the back of your knees. Sliding seat options can help you set the proper depth position.

### **BACKREST:**

- **Height:** The backrest should adjust up and down to fit the curves of your spine. Adjustable lumbar support is often necessary to accommodate flat, average or deep low back curves.
- **Contour:** The backrest of the chair should support your upper and lower back, while allowing free arm movement. If you recline, you may need a backrest that extends up to your shoulders or neck.
- **Angle:** The backrest should adjust independently from the seat tilt to provide optimal support for a variety of work positions, such as reclining or leaning forward.

### **ARMREST:**

- **Armrest:** Armrests can provide additional upper extremity and back support when taking breaks or pauses between writing or keying tasks.
- **Height:** If you have armrests, they should be adjustable. Your forearms should be able to rest on the armrests with your shoulders relaxed.



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- **Width:** Inward and outward adjustment provides additional personal fit. This is especially important with large and small stature individuals.
  - **Pivot:** Pivoting armrests provide both width and angle adjustment of the armrests.





## Workstation Myths

Many generally accepted guidelines for posture and furniture at computer workstations are, in reality, myths. If rigidly followed, these misconceptions can lead to uncomfortable and costly mistakes. Some of these myths include:

**Correct posture at the computer eliminates discomfort and possible injury.** "Picture-perfect" posture can be extremely fatiguing. When sitting, the full force of gravity is carried by the upper body and can lead to fatigue, muscle strain, or joint pain. The best posture is dynamic in nature. Change your position frequently, alternating sitting and standing.

**Computer operators should sit upright at the computer.** If given a choice, four out of five workers prefer to sit slightly reclined. A reclined posture is easier to maintain than sitting erect. Sitting slightly reclined also reduces pressure on the discs in your lower back.

**Height adjustable chairs enable you to work at any height table.** In some situations, chair height adjustments won't result in safe work postures at a desk or table. If the table top is too low, lowering the chair can result in an awkward position that places extra pressure on your legs and back. A better alternative would be to raise the desk on blocks. Petite workers can have difficulty working at a standard or high desktop. If the chair is elevated to work comfortably, feet can dangle above the floor. Footrests can provide foot support in this situation, but may not accommodate all positions a worker might need to reach equipment or complete all work tasks. The best solution is to lower the desk or change the work task to eliminate the need for forward reaching.

**Ergonomic chairs are designed to fit all users.** Everyone is shaped differently. Women generally have larger hips than men and need a chair with a higher lumbar back support and a wider seat area. Men frequently have longer legs and need a deeper seat area. When selecting a chair, consider your individual needs.

**Adjustable work stations are the best office furniture.** Most work stations require adjusting work surfaces manually which is often inconvenient and time-consuming. A better solution is to place keyboards and monitors on flexible, counter-balanced arms that can be adjusted to accommodate a variety of workers and work postures.



Don't be hurt by workstation myths. Make sure your furniture and chair are adequate for your needs and use good work habits. Change postures and take frequent short breaks throughout the day.



The back is a wonderfully designed system for flexibility, weight bearing, and mobility. Unfortunately, because it usually works so well, we tend to neglect it's needs. Proper posture and correct body mechanics are important to preserve the health of our back.

### 1. Lifting Safely

"Lift with the legs." We've all heard this before, but proper body mechanics is more than a catch phrase. These steps will help you lift safely and efficiently.

### 2. How to Save Your Back

Here are suggestions you can use everyday to maintain the health of your back.

### 3. Why Back Pain Happens

More than 7 out of every 10 adults have experienced significant back pain in their lives. Find out how your weight, fitness level, and posture can make you a back pain statistic.



## Lifting Safely - Basics of Good Lifting

Today, forklifts, hoists, and other types of lifting equipment are used to lift heavy objects. However, sometimes it is necessary to load or unload moderate to heavy objects by hand. When that is the case, knowing the proper ways to lift can save you a great deal of pain and misery from a sprained back.

**Assess the situation:** Before lifting or carrying a heavy object, ask yourself the following questions:

- Can you lift this load safely, or is it a two-person lift?
- How far will you have to carry the load?
- Is the path clear of clutter, cords, slippery areas, overhangs, stairs, curbs or uneven surfaces?
- Will you encounter closed doors that need to be opened?
- Once the load is lifted, will it block your view?
- Can the load be broken down into smaller parts?
- Should you wear gloves to get a better grip and protect your hands?

### **Size up the load:**

- Test the weight by lifting one of the corners. If it is too heavy or an awkward shape, stop.
- If there is any doubt, ask for help from fellow workers.
- Try to use a mechanical lift or a hand truck.
- Try to break the load down into smaller parts.

### **Use good lifting techniques:**

- Get close to the load. Centre yourself over the load and stand with your feet shoulder width apart.
- Tighten your stomach muscles. Tight abdominal muscles increase intra-abdominal pressure and help to support the back.
- Get a good handhold and pull the load close to you. The farther the load is from your body, the heavier it will feel.
- Bend your knees. Bending your knees is the single most important thing you can do when you lift moderate to heavy objects. Squat down like a weightlifter, bend your knees, keep your back in its natural arch, and let your legs do the lifting. Your leg muscles are much more powerful than the smaller muscles in your back.
- Do not jerk. Use a smooth motion and lift straight up.



- Do not twist or turn your body while lifting. Keep your head up, and look straight ahead. Hold the load close and keep it steady.

#### Carrying the load:

- Change direction by turning your feet, not your back. Your nose and your toes should always be pointing in the same direction. Any sudden twisting can result in taking out your back.
- Rest if you fatigue. Set the load down and rest for a few minutes.

#### Setting the load down:

- Bend your knees. Squat down and let your legs do the work.
- Keep your back curves. Remember not to twist your body while setting down a load, and keep your head up.
- Keep the load close.
- Plan your release. Once the load is where you want it, release your grip. Never release your grip until the load is secure.

#### Using hand trucks and pushcarts:

- Push rather than pull. It is easier and safer to push than to pull. You can use your body weight to assist when pushing.
- Keep close and lock your arms. Stay close to the load, try not to lean over and keep your back in its natural arches.
- Use both hands. Carts are easier to push and control using both hands.
- Use tie-downs, if necessary, to secure the load.

#### Forklifts:

- Use a forklift to lift and transport very heavy objects.
- Obtain training and authorisation before using a forklift.



### **Always try to maintain the natural curves in your back.**

These curves provide strength and support for your back. This is especially important when lifting or when sitting for long periods.

### **Hinge at your hips and bend your knees when lifting.**

You should be doing most of the work with your legs rather than with your back! Placing your feet shoulder-width apart will help you stay balanced. A wider stance can also help if you have difficulty bending your knees.

### **Tighten your stomach muscles before you lift.**

They help support and stabilize your back when you lift.

### **Plan ahead before lifting. Test the weight first.**

Many injuries result from poor planning and overexertion.

### **Keep objects close.**

A 10 pound bag of groceries can put 100 pounds of pressure on your lower back. Holding things away from your body greatly increases this pressure.

### **When possible, use your hand and arm for added support when bending and lifting.**

Use a golfer's lift to retrieve light objects, or when reaching into low containers like a hamper or shopping cart.

### **Pivot with your feet when lifting and moving objects.**

Turn your whole body instead of twisting your spine - especially if you are holding something heavy. Your nose should always be in-line with your toes.

### **Balance objects when you carry them.**

Use carts etc for heavy items whenever you can. Use your body weight to push the dolly or cart with your legs, rather than pulling with your back.



**When sitting, sit all the way back in the chair seat against the backrest.**

Let the chair do some of the work for you - no slumping allowed!!!

**Use a bookstand or a copyholder to elevate reading materials.**

Looking down puts a tremendous strain on the neck and upper back.

**Change positions frequently when sitting or standing for prolonged periods.**

When standing, use a footstool to prop one foot up, and switch sides every so often. When at a sink or counter, see if you can open one of the cabinets and put one foot on the bottom shelf.

**Get as comfortable as you can in the car.**

Long commutes can be hard on your back. Adjust your seat and position your arms so that you can easily reach the steering wheel. Use a pillow in the seat if needed to support your lower back curve. Remember to stop to take stretch breaks when on a long trip.

**Sleep on a firm mattress providing good support.**

Place a pillow under your knees when on your back, or between your knees if you are on your side.

**Back injuries can result from use of bad postures and poor movement patterns.**

Always use good mechanics when lifting either a heavy box or a light newspaper.

**Stay in good shape.**

Exercise. Do daily stretches and watch your weight. Extra weight, muscle weakness, or muscle imbalances due to tightness, can affect your posture and result in back discomfort or pain.



## Why Back Pain Happens

Using improper lifting techniques can lead to back injuries, but other factors can contribute to this age-old problem.

### **Poor Posture**

Whether you're standing, sitting, or reclining, your posture affects your back. Awkward postures increase strain on back muscles and can bend the spine into positions that can put pressure on discs and cause trouble. When awkward postures are prolonged or repetitive, the risk of injury is greater.

When standing correctly, the spine has a natural "S" curve. Your ears, shoulders, hips, knees and ankles should be aligned with your spine in this natural "S" curve.

When you sit using proper posture, your hips should be equal to or slightly higher than your knees. Sit with your hips pushed against the back of the chair so that the backrest supports your back.

Sleeping posture is as important as standing and sitting postures. Try to sleep on your side with your knees bent or on your back. Sleeping on your stomach can strain your spine and cause morning backache.

### **Poor Physical Condition**

Your physical condition can lead to back pain. If you are overweight, especially if you have a pot-belly, extra strain is placed on your spine. Every pound up front puts 10 pounds of strain on your back.

When you are out of shape, the chances for chronic back pain are greater. Infrequent exercise can also lead to trouble. Sudden strains on unconditioned back muscles can cause injury, especially when there is sudden twisting or turning of the back. Proper diet and exercise can both help to avoid back problems.

Stress is another factor that can lead to back pain. Stress at work or home can cause tension in muscles leading to tightness and muscle spasms. Although stress is part of everyone's life, excessive stress may cause backache. The solution is to a balanced lifestyle with time to relax.





## Repetitive Trauma

Most people think back injuries result from lifting heavy or awkward objects. Many back injuries, however, do not come from a single lift. They result from relatively minor strains that occur repeatedly over time. As you repeat irritating movements, minor injuries begin to accumulate and weaken affected muscles or ligaments. Eventually, the small injuries add up and a more serious injury can result.

It is important to remember that a specific lift may have little to do with any single injury. Remember to use mechanical aids along with good lifting technique to do any lifting whenever possible. And always ask for help if you need it.



### 1. Musculoskeletal Disorders: Anatomy of an Injury.

Welcome to the world of computer generated injuries. Here we have a brief description of the anatomy behind many of the injuries that can occur to the nerves, muscles, tendons and joints. The list includes; carpal tunnel syndrome, tendinitis, muscle trigger points, and many more.

### 2. Eye Strain

Is there really such a thing as "computer vision syndrome"? This section provides some answers.

### 3. Preventing Visual Discomfort

Visual discomfort is one of the most frequently cited complaints of computer workers. Find out how to save your eyes from pain and strain.

### 4. Preventing Musculoskeletal Disorders

Your work, your tools, and your habits can make or break your body. Here are some general tips on avoiding injuries.

### 5. Preventing Injuries at Computer Workstations

Awkward postures, high repetition and excessive force are the banes of the computer world. Discover some antidotes in this article.

### 6. RSI: What is Good Treatment?

The term RSI encompasses many different injuries with the common denominator being overuse. The following is a sequence of the evaluation a typical RSI patient should receive.



## Musculoskeletal Disorders - Anatomy of an Injury

The average person working at a keyboard can perform 50,000 to 200,000 keystrokes a day. Small repetitive movements can disturb the delicate balance of muscles, tendons, and ligaments in the hand and cause cumulative trauma disorders (CTDs), also known as repetitive strain injuries (RSI's) or musculoskeletal disorder (MSD's). The use of proper keyboard and pointing device techniques, rest breaks, and a properly set up workstation, can significantly reduce the risk of developing an overuse injury.

The nerves that supply the muscles and the skin in the upper extremity leave the spinal cord in a complicated network of nerve fibers, roots and bundles - this is called the brachial plexus. These nerves course down the side of the front of the neck and divide, then rejoin to form the median, radial and ulnar nerves. These nerves travel down the arm in different distributions and innervate the muscles and provide sensation. The nerve sends the signal to the muscle telling it to contract, and allows you to feel sensation where it supplies the skin. If these nerves are compromised in any way, loss of strength and sensory changes can result.

Nerves can be compromised through repetitive movements. Repeated motions can result in compression or "entrapment" of nerves. Compression can be caused by tight muscles, inflammation of surrounding tissues, or misalignment of the nerve.

When a nerve is compressed, you feel the sensations somewhere between the point of compression and your fingertips. Ulnar, radial or median nerve compression can occur anywhere along the path they travel through, from the neck to the hand. Shoulder pain can be referred from a nerve pinched in the neck. Pain in the forearm, wrist, or fingers can originate from compression at the neck, elbow or wrist level. That is why when you have pain in your elbow, wrist or hand, you should start looking for the cause at the neck and move down the arm.

Nerves can also be compressed in more than one place. This is very common with computer users who have muscle tightness or tension in several places. This phenomenon is called a double crush injury and can be very difficult to diagnose.

Some common nerve injuries/syndromes that can result from repetitive movements include thoracic outlet, radial tunnel, cubital tunnel and carpal tunnel syndromes.



**Thoracic outlet syndrome** occurs when the brachial plexus is compressed by tightness of the scalenes (a group of anterior neck muscles that attach to the first rib), or by the first rib being elevated. Signs and symptoms include numbness and tingling in the hand, often made worse with overhead activities such as drying your hair with a dryer, or cradling the phone between the ear and shoulder. Compression of the brachial plexus often stems from muscle tightness at the side of the neck that can result from poor head position or slumped posture. Sleeping with your hands up over your head or around your pillow can make pain worse at night.

**Radial tunnel syndrome** refers to compression or entrapment of the radial nerve at the outside of the elbow. It is frequently caused by repetitive wrist and finger extension or turning of the forearm. Symptoms can occur at the elbow where the nerve is compressed or near the base of thumb, or anywhere in between. Wrist weakness is a common symptom.

**Cubital tunnel syndrome** occurs when the ulnar nerve is compressed or entrapped at the inside of the elbow. Common symptoms include numbness or tingling up and down the inside of your arm, with tingling into the ring and little fingers. Repetitive bending of the elbow, or resting your elbow on a hard surface, are common causes of this nerve injury. The ulnar nerve can also be compressed at the Guyon's canal in the wrist, but this is less common.

**Carpal tunnel syndrome** is caused by compression of the median nerve at the level of the carpal tunnel. This tunnel is formed at the wrist by the transverse ligament over the carpal bones in the hand. Early signs or symptoms may include numbness or tingling in the thumb, index or middle finger and one half of the ring finger. Persons are often awakened at night by the hand "falling asleep". Symptoms are often increased when driving or attempting to hold objects. Frequent dropping of objects is a common complaint.

**Tendons** also can be affected by repetitive motions. They attach muscle to bone, and are connective tissues that contain little stretch or rebound. If they are stressed beyond their strength by overuse, or maintaining a static or prolonged position, they can get tiny tears in them. Friction from overuse can also cause inflammation. This causes a condition known as tendinitis.



Tendinitis occurs most often in the flexor and extensor tendons of the fingers, thumb, forearm, elbow or shoulder. Symptoms range from specific aches, stiffness, tightness and burning sensations, to a deep nonspecific pain. Grasp can be impaired to the point where you have difficulty holding on to objects.

The tendons of the wrist and hand are very small and are at high risk for injury when overused. This can occur with activities such as keying in awkward positions, pressing the keyboard too hard, or holding a mouse or pointing device too tightly, or for too long. Although naturally stronger and more durable, the larger tendons in the shoulders can be affected if the arms are held out in front, or off to the side too long, or excessive reaching is done while working. Tennis elbow, or *lateral epicondylitis*, affects the tendons of the finger extensor muscles at the outside of the elbow. Golfer's elbow, or *medical epicondylitis*, affects the tendons of the finger flexor muscles at the inside of the elbow.

**Muscles** can be strained by overuse resulting in tiny tears in the muscles. These tiny tears form scar tissue and contribute to inflammation and muscle stiffness. A diffuse, achy pain can result in what's called myofascial pain. Painful nodules, or tender spots called trigger points, can also occur in overused muscles.

Trigger points can occur in almost any muscle. When you press a sore spot, the pain can travel out to a distant area and then recede. This is called a referral pattern. The site of the trigger point is usually distant from the site of the referred pain. Muscles in the neck refer pain to the head, shoulders, upper back and hand. Muscles in the arms can refer pain to the neck, shoulders, elbows, wrists and hands.

Sleep patterns are often disrupted by muscle pain. You wake up feeling stiff and tired even when you think you have had enough sleep. This disruption of sleep, and increased discomfort, can increase fatigue levels that result from working with overused muscles.

**Joints** can get stiff and dysfunctional if they are being held in one position for multiple hours day in and day out. The cervical and lumbar spine joints are particularly susceptible to strain when the spine is held in prolonged, awkward postures. Looking down while typing, looking over towards a copy holder off to the side, or sitting slumped in a chair, can strain the ligaments in the spine that support the joints and create stiffness and inflammation in a joint.



## Avoiding Repetitive Trauma Disorders

There are several forces that work together to result in a repetitive trauma disorder. Your work environment, your job duties, your equipment, and how you use your body, are all important components. Increased awareness of your posture and work habits are necessary to enable you to work safely and avoid the problems associated with repetitive trauma disorders.



## Preventing Visual Discomfort

Computer workstations present complex visual needs. Challenges can include uneven lighting, reflections and glare, and prolonged use of the eyes. Here are some guidelines to follow to reduce visual discomfort:

### **Keep lighting levels as even as possible.**

To determine problem areas, shield bright sources from your view with your hand or a file. If you feel relief, eliminate the bright source. To improve lighting:

- Use indirect lighting sources and task lights.
- Use low-glare bulbs or cover bright bulbs with filters.
- Adjust light levels by turning off light banks or using adjustable light switches.
- Avoid sitting so that overhead lights are within your visual field.
- Wear a visor to shield your eyes from bright overhead lights.
- Reduce light from windows with shades or room partitions.
- Sit at right angles and at least 3 feet from windows.
- Avoid glossy, reflective wall paint or reflective light-coloured work surfaces.

### **Reduce glare.**

If you can see your own reflection or the reflection of windows and lights in your monitor screen, you have a glare problem.

- Use a monitor visor to reduce glare from overhead lighting sources.
- Consider using a good quality anti-glare screen. Use a circular polarized filter if you sit near a window.
- Adjust the monitor tilt to avoid reflections from windows and ceiling fixtures.
- Adjust screen/character background. Use dark characters on a light background. White characters on a blue background can provide positive contrast while limiting glare often seen on a white background.



### Select a high quality monitor. - Size is not the only consideration.

- Select a monitor large enough for the work you complete. The size of the text should be three times the size of the smallest text you can read. If you work with spreadsheets, you will need a larger screen to view your work.
- If you don't need a colour monitor, consider a monochrome monitor with higher screen resolution.
- Adjust contrast level to maximize character definition.
- Select a colour monitor with dot pitch less than .28mm.
- Use refresh rates above the standard 60 Hz default setting to reduce flicker. A minimum of 70 hertz is recommended.
- Select a screen with good screen resolution (more pixels). 800 x 600 is recommended. Make sure you don't compromise resolution for a lower refresh rate. Both are important.
- Adjust the screen brightness to match the general brightness of the room.

### Set up your monitor to reduce eye and neck strain.

- Position the centre of the screen 10-20 degrees below your straight-ahead gaze. You should be able to look at your screen without tilting your head.
- The closer an object, the harder your eyes work to focus. Place the screen as far away as possible, provided you can read it easily. Adjust font size if necessary.
- Keep the screen and source documents at about the same distance away from you to avoid constant re-focusing while working.

### Use good work habits.

- Eyestrain can result from dry eyes. Blinking helps lubricate your eyes. Post a "Blink" post-it note on your monitor to remind you to blink while working.
- Follow the "20-20-20 rule". Every 20 minutes, look 20 feet away for 20 seconds to rest your eyes.





## Preventing Musculoskeletal Disorders

### Prevention:

- Warm up and stretch before starting activities that are repetitive, static or prolonged.
- Take frequent breaks from any sustained posture every 20-30 minutes and stretch stiff muscles.
- Respect pain. Change positions or stop whenever activities cause pain.
- Recognize early signs of the inflammatory process, and *treat early*.
- Only use splints and wrist supports after instruction by your physician or therapist.

### Posture:

- Maintain erect position of back and neck with shoulders relaxed. Minimize twisting and bending motions. Position equipment and work tasks so that your body is directly in front of and close to your major work tasks.
- Use proper positioning during all activities. Keep upper arms close to the body, elbows at 100 degrees, forearms neutral (thumb toward ceiling), and wrist straight. Keep feet flat on the floor when seated by proper adjustment of your chair, or use of a footrest.
- Keep wrists as neutral as possible. Avoid extreme motions. There is a safe zone of movement for your wrist. This zone is about 15 degrees in all directions.
- Avoid bending neck forward for prolonged periods of time. If typing from a manuscript, place the document on a holder beside or below your computer screen.
- Avoid static positions for prolonged periods. Muscles fatigue faster when they are held in one position. Keep moving to increase your blood circulation.

### Task Modification:

- Whenever possible, alternate activities frequently throughout the day. Rotate heavy and/or repetitive tasks with lighter, less repetitive tasks.
- If symptoms become worse, or a specific activity consistently causes discomfort, reassess the task setup and look for alternative methods.



- Avoid repetitive or prolonged grip/pretension activities. Avoid pinching with wrist flexion or wrist deviation (bending to side). Take frequent breaks to stretch and rest hands.
- Avoid tugging, jerking, or pounding with the hand.

#### **Tool/Environmental Modification:**

- Avoid tools with finger grooves, hard plastic handles, sharp edges, small diameter, or large diameter handles.
- Use power devices when available.
- Use grips/tape to build up small diameter pens/pencils for writing. Better still, select large diameter pens with soft grip pads.
- Use the longest tool possible (screwdrivers, wrenches) for the best leverage.
- Use vises, clamps, or jigs to stabilize objects to avoid sustaining forceful gripping with the hand.
- Use a step stool or ladder when necessary to reach above shoulder level, or to lift objects overhead.
- Use carts/dollies to carry heavy loads. Avoid the need to handle heavy loads by making several trips.
- Use forearm troughs, armrests, or pillows under forearms during tasks if needed.
- Use adjustable keyboard trays large enough to support a pointing device to properly position your keyboard. Negative tilt adjustability is highly recommended if you sit in an upright position to work.
- Tilt containers or objects to avoid bending the wrist to pick up objects.

#### **Body Mechanics:**

- Use the largest joints and muscles to do the job.
- Use two hands to lift rather than one, even with light objects and tasks. Avoid lifting with the forearm in full pronation (palms down) or supination (palms up).
- Slide or push and pull objects instead of lifting.
- Keep reaching to a minimum. Position objects close to the body within easy reach. Carry objects close to body at waist level.



## Preventing Injuries at Computer Workstations

Repetition, awkward posture, high force levels and eye strain can lead to discomfort and injury when using a computer. Here are some ways to reduce your risk exposure:

### Repetition

- Alternate tasks
- Share tasks with co-workers
- Take frequent breaks from keying/or mouse use
- Reduce or eliminate unnecessary work

### Awkward Posture

- Sit supported against the back of your chair
- Avoid bending or twisting your neck or trunk
- Keep shoulders relaxed and arms close by sides when working
- Keep elbows at a 100 to 110 degree angle when using the keyboard and mouse
- Keep wrists in a straight or neutral position when keying or using a mouse
- Keep fingers in a relaxed position when keying or using the mouse
- Keep work materials within close reach
- Use a telephone headset for frequent/prolonged phone use
- Change positions/tasks frequently

### Force/Pressure

- Key with a light touch
- Avoid prolonged or excessive grasping of the mouse
- Use larger diameter pens to reduce grip when writing
- Use electric stapler for large stapling jobs
- Select a chair with adequate padding
- Avoid resting elbows and wrists on sharp or hard edges and surfaces

### Eye Strain

- Reduce glare on your computer screen by adjusting it's placement and tilt, using a glare guard or using window blinds and light filters
- Rest eyes intermittently by focusing on distant objects



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- Take visual breaks
  - Blink often when viewing the monitor
  - Wear appropriate corrective lens for computer work
  - Adjust the font, flicker and contrast of your monitor screen



## Repetitive Strain Injury (RSI): What is Good Treatment?

Repetitive strain injury (RSI) is a common condition that encompasses many different injuries. The spectrum ranges from carpal tunnel syndrome to tendonitis. The common denominator is that they are caused by excessive repetitive activity or overuse. There is no specific protocol for treating RSI, due to the fact that RSI can be so many things. However, getting the correct treatment is essential for recovery of the affected area. And the earlier you seek treatment, the faster the recovery.

It can be difficult to find a doctor who is experienced in diagnosing and treating RSI. Most people will start with their primary care physician. Some primary care physicians will have the skills to treat your condition, but most will refer you out to specialists. Some of the specialists you might see include orthopedic surgeons, rheumatologists, neurologists, hand specialists, and physiatrists. The correct doctor often depends on the seriousness of your injury.

Diagnosis of RSI is not simple. Sometimes it is difficult to arrive at a definite diagnosis because you may have a multitude of symptoms that can change from time to time. Your doctor may use a variety of diagnostic procedures in addition to a physical examination to evaluate your symptoms.

- **Nerve conduction studies and EMG tests.** These tests involve attaching electrodes to your hand and passing an electrical current through your arm. The time required for the nerve to respond is measured. Slow or delayed times can be indicative of pinched or injured nerves.
- **Diagnostic imaging.** X-rays and MRI scans are used to check for skeletal problems, most commonly at the wrist, elbow, back, shoulders and neck. If you have the symptoms of thoracic outlet syndrome, your doctor might also want to check for extra ribs or other abnormalities.

Your doctor will use the findings from these exams and his clinical findings to refer you to another doctor or a therapist to begin the rehabilitation process. Sometimes you may see more than one specialist. The most common are:

- **Physical therapist.** The physical therapist should check your spine and neck and look for pinched or stretched nerves. A good assessment will include the following:



- Posture - To determine areas of the body that may be compromised due to poor posture
- Spinal range of motion - Determines how much motion there is in the neck and back to determine limitations in range.
- Joint mobility - Determines how the each individual neck and back vertebrae moves.
- Strength – Specific assessment of scapular muscles and functional assessment of arm, leg and abdominal strength.
- Neural tension - Assessment of nerve tissue integrity and mobility as it courses out from the neck and down the arm.
- Soft tissue - Assessment of restrictions of movement in the arm and hand.
- **Occupational therapist.** The occupational therapist should complete a thorough evaluation of the following:
  - Strength – To determine areas of upper extremity that are weak.
  - Flexibility – Determine tightness or range limitations in shoulder, elbow, forearm, hand and wrist.
  - Soft tissue - Determine presence of scar tissue, swelling, and tendon and nerve integrity.
  - Pain – Determine areas of discomfort and things that increase pain levels.
  - Time management/Lifestyle assessment - Determination of effective stress management strategies for home and work.
  - Worksite evaluation – Review of your job to determine problems in workstation design or work that can interfere with your recovery.
- **Hand therapist.** A certified hand therapist can also treat over-use injuries. Hand therapists can either be physical or occupational therapists and may provide a combination of the previously listed services.

Therapists have a variety of skill levels and expertise. Make sure you choose a therapist who has experience and expertise in treating over-use injuries.

Your therapists should collaborate to develop a comprehensive treatment plan that addresses all of the identified problem areas.



Typical treatment plans include the following:

- Range of motion and mobility exercises
- Strengthening exercises
- Postural exercises with emphasis on scapular and abdominal or “core” strengthening
- Nerve gliding activities
- Soft tissue mobilization
- Massage
- Splinting PRN
- Pain management
- Work techniques
- Work pacing and time management
- Use of adaptive equipment including specially designed keyboards, pointing devices, furniture and alternative technologies such as speech recognition

There is frequent cross over between hand, occupational, and physical therapists. For example, the hand therapist might use modalities to reduce swelling. Soft tissue mobilization and stretching might be performed to increase the flexibility of the soft tissue. Treatment is very individual and this outline is general. It should give you an idea of what to expect if you need treatment.

Remember, don't wait too long to seek treatment. RSI can become so serious that it is not curable. Your symptoms may never go completely away if you wait too long to get help.

For further information on our services or training, please contact [enquiries@eighty20consulting.co.uk](mailto:enquiries@eighty20consulting.co.uk) or call 07814 010830

