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# UNIT 14 ERGONOMICS

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## 14.1 INTRODUCTION

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Today, changes in technology, changes in the way we perform work and where and how we work are change of at a rapid pace. Nowhere is the change more evident than in the use of computers.

The new technology has brought on new demands for information as well as new and more sophisticated computing systems. Today, almost every one of us interacts with computers on a daily basis to create new things and ideas, to produce documents, to correspond with friends and associates, and for many other purposes including research. But do you know that the excess and unsafe use of computers can have adverse effect on our health and performance?

The answer of the above question is ergonomics. **Ergonomics**, also known as human factors, is the science of designing the workplace environment to fit the user. Proper ergonomic design is necessary to prevent repetitive strain injuries, carpal tunnel syndrome, which can develop over time and can lead to long-term disability. Ergonomics is concerned with the 'fit' between people and their technological tools and environments.

Here we will examine the factors that may impact your health and performance while using a computer. Whether you use a desktop computer in an office or a portable computer in an alternative setting, you make choices that can either improve or decrease your performance and comfort.

By thoughtfully reviewing the layout of your workplace and your equipment, you can mostly identify what is wrong and begin to develop improvements to make computer use more rewarding and less physically demanding.

Or, do certain tasks or pieces of furniture and equipment stand out as awkward, difficult, even painful to use? Use your common sense to eliminate the barriers to performance that you find. Also, in this unit will

examine many possible solutions to common challenges in work area setup.

Health and safety issues associated with computer use exist in many degrees. In some cases, the designs of the equipment or procedures present you with a nuisance. In other situations, the work area design may cause discomfort or short-term pain. A well-designed work area is only part of the solution. You must also contribute by using proper work habits and techniques. In the worst case, poor workplace design and /or improper use may contribute to injuries.

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## 14.2 OBJECTIVES

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After studying this unit, you will be able to:

- understand the disorders associated with the overuse of human joints;
- enumerate the upper and lower body risk factors;
- discuss proper posture and seating arrangements while working on a computer; and
- describe the ill-effects on eyes and vision on prolonged exposure to computer screen.

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## 14.3 REPETITIVE MOTION INJURIES

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Repetitive motion injuries, also called repetitive stress injuries, are temporary or permanent injuries to muscles, nerves, ligaments, and tendons caused by performing the same motion over and over again. A common repetitive motion injury is carpal tunnel syndrome as shown in figure 14.1. This disorder occurs when the median nerve, which travels from the forearm to the hand through a “tunnel” in the wrist, is compressed by swollen, inflamed ligaments and tendons. It is often seen with people who use computer keyboards for long duration or work on assembly lines.

The injury can be quite painful and can also cause numbness, clumsiness, and a loss of motion, flexibility, and strength in the area. It can worsen over time without treatment, and can result in a complete loss of function.

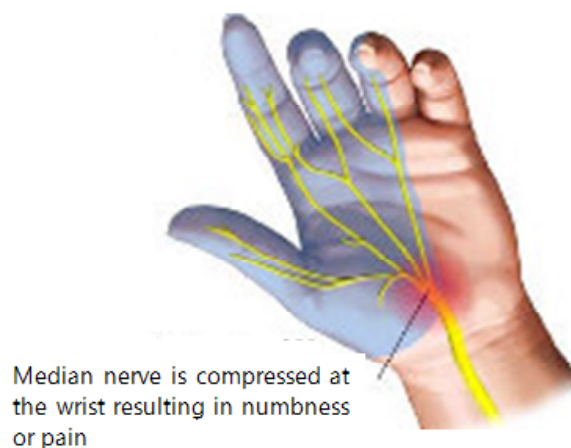


Fig. 14.1: Carpal tunnel syndrome

Repetitive Motion Injuries is a disorder that is based upon the time, amount and severity of your exposure. Repetitive Motion Injuries disorders occur gradually over a long period of exposure to low-level harmful conditions. A brief exposure to these conditions would not cause harm. But a prolonged exposure may in some people, result in reduced ability to function.

Not all pain will result in long-term disability. Muscle pain often develops after exerting yourself in ways that the body is not accustomed. Luckily, muscles heal very quickly, and even extreme muscle pain will usually diminish within a few days when managed properly.

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## 14.4 UPPER BODY RISK FACTORS

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The main vulnerable parts in the human upper body are the neck, wrist and back. Therefore particularly while typing/using the mouse you should be very particular about your posture.

Typing at a keyboard on a desk is a common work posture for many computer users. In this position it is difficult to maintain the wrist is in a neutral posture, because the forearms sag as they tire and this puts the wrists into greater wrist extension. Also, most users have to work with their elbows flexed, which can compress the median and ulnar nerves at the elbow and restrict blood flow to the hands. Working with the forearms sloping up increase muscle loads in the upper arms, shoulders and neck, when you have worked in this position for more than 3-4 hours invariably leads to muscle fatigue.

Typing at a keyboard on a conventional articulating keyboard tray can increase postural problems for users. Working with the keyboard more steeply angled on the tray is a common work posture for many computer users. In this position, it is also difficult to maintain the wrist is in a neutral posture, because the forearms sag as they tire and this puts the wrists into greater wrist extension.

### Back

The spine is one of the most important organs that need to be taken care of. Right and wrong postures have their effects not only on wrist and hands but a tremendous effect is on the back also, so due care must be taken. You can use the following exercises for back: (These methods should not be tried without doctor's consultation.

- **Shoulder Squeeze:** Raise your arms in front of body with elbows bent and thumbs up. Pull elbows back, squeezing shoulder blades together. Hold for a few seconds then release.
- **Stretch Up:** Sit up straight and gradually stretch to be as tall as possible, hold for a few seconds and then relax.

### Wrist

It has been recognized that repetitive movement at the wrist, as occurs with prolonged use of a computer keyboard can lead to inflammation in the carpal tunnel and the resultant painful syndrome. Patients usually feel pain in the forearm area as well as numbness in the affected hand in the finger distribution. You can use the following exercises for carpal tunnel problems that seem to be speeding healing. (try them only after taking advice from a doctor).



Fig. 14.2: Hand Exercises for Carpal Tunnel Syndrome

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## 14.5 LOWER BODY RISK FACTORS

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The lower body even though may not seem to be in direct participation when working on computers. Nevertheless its importance is not secondary in any way whatsoever to any other portion of the body.

### Position of Legs:

You should make sure that your legs are comfortable while you are working on the computer for long durations. Generally, if you are a little aware, you know yourself whether your sitting position is right for your body or not. Depending on your height you might need to keep some extra footrest underneath your feet to support your seating.

### Lower Back

In the following figure 14.3, you have seen poor and correct working posture. Human back is very agile and is unaffected in long run by such positions but repetitive and prolonged strain of this sort can damage the discs in the backbone badly and permanently. You should take care that while working on the computer, the monitor should be placed at such a distance so that you don't have to crouch to look at it.



Fig. 14.3: Poor Working Posture and Correct Working Posture

You should make sure that the chair you are using provides back rest that is according to your height so that its back rest aligns with your lower back. Also, the vertical height above the ground is equally important, and should be according to your height. The chair should be well cushioned for added comfort. You should not sit in one position for prolonged periods rather you should keep on changing your positions or keep taking rest after short durations of time.

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## 14.6 SEATING

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The human body was designed to move. One of the most important aspects of a good sitting habit is movement. Standing up from your chair and frequently adjusting your sitting posture can be one of the best methods to guard against injury and fatigue. The best chair design in the world will not force good posture or prevent the need for the human body to move.

### Height

Your feet should rest comfortably on the floor or if necessary, should be supported by a footrest. For most people the knees should be at a level equal to or slightly lower than the hips. Adjust the chair height to attain a natural inward curve of the spine and optimize the comfort of your lower back. If the chair is too low, your lower back will flatten or round out. If the chair is too high, your feet, and therefore your back, are unsupported. Circulation to the lower legs can also be compromised if the chair is too high.

### Length of the seat pan

There should be 2-3 inches between the back of your leg and the seat of the chair. This will allow for a natural bend in your knees. If the seat pan is too short, it can create pressure points and discomfort in the back of the thigh. If the seat pan is too long, you will not be able to sit back in the chair. Some chairs have adjustments that shorten or lengthen the seat pan if necessary.

### Lumbar support

The curve of the backrest should support the natural curve of your back. You should not feel too arched, nor should you feel unsupported. If your chair does not provide sufficient lumbar support, you might be able to use a lumbar pillow or towel roll to improve the fit.

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## 14.7 EYES AND VISION

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Eye and vision problems are the most common health complaints of computer users. Using computers for extended periods can cause visual discomfort, headaches and vision challenges. In general, it is unlikely that you will suffer permanent changes or damage to your eyes. Rather, you may experience these symptoms whenever you use a computer intensively for periods of a couple of hours or longer; the symptoms will diminish soon after you stop working on the computer. Typical symptoms of vision challenges include eye strain, blurred vision, burning, itching or tearing eyes, temporary change in ability to see colors and headaches.

Let us know more about eyes' related problems. If you have these symptoms then you must see a doctor for the same.

### **Eye strain**

Eye strain refers to ocular fatigue, eye discomfort and headaches associated from intensive use of the eyes. Common causes include glare on the computer screen, reading small character sizes on the screen and poor contrast between text and background on the monitor.

### **Blurred vision**

Blurred vision can be caused by normal physiological changes in the eye. It can also be caused by constant focusing on objects within 12" of the eyes, which often occurs when reading in low light.

### **Dry and irritated eyes**

Dry and irritated eyes occur when there is insufficient fluid in the eyes to keep them moist. Eyes are kept moist and refreshed by a normal blink reflex, which is present from birth. Blink rates vary with different activities and can become slower when concentrating. Eyes can become red and itchy. Common causes include:

- reduced blinking when using the computer and
- Air movement that is noticeable in the face area.

If you feel your eyes become dry or tired with computer activities, remember to take frequent vision breaks. Breaks can include momentarily closing your eyes or looking away from your computer to focus on distant objects. If your eyes tend to feel dry or you wear contact lenses, eye drops of an artificial tear substitute (taken with doctor's advice) may also help prevent or relieve symptoms.

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## **14.8 HELPFUL TIPS FOR WORKING ON COMPUTER**

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You can use the following tips for working on computer:

- **Correct way of using a mouse**

A well-designed mouse should not cause undue pressure on the wrist and forearm muscles. A large bulky mouse may keep the wrist continuously bent at an uncomfortable angle.

Pressure can be reduced by releasing the mouse at frequent intervals and by selecting a slim-line, low-profile mouse. Keep the mouse as close as possible to the keyboard, elbow bent and close to the body. The following figures show the correct way of using a mouse:

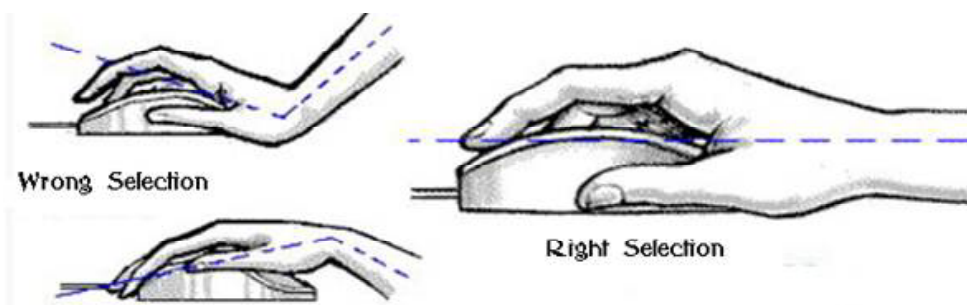


Fig. 14.4: Correct way of using a mouse

- **Positioning is everything**

Correct positioning of your computer, keyboard and mouse is essential. Your screen should be positioned about an arm's length from your eyes and 20 degrees below eye level. Consider foot and wrist rests for added comfort.

- **Proper Position of Keyboards**

Place the keyboard in a position that allows the forearms to be close to the horizontal and the wrists to be straight. That is, with the hand in line with the forearm. If this causes the elbows to be held far out from the side of the body then re-check the work surface height. Some people prefer to have their wrists supported on a wrist rest or the desk. Be careful not to have the wrist extended or bent in an up position.

- **Room Lighting**

Proper lighting in the room is very important. Try to reduce glare and reflections from your screen and set your color, contrast and brightness levels to suit you.

- **Splash water on your face**

During breaks, splash water on your face while closing your eyes. This has an overall relaxing effect and helps you feel refreshed.

Take time out and follow three steps:

**In the first step**, after every 20 minutes of looking into the computer screen, turn your head and try to look at any object placed at least 20 feet away. This changes the focal length of your eyes, a must-do for the tired eyes.

**In the second step**, try and blink your eyes to moisten them.

**In the third step**, you should walk to some distance. It helps blood circulation for the entire body.

With so many of us spending lots of time in front of the computer every day it comes to no surprise that research is showing a rise in visual problems. What can one do? First, it's important to find out how you can protect your eyes through eye health examination and by making a few minor changes in your computer viewing habits.

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## 14.9 LET US SUM UP

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In this Unit you learnt about the various health related issues while using computers. The term that is coined for this discipline was Ergonomics. You learnt about the upper and lower body parts, seating, eyes and vision and the work layout. As the use of computers is increasing in every field these days, these issues should be kept in mind and incorporated religiously by every individual who is using computers in his habits. Computers provide you with tremendous benefits in all walks of life, but their prolonged usage can also lead to physiological problems in your body therefore Ergonomics is something that everybody should be aware of and incorporate in their lives in order to remain healthy and still be avid computer users.

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### 14.10 CHECK YOUR PROGRESS EXERCISE

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1. What is Ergonomics?  
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2. What is Carpal tunnel syndrome?  
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3. What is the main cause of lower back pain?  
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4. What effects can prolonged exposure to computer screens have on your eyes?  
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5. Explore the various Ergonomic computer equipment's are available in the market.  
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## 14.11 ANSWER TO CHECK YOUR PROGRESS EXERCISE

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1. Ergonomics is a field of study that attempts to reduce strain, fatigue, and injuries by improving product design and workspace arrangement. The goal is a comfortable, relaxed posture.
2. Carpal tunnel syndrome is a common condition that causes pain, numbness, tingling and weakness in the hand and wrist. It occurs when there is increased pressure within the wrist on a nerve called the median nerve. This nerve provides sensation to the thumb, index, and middle fingers, and to half of the ring finger.
3. The main cause of lower back pain is the wrong posture and prolonged strain in the long run.
4. Prolonged exposure to computer screen can cause visual discomfort headaches vision challenges, eye strain, blurred vision etc.
5. This is a practice exercise. Try doing it yourself.