

## A Comparative Study for Ergonomic Aspects with Respect to Computer Usage



### Engineering

KEYWORDS : : Ergonomics, Posture, Musculoskeletal, Eyesight.

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### ABSTRACT

*Ergonomic principles relates to human-machine interaction derive to the design of a new, commercially available primary means to connect people with computer applications for comfort & speed. In this paper, we provide some of the issues related to computer usage & required ergonomics for example: eye sight, back sitting posture, risks associated for employees and suggestions for companies to implement. These concepts were evaluated using methods of design research to positively affect the efficiency, and creativity for consumption activities and experiences when utilizing the power of computers. Also it focuses on its after effects like computer borne diseases and some design themes that are arranged for better use of computers today.*

### Introduction

Ergonomics is about matching equipment to the user and the task to the worker giving comfortable environment to a user with respect to machine he works on. Another term used overseas for ergonomics is human factors. To apply ergonomics, we need to know about human capabilities and, of equal importance, what the person is trying to achieve. A person who has expertise in ergonomics is called an Ergonomist. The fundamental issues related to computer ergonomics are eye sight, back sitting posture, risks associated with computer usage for employees & suggestions for eliminating them by companies and it's after effects/computer borne diseases. When choosing equipment, the size range of that part of the person using the product needs to be assessed. For example, for a computer mouse hand size is important while the person's height is not.

### 2. Sitting Postures

Criteria considered while at work, for long period sitting requires a padded well dimensioned chair that can be adjusted in height and appropriate depth of seat. It must have lumbar support in an appropriate spot – a firmly padded part that fits snugly.

A seat pad allowing adjustment towards, forward tilt is desired. Which increases the angle between the hip and the back making people feel easier to keep the curve in the small of their back. Many users with back pain find this beneficial & comfortable.

- The upper arms should be hanging, relaxed besides the body with shoulders not being lifted and causing no pressure point between the user and the chair. There should not be any obstacle between the seat front and the calves while the lumbar spine supported by the backrest.
- It is desired that postures be changed in due intervals allowing muscle movement by getting up and out of the chair.
- Recommended Sitting posture for a 'tall' back with natural curves is – an 'S'-Shape instead of 'C'-Shape.

### 3. Chair Seating Essentials

There is distinction between dimensions of Management/ Executive chairs and clerical chairs. The major difference is due to executives increasingly usage of computers where as the clericals do not. Thus the adjustments that should be considered essentially, ergonomically for an executive/Manager chair are:

- Height
- Backrest angle and seat depth
- Lumbar support height
- Adjustable armrests
- Forward tilt

### Correct Sitting Posture for Computer



Fig. 1 Correct Sitting Posture[10]

Armrests on chairs are generally not recommended for people doing a large volume of typing. The armrests generally restrict the chair movement, and may be too high for some users. However, armrests can help less mobile people push themselves out of the seat. Also, armrests can be used to change posture for managerial, professional and executive staff that spends less time on keying tasks but long periods sitting.

Castors on chairs moving on hard surfaces are unsafe as the chair can move too freely. Glides or rubber tiered 'brake' castors are recommended on hard surfaces. This reduces the risk of a person sitting and inadvertently falling when the chair is rolled away.

A work surface can be a desk or part of a workstation. Australian Standard AS/NZS 4442:1997 states the minimum requirements for a work surface:

- 800 mm deep (14"-15" CRT monitors)
- 1200 mm wide for a single task for e.g. keyboard work only
- 1600 mm wide for mixed tasks for e.g. clerical and keyboard work
- Work surface height is preferably adjustable:

Adjustable including range from 610 to 760 mm Fixed, 700-720 mm preferred but can be low as 680 mm.

- Legroom width should be a minimum of 650 mm or preferably 800 mm to allow chair to swing in both the ways
- Knee space just under the work surface should be a minimum of 450 mm deep
- Leg space at 120 mm above the floor should be a minimum of 600 mm deep.
- One must change his/her posture and position frequently by adjusting the setting on the chair for eg: typing, writing,

walking and standing as often as possible. This would reduce the risk of injury and ensure proper blood circulation.

**4. For Eyesight**

User eyes should not be neglected as they play indispensable role in computers usage. Muscles control the eyes and these muscles need a change in position too. So if user is looking at a monitor for longer period (say more than 10 minutes) he needs to swivel on his chair and focus on something straight ahead of him in the distance. This relaxes your eye muscles. The object in the distance can be out of the window or on the other side of the room. Take the opportunity to get up and stretch – this will provide a posture change.

Researchers have proved that people should maintain distance of screen, at about 600-800 mm away which is very comfortable for eyes. Generally, one should look straight into the monitor, he/she should not have to twist his neck to concentrate on the monitor. Ideally, the monitor should tilt upwards allowing monitor to be perpendicular to the line of sight.

Now a days the minimum depth specified allows monitors to be placed at a comfortable distance from the eyes and allowing flexibility in the positioning of the keyboard and mouse. Australian Standard states AS/NZS 4442:1997 which was written in an era where monitors were typically 14” or 15”. Bigger monitors often are deeper and a deeper desk should be used.

**5. Touch pads v/s Mice**

Though touch-pads are also available for desktop computers but most people prefer to use a mouse because it is a better pointing device than a touchpad.

While using a mouse, the pointer is positioned by moving the mouse on a mouse pad or any hard surface. The device is gripped between the fingers and thumb and the movement occurs via the wrist & the forearm. While with a touchpad, the pointer movement is accomplished by sliding any of the fingers along the surface of the touchpad. Both devices are used as relative positioning devices where in, the pointer moves relative to its previous position when the finger or device moves.

Considering a mouse, selecting is the act of pressing and releasing a button while the pointer is over an icon or any screen object. Dragging & Double clicking are related operations that require pressing the button. There are two common implementations for selecting with touch pads- By using the physical buttons or by using lift & tap.

**5.1 Use of Physical Buttons in the Touchpads**

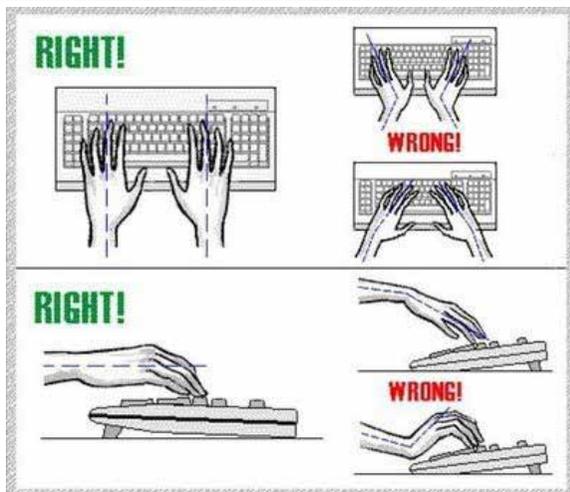
Mostly touch pads include physical buttons that are operated with the index finger/thumb. If the index finger is used to operate, the finger has to move frequently between the touchpad and the physical buttons & this impedes the performance compared to using a mouse for the same. If the thumb is used, then positioning and selecting proceed in concert, as while using a mouse. However, the result is not very optimal because of interference between the muscle and limb groups that are engaged.

**6. Keyboard**

A research suggests that the ergonomic keyboards eg: split keyboards with each hand at a different angle are more comfortable to use than the standard keyboards.

This is because the wrists maintain a natural line rather than angled toward the little finger.

If the number pad is not used often one should consider keyboards without a number pad because this allows the mouse to be brought closer to the centre line of the body.



**Fig. 2 Correct Typing posture[10]**

**7. Computer borne diseases**

It's a well known Fact that prolonged sitting contributes to a broad range of chronic disorders that include joint impairments such as arthritis, inflamed tendons and tendon sheaths, chronic joint degeneration, muscle pain impaired circulation and tissue damage. Static and constrained postures interrupt blood flow in direct proportion to the muscle loads. Static postures reduce our effectiveness, causing us to move less often and to move into postures that harmful.

This could also lead to infertility in men due to stress and uncomfortable posture and strain in the body.

Some researchers state that such damaging effects are more related to “lack of physical variation” than inactivity. That is, the actual lack of variety of postures is more hazardous than the sedentary nature of the work. Thus an individual is more prone to diseases such as:

Disease	Affected part	Reasons
Carpal Tunnel Syndrome	Wrist, back problems, neck & shoulders, generates stress, musculoskeletal problems	Due to poor Postures on computer and prolonged sitting
vision syndrome	Eye- Myopia, Glaucoma and blurred vision	Prolonged sitting on computers
Motion Disorders	hands, wrists, neck, back, hips, knees, feet, legs, and ankles & causes Numbness	Prolonged sitting & fatigue
Tendon Injuries	Legs & hands inflammation	Lack of mobility
Sleep Disorder	Brain- insomnia, depression	Late night working
Radiation Disorders	Body, Cardiac system	Due to generation of rays from the electronic devices

**Table 1. Borne diseases vs affected parts of body**

**8. Suggestions for Companies**

Employers Duty of Care – Preventative Maintenance

Taking examples from employers in Australia who have a general duty of care to their employees, provide a safe and healthy work place where in the office working environment under the duty of care includes:

- Appropriate equipment and environment are provided.
- Reasonable time is allocated for tasks.
- Ensuring employees know how to use and adjust the static equipments like desks, chairs and computers etc. and providing instruction/training .
- Supervision ensures the equipment being used properly.
- Ensuring the system of work is appropriate and not detrimental to the employee's health, safety or welfare.

## 9. Conclusion

Prolonged & static sitting postures introduce ergonomic risk factors to heart, wrist, hand, neck, shoulders, legs, back, eye etc inducing several disorders, stress & insomnia which negatively affect our health. The only truly effective way is to maintain some standards for working on computers.

In the summary we see that although technology has provided us lot of services and has enabled faster working but have lead to various side effects, and problems due to malpractice in sitting posture while using computers. Hence it must be compulsory to adhere to strict ergonomic norms and regulations, especially in the context of a vast programming populace with 17% of the world programmers being Indians.

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