Ergonomics Principles for Computer Vision Syndrome

Dr. Sakshi Sharma[1], Mahendra Kumar Sharma[2]

[1]Assistant Professor, Department of Swasthavritta& Yoga, SBLD AyurvedVishwa Bharti, Sardarshar, Rajasthan, India
Email: *drsakshi1993[at]gmail.com*

[2]Professor & Head at P. G Department of SharirRachna, Dr. S. R Rajasthan Ayurved University, Jodhpur, Rajasthan, India

Abstract: *Spending many hours a day in front of a computer can have a very harmful impact on our body. Most of the computer users unknowingly by extending their wrists, slouching, sitting without foot support, and straining to look at poorly placed monitors putting so much physical stress on their body. These habits can cause cumulative trauma disorders or repetitive stress injuries, which make a lifelong impact on health by causing the emerging pandemic of new era known as Computer vision Syndrome. They may show symptoms like pain of neck, pain at back, eye muscle fatigue, irritation in eyes, blurred vision, headache etc. and all these leads to reduced work performance. Ergonomics helps to reduce strain, fatigue, and injuries at workplace by improving product design and workplace interior arrangement. The main aim is to attain a comfortable, relaxed posture for working people and providing them relief from the symptoms of Computer Vision Syndrome.*

Keywords: cumulative trauma disorders*, repetitive stress injuries, computer vision syndrome, ergonomics

1. Introduction

When visual demands of the task exceed the visual abilities of the person it leads to visual discomfort at the workplace. The problem can be treated by adjusting the visual condition and by decreasing the visual task of a person [1]. VDT related vision problems are a significant health concern as musculoskeletal disorders in persons working on a computer for a prolonged period. Studies indicate that eye - related symptoms occur in 50 - 90% of VDT workers, while a study released by NIOSH stated that 22 % of computer workers have musculoskeletal disorders. CVS more tends to occur when the viewing demand of the task goes beyond the visual abilities of the user. These visual - related symptoms mostly occur due to individual visual problems, poor workplace ergonomics, improper work habits, etc. On average among all CVS patients, 2/3 of the complaints are related to vision problems, while 1/3 are due to environmental factors. Most people suffer from marginal vision disorders that usually do not cause symptoms while performing less visually demanding tasks. However, VDT users have a higher incidence of complaints than non - VDT users in the same workplace environment. Therefore arrangement of workstation to make it comfortable for a long time working on computers and to minimize the excessive pressure on eyes turns out to be very successful in such scenario.

2. Material & Methods

Various books related to ophthalmology and ergonomics were used as main source materials while working on this article. Apart from this, various websites, articles, and various other literary works were considered and searched thoroughly for this review article.

Aims & Objectives
The main aim behind writing this article is to make people aware of the day to day mistakes they do while working on the computers. This minute mistakes turns into a group of sign & symptoms known as syndrome. Hence an honest attempt has been made to bring together all the steps which can make our working hours comfortable and more productive.

Computers &Ergonomics
Ergonomics [2] is based on human capabilities in relationship to work demands. It explains the associations among humans and other components of the system, and the profession that considers theory, data, principles, and methods to design to optimize the well - being of humans and overall system performance.
By following the suggestions listed below we can regulate the stressful movements of our eyes and can help our eyes to work effectively on computers listed below are the suggestions -

1) Adapt to Laptops:
If you are working on a computer for a prolonged period then try to use a monitor and keyboard setup because in laptops keyboard and monitor are so close to each other that the ergonomics of workplace can't be maintained here. If a person is working on a computer for a very long time, it's best to have a separate monitor and keyboard.

2) Improve body posture:
If someone is using eyeglasses then they should have proper fitting on eyes because less fitted eyeglasses can be the reason for squinting in eyes. The sitting posture of the person working on a computer should be straight, one should try to sit in the posture where the alignment of his neck, back, and hips should be in a straight line. Try to rest your wrists during breaks also take your hands off the mouse after a regular interval.

3) Adjust your working hours:
Reduce prolonged working on a computer. Try to distribute the work into smaller segments and switch between tasks that use different motions by this we can reduce the excessive pressure on the eyes as well as on the body.
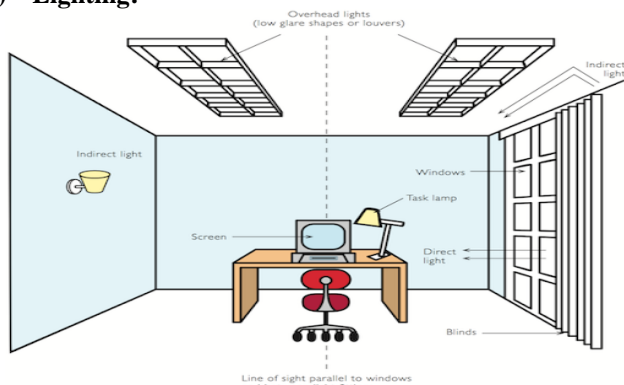
4) Lighting:

Figure 2.7: Showing uniform illumination [3]

Although illumination is an important part of the workstation, it is probably more important to have good light distribution than high illumination. When all objects in the field of view have approximately equal brightness then the condition can be termed as good light distribution. Lighting plays a very crucial role in the development of visual discomforts including eyestrain, burning or itching eyes, and blurred or double vision. According to the American National Standards Institute (ANSI), computer workstations require only 18 - 46 foot - candles but generally typical office environments have an illumination level of 75 to 100 foot - candles. This excessive lighting is the major reason behind various eye - related symptoms.

Recommendations to reduce eye strain and eye fatigue due to high illumination:
- Use blind drapes on windows to eliminate the excessive light. It should be adjusted in a way to stop entering bright light into the room directly.
- Additional lighting should be avoided on reference documents this makes them too bright as compared to the computer screen.
- An indirect lighting system provides the best illumination in the office space.
- Protect your eyes from bright overhead lights.
- Place computer screen at 90° angle to windows.
- Paint walls of the workplace with medium or dark color and they should not have a reflectivefinish this creates glare in the office environment which is highly dangerous for the eyes.

1) Reflections of the screen -

The visibility of texts on the screen is very highly decreased by the reflection. Computer users can regulate this problem by using light baffles such as files, folders to protect the computer screen from troubling light sources. If this leads to an increase in contrast and clarity of the text, the reflections create a major problem and need to be corrected in the following ways
- An anti - reflection screen glass screen can be placed over the monitor to prevent reflection.
- Remove the troubling light source.
- Prefer using dark characters on a light background, because these are less affected by reflections.
- A hood can also be used in place of an anti - reflection screen, but the hood is not preferred over anti - reflection screens.

2) Sitting Adjustments:

Generally, people think that sitting in a relaxing position is a good option but prolonged sitting creates excessive stress on intervertebral discs (shock - absorbing part of the spine) as well as on feet and legs. Due to gravity blood pools in the legs and feet and create a slow - moving return back to the heart.
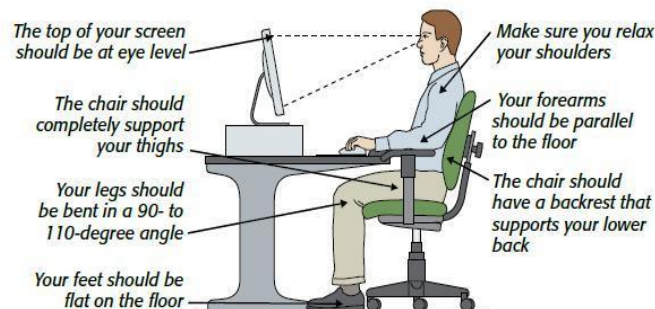

Figure 2.8: Showing ideal sitting posture [4]

By adopting the following measures we increase comfort for computer users [5]:
- **"*Dynamic sitting*"** - sitting in one position for long periods should be avoided while performing daily tasks adopt alternate sitting and standing position.
- **Chair** - backrest of the chair should be adjusted in a way to support the natural inward curvature of the lower back. We can also use a rolled towel or lumbar pad to support the lower back. Set the backrest angle of the chair in a way that your hip - torso angle is 90 degrees or greater than that. The height of the chair should be in a way that feet rest flat on the floor (if a chair is not adjustable type then a footrest can be used). Sitting posture should assure that thighs should be parallel to the floor and knees are at the same level as hips. The armrest provides support to the forearm and makes the sitting posture more comfortable. Adjust the height and/or width of armrests it gives a more appropriate position for working on the keyboard.
- **Desk** - the working height of the desk should be equal to elbow height for desk work. The area under the desk should be clean anything unnecessary shouldn't be placed there so that it allows appropriate space for users comfortable sitting or for stretching of legs.

3) Desktops arrangement for workstations:

In general, the computer, keyboard, and mouse are kept on the desk. There is no specific height advised for the computer desk but it should be approximately equal to elbow height. For good alignment of arms, the keyboard should be placed approximately2 inches above the thighs of the user. A desk that is 25 inches to 29 inches in height for the use of an articulating keyboard tray is considered appropriate. The desktop should be arranged in a way that frequently used objects like a mouse, keyboard, etc. should be kept in easy reach of the user. If a document holder is used, it should be placed approximately at the same distance as the monitor so that frequent eye shifts between the screen and reference materials can be prevented.

Keyboard & Mouse -

The forearm, wrist & hand are the main parts of the body affected by the prolonged working on computers after eyes. Working on the computer for a prolonged period exposes soft tissues in these areas to repetition, awkward postures, and forceful exertions.

To avoid these conditions following measures can be taken
- Adjust keyboard height so that shoulders can be in a relaxed position and allow arms to rest at sides.
- Forearms must be kept parallel to the floor.
- A mouse should be placed together and at the same height as the keyboard.
- Avoid resting your hand on the mouse when you are not using it.

4) Blinking

VDT characters require more attention than words written on simple paper so due to this excessive paid attention, we forget to blink often.
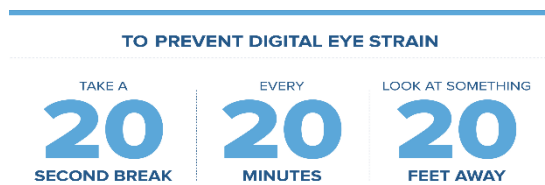
Figure 2.9: Showing 20 – 20 rule for computer users [6]

Blinking is an automatic reflex and doesn't need our conscious effort. A study (*Tsubata and Nakkamori 1993)* showed that there is less blinking while viewing a VDT's than other tasks. As the monitor is placed on a height it is in a higher field of the viewing area, eyelid opening create a bigger angle in this condition which provide more surface area for evaporation of tears and our blinking rate is also decreased here so a new layer of tears is not formed immediately with make our eyes more prone to dry eye. Take rest for 15 minutes after two hours of continuous working on a computer. We can also practice following the ***20 - 20 - 20 rule*** which plays a very significant role in the wellbeing of eyes for every 20 minutes of computer viewing, look into the distance of 20 feet for 20 seconds to allow your eyes a chance to refocus.

A mega break should follow along with our routine work breaks where we get up from the desk and move around for a brief period for at least every two hours and last for at least fifteen minutes. This will allow the eyes to change their viewing condition regularly and allow the worker to perform their work effectively.

3. Discussion & Conclusion

Computer vision syndrome (CVS) - The American Optometric Association defines CVS as that 'complex of eye and vision problems related to near work, which are experienced during or related to computer use. '

Another definition – it is a temporary condition resulting from focusing the eyes on a computer display for protracted, uninterrupted periods of time'.

According to the United States Bureau of Labour Statistics, 100 million people use computers at their jobs daily in the United States. Further, the National Centre for Education Statistics reported that 95% of schools and 62% of all classrooms in the United States are using computers since 1999. National Institute of Occupational Safety and Health has stated that computer vision syndrome affects some 90% of the people who spend 3 hours or more a day at a computer [7].

Prevention remains the main strategy in managing of computer vision syndrome. Modification in the ergonomics of the working environment, patient education and proper eye care are important strategies in preventing computer vision syndrome.

Computer vision syndrome can cause so much in loss of productivity of workers but by focusing on minutes day to day habits we can decrease the risk of such diseases like my maintaining good sitting posture, proper use of desk and chair, avoiding longer working on laptops rather try to work on monitor and keyboards, get rid of excessive illumination, taking breaks while working by following 20 - 20 - 20 rule. All of such habits saves your eyes from excessive workload and stress and keep them healthy and sound for longer time.

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