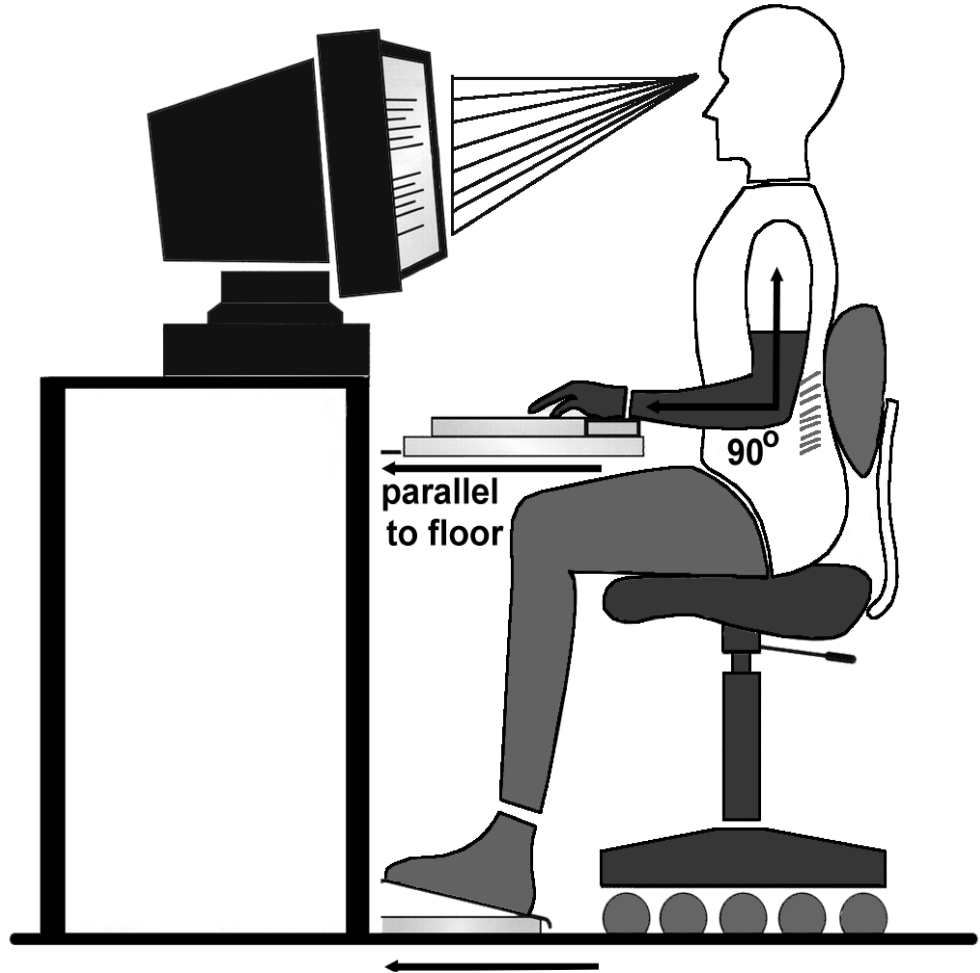


A Guide for the Safe Use of a Video Display Terminal



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Introduction

The video display terminal (VDT) has established itself as the most common piece of office equipment in use today. The VDT is used on a regular basis by most industries, service-oriented businesses and institutions, and governmental agencies. Its use has grown as demand for instant data access and the processing of information expands. As with any new technology, the VDT brings with it a set of health and safety concerns. Extensive studies have been performed which indicate that VDT use is associated with certain symptoms and health complaints. These include - eye irritation and strain, low back, neck and shoulder pain, repetitive trauma disorders, dull headaches and a general feeling of tension and irritability. Recent research also indicates that these symptoms can be prevented with proper VDT workstation design and work habits.

The purpose of this document is to increase your knowledge of the potential hazards associated with VDT use and to describe how to arrange a VDT workstation to increase your comfort and prevent injury. Two potential problems associated with VDT use are discussed in detail - visual problems (eye strain and eye fatigue) and ergonomic disorders (muscle strains, sprains and cumulative trauma disorders). The sections addressing these issues will outline the most commonly reported health complaints and provide specific guidance on setting up and using a VDT workstation to avoid these problems. A third section discusses radiation emissions from VDTs. Included at the end is a series of exercises a VDT user can complete at their workstation to assist in the prevention of strains, sprains, stiffness and fatigue.

Visual Problems Associated with VDTs

Visual problems are the most commonly reported VDT related health complaints. The problems most frequently reported by VDT operators include - eye fatigue, eyestrain, difficulty in focusing, burning or irritated eyes, watery and red eyes, and blurred vision. These eye problems can be attributed to: (1) focusing the eyes on a close object for a long period of time; (2) the constant refocusing of the eye when the source document and screen are placed at different focal distances; and (3) improper lighting. Examples of improper lighting that can contribute to visual discomfort include - glare from shiny wall surfaces, too much light, too little light, reflections from light fixtures or a poorly placed VDT screen with respect to lighting. If you can see a light fixture reflection clearly on your screen, you have a lighting problem. It is believed that eye fatigue and other visual difficulties contribute to other health issues such as headaches, postural fatigue, and general tiredness. All visual and related problems can be reduced by adhering to the guidelines which follow for adjusting your display, document holder, area lighting and maintaining proper vision care. Also, by occasionally performing the eye exercises outlined in Section 6, eye fatigue can be reduced.

Adjusting Your Display

Most displays feature a variety of adjustments, which enable you to arrange the equipment in a way, which is most convenient for you. Make sure that you. . .

- Adjust the display so that the top of the screen is slightly below eye level when you're sitting at the keyboard. The top of the screen should not be above eye level.
- Position the screen so that it is sixteen to twenty inches from your eyes.
- Position the screen to minimize glare and reflections from overhead lights, windows, and other light sources. Place it between ceiling fluorescent lighting fixtures if possible.

Where it is impossible to avoid reflections or adjust lighting, an anti-glare filter placed over the screen can be helpful. However, filters may affect the clarity of the image on the screen and should be tried only after other methods of reducing glare have been exhausted.

Most displays are equipped with brightness and contrast controls. Set the contrast and brightness of the screen at a comfortable level. You may have to do this more than once a day as the light in the room changes. Since the position of these controls varies, check your operator's manual for location.

Adjusting Your Document Holder

Like many VDT users, you may find a document holder useful, particularly if you work primarily from source documents. If source documents are placed on the top of a desk (not in a document holder), the VDT user will bob their head up and down continuously as they alternately view the source document and terminal display. Over an extended period of time, this can lead to neck and shoulder muscle fatigue (pain). When a document holder is properly positioned, as described below, this muscle fatiguing motion is not required.

If you use a copy stand make sure that you. . .

- Position it at a height that is comfortable for you, close to the screen so that it will be the same distance from your eye.
- Position your desk lamp (if you use one) so that it illuminates source documents without causing glare on the screen or your documents. Add just enough light so that you can see the document clearly; the illumination on the source document should be kept to a minimum so that lighting contrast between the screen and document is minimized.

Adjusting the Lighting

In any office it is important to ensure that lighting is adjusted to a comfortable level. Windows, overhead lighting and reflections from shiny surfaces can all create reflections on your VDTs screen.

- To avoid distracting reflections and glare make sure that you. . .
- Draw the drapes or adjust the blinds.
- Adjust your desk lamp or task light (if you use one) to avoid reflections on the screen.
- Reduce overhead lighting (where possible) by turning off lights or switching to lower wattage bulbs.

Vision Care

Concentrated visual activity, whether it involves reading conventional text or operating a VDT, can be fatiguing. Such fatigue is both normal and temporary but can be minimized with a little care, good work practices, and attention to your work environment.

Since studies show that one out of every three people has some kind of uncorrected vision problem, make sure that you. . .

- Have your vision checked as part of your regular health care program.
- Advise your vision care specialist of the visual tasks you perform. Eyeglasses suitable for one task may not be appropriate for another.
- Clean your screen, anti-glare filter and eyeglasses (if you wear them) on a regular basis.

Ergonomic Disorders

Ergonomic disorders are disorders of the musculoskeletal and nervous systems occurring in either the upper or lower extremities, including the lower back. These may be caused or aggravated by repetitive motions, forceful exertions, vibration, sustained or awkward positioning of the body or mechanical compression of the hand, wrist, arm, back, neck, shoulder and leg over extended periods of time.

Muscle Strains and Sprains

Muscle strains and sprains are common in VDT users whose workstations are not properly arranged. Common symptoms are muscle fatigue and pain in the shoulder, neck, and lower back. When the body is placed in a posture that requires muscle groups to exert considerable force to maintain the posture (such as outstretched arms), muscles may become fatigued and eventually strained if the posture is maintained for an extended period of time. This is called static muscle loading. The muscle strains and sprains associated with

VDT use are not like those associated with heavy lifting but rather strains and sprains from the loading of muscles. To avoid muscle fatigue and associated problems, VDT operators must maintain a neutral posture (one that minimizes the static loading of muscles). By adjusting the VDT workstation layout (as described in Section 4.0 and illustrated in Figure 2), an operator can maintain a neutral posture to minimize static loading of muscles and thereby prevent discomfort and potential injury.

Cumulative Trauma Disorders (Muscle, Tendon and Nerve Problems)

Cumulative trauma disorders (CTD) are defined as disorders of muscles, tendons, or nerves caused by repeated mechanical stress to a particular part of the body, typically hands, wrists, arms or shoulders. Research has found that the contributing factors tend to be the amount of force exerted, the frequency of the repetitive motion, sustained posture, nerve compression and insufficient rest or recovery time. CTDs are not new to medical reports. Tennis elbow, writer's cramp, telegraphist's cramp, cotton-twister's hand, stitcher's wrist and bricklayer's elbow are some of the disorders familiar to health care professionals. Whether or not the CTD is office or non-work related is difficult to determine. Such activities as weekend sports, carpentry, driving or home stitchery can predispose employees to CTDs. CTD problems can be grouped by the physiologic group affected, including muscle problems, tendon problems, and nerve problems. Some examples of CTDs are as follows:

Muscle problems:

- myalgia (general term for muscle pain)
- myofascial pain syndrome (irritation of the membrane around muscles)

Tendon problems:

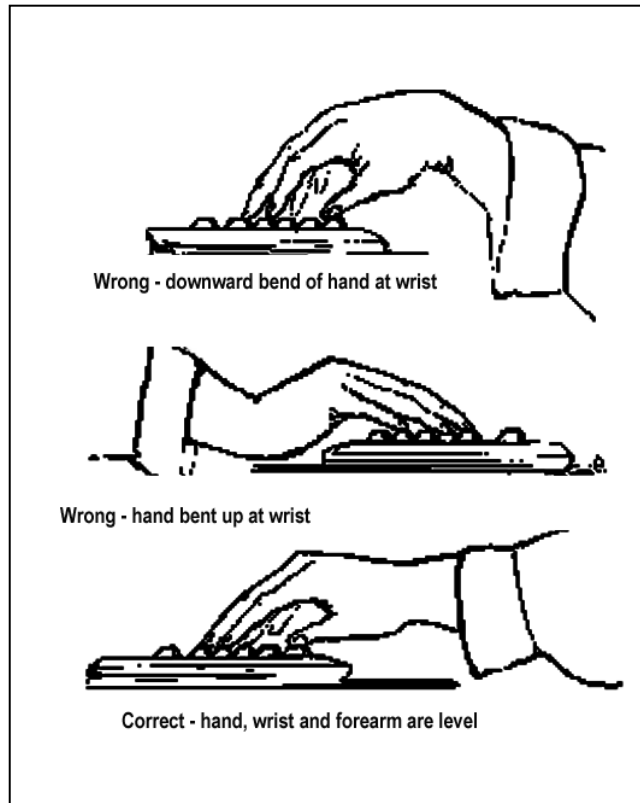
- tendon problems :
- tendinitis (irritation of a tendon)
- tenosynovitis (irritation of the sheath around a tendon)
- Dequervain's disease (tenosynovitis at the base of the thumb)
- epicondylitis (irritation of the tendon attachments at the elbow; includes tennis elbow and golfer's elbow)
- trigger finger (a type of extreme tenosynovitis, leading to locked fingers)

Nerve problems:

- carpal tunnel syndrome (damage to a nerve passing through the wrist)
- Guyon's canal syndrome (damage to another of the three nerves passing through the wrist)
- cubital tunnel syndrome (damage to a nerve passing through the elbow)

- thoracic outlet syndrome (compression of the nerves and vessels between the neck and shoulder)
- hypothenar hammer syndrome (nerve damage resulting from repeated impacts at the base of the palm).

The most common CTDs observed in VDT users are hand tendinitis, tenosynovitis and carpal tunnel syndrome. One of the most important factors in preventing these CTDs (particularly carpal tunnel syndrome) is maintaining a neutral wrist posture as illustrated in the bottom wrist of Figure 1. VDT users should follow the guidelines outlined in Section 4.2 for proper keyboard adjustment to obtain a neutral wrist posture.



Diagnosis of Ergonomic Disorders

As shown above, there are many conditions that fall into the category of CTD. The symptoms and methods of diagnosis for each condition are different and a physician's diagnosis is based on the patient's symptoms. Some typical symptoms might include - persistent pain, tingling and numbness or a feeling of heat in the affected area. These symptoms will occur while working and resting, often becoming more intense during the night when the circulatory system and body temperature are lower. If you are experiencing symptoms which you feel are related to your workstation, contact the Department of Employee Health (432-7978) to arrange for a physician's evaluation, and the Occupational Health and Safety Section (785-3550) to arrange for a workstation evaluation.

Treatment of Ergonomic Disorders

Treatment will vary depending upon the severity and period of time that the condition has existed. Early diagnosis and treatment is more effective than late treatment. Mild cases detected early can be successfully treated with anti-inflammatory drugs, rest or restricted activities, and possibly physical therapy. The more severe cases are treated with prolonged rest, anti-inflammatory drugs, immobilizing splints, heat or ice treatments, physical therapy and surgery.

Reducing the Risk Factors/Preventing Ergonomic Disorders

As with any prevention program, the areas causing the problems must be identified and corrected. Research thus far indicates that there are a complex set of conditions relating to job activities which cause or contribute to ergonomic disorders and particularly to cumulative trauma disorders. These include individual physiology and age, the work environment, technology, management and sociology. These are broken into three groups of risk factors - ergonomic stresses, psychosocial stresses, and physiological predisposition's. The ergonomic stresses, those factors involved with the interaction of the body and the physical environment, are the stresses further identified in this document. The psychosocial stresses and physiological predisposition's refer to other areas of organization, social environment, and individual physiology; these will not be discussed in this document.

Ergonomic Assessment

To understand the ergonomic stresses experienced by employees and potential for ergonomic disorders, one must evaluate the tasks performed by the employee, the equipment available to perform the tasks and the layout of the workstation. Together, these factors define the ergonomic stresses on an employee. The more intense the VDT work, the more important it is to: (1) optimize employees' posture when operating the terminal; (2) include flexibility in the workstation layout; and (3) provide adequate rest periods.

Most VDT operators at Yale University can be characterized as "moderate";. A moderate user has scheduled formal breaks every few hours and performs both VDT and non-VDT tasks. Examples of non-VDT tasks include - filing, photocopying, collating and sorting paperwork and working with clients or customers, etc. Some moderate users may work with the VDT continuously but not intensively. The VDT tasks of these individuals may include some minimal data input such as selecting a record, followed by retrieval of information off of the monitor. The information returned via the monitor is used in a subsequent non-VDT task such as letter writing, addressing envelopes, discussing the status of a record with a customer, etc. Most employees at Yale also have opportunities for frequent short-term breaks between formal breaks during which employees can stop, stretch, and relieve static loading on various muscle

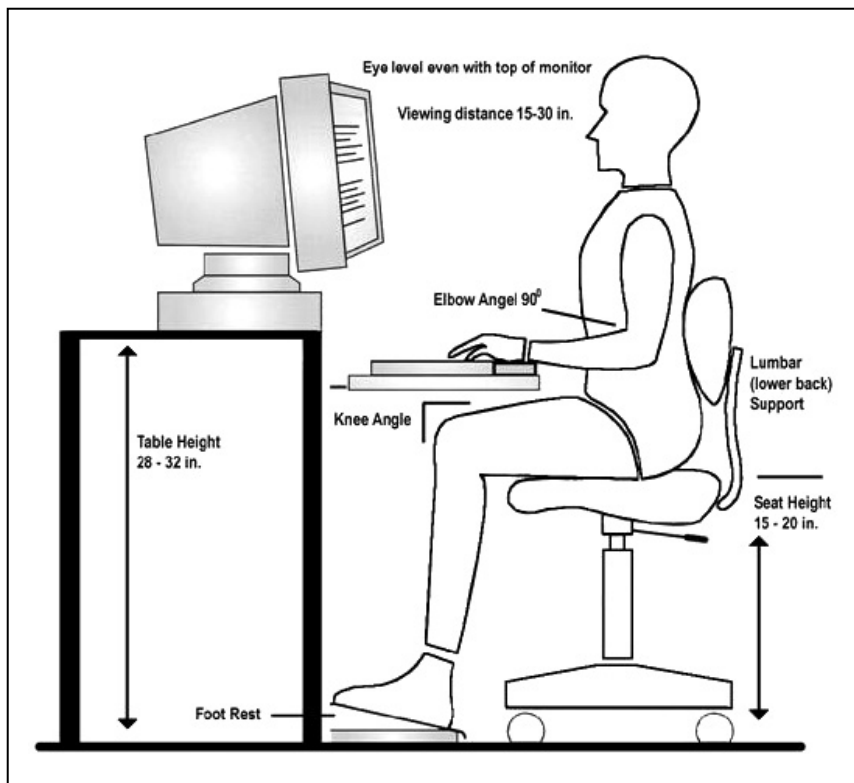
groups.. It is important to use these periods to relieve muscle tension as described in Section 4.5, Working Smart.

Ergonomic disorders can be reduced by adhering to the guidelines that follow for adjusting your body/keyboard relationship, chair, and organizing your work area. The guidance provided in this document is appropriate for moderate users of VDTs as defined above. If you are an intensive, continuous user of a VDT i.e., 100% data entry with few/no non-VDT tasks, additional flexibility may be required in your workstation to ensure a safe, productive work environment. If you are this type of VDT user, contact the Occupational Health and Safety Section (785-3550) for a workstation evaluation. Also, by occasionally performing the hand, arm and body exercises outlined in Section 6, muscle fatigue and potential for ergonomic disorders can be reduced in all VDT users.

Adjusting the Body/Keyboard Relationship

To create the best position for typing, you may need to adjust the height of both your chair and the keyboard. If your keyboard is placed on a fixed surface (not movable), the hand/keyboard connection is the first adjustment that should be made. Otherwise, adjust your chair first and then adjust the keyboard height as described below.

If your keyboard is on a fixed non-movable surface you:



- Adjust the height of your chair's seat so that your elbows are even with the fixed work surface (keyboard height). At this height, the elbow should be at a 90° angle when your hands are resting comfortably on the keyboard.
- Use a footrest if your chair is too high for your feet to rest flat on the floor when you are seated at the keyboard.
- If your keyboard is on a movable surface you.
- First adjust the height of your chair's seat as described in Section 4.3.
- Adjust the keyboard height so that your elbows are even with the keyboard when your shoulders are relaxed. At this height, the elbow should be at a 90° angle when your hands are resting comfortably on the keyboard.

Adjusting Your Chair

A comfortable chair that allows you to sit in a variety of positions throughout the day is important whether you work with a VDT or any other piece of equipment. You can quickly find the sitting position that suits you best by following these simple suggestions.

Make sure that you. . .

- Adjust the height of your chair's seat so that your thighs are horizontal, your feet rest flat on the floor and your hands are comfortably positioned at the keyboard. (Disregard this if you must adjust the chair to accommodate a keyboard on a fixed surface.)
- Use a footrest if your chair is too high for your feet to rest flat on the floor when you are seated at the keyboard.
- Adjust the backrest, if possible, so that it supports your lower back and fits the curvature of your spine.
- Change your seated position frequently throughout the workday.

Organizing Your Working Area

A few minutes thought about the best position for your display and the most effective use of the space available to you can save time and effort throughout the workday. The maximum flexibility should be used when setting up your workstation.

Make sure that you. . .

- Organize your desk or worktable to accommodate the materials and equipment you need.
- Place the things you need regularly (such as a telephone or calculator) within easy reach.
- Experiment with the placement of your keyboard, screen and other items you work with to find the arrangement that works best for you.

Working Smart

Sitting in a fixed position for long periods of time can be fatiguing. Shifting your position and occasionally changing your routine (by doing other kinds of work, taking a stretch break, or focusing your eyes on something else) can help keep you alert and reduce fatigue.

Make sure that you. . .

- Change position, stand up or stretch whenever you start to feel tired.
- Rest your eyes occasionally throughout the workday. Focus on something at least six feet in the distance and blink to moisten eyes.
- Try to keep a soft touch on the keyboard and keep your hands and fingers relaxed.
- Make your job fit you, adjust the workstation so you can efficiently and comfortably complete your work.
- Periodically exercise and perform the stretching exercises found in Sections 20 and 21.

Radiation

Another issue of concern for the VDT operator is whether the emission of non-ionizing radiation (such as electromagnetic fields in the radio frequency and extremely low frequency ranges) and ionizing radiation (such as x-rays) pose a health risk. Throughout the 1980's, many epidemiological studies were performed to determine the health hazards related to VDT use. The studies to date do not provide any conclusive evidence that the low levels of radiation emitted from VDTs pose a health risk to VDT operators. The threat from X-ray exposures is largely discounted because of the very low emission levels. The radio frequency and extremely low frequency electromagnetic fields emitted by VDTs are not considered a problem for VDT users by most experts. However, potential health effects from exposure to electromagnetic fields, particularly those associated with high voltage systems, such as high voltage overhead electrical lines, continue to be studied.

The individual most sensitive to radiation effects is the developing fetus. The study tracked the reproductive outcomes of 2118 female telephone operators who use VDTs. The researchers found that occupational VDT use was not associated with increased risk for spontaneous abortion. The researchers also found no difference when miscarriage rates were calculated according to the number of hours per week spent at a VDT and when early and late miscarriages were analyzed separately.

Exercising to Prevent VDT Fatigue

In addition to following the guidelines described in the preceding sections of this document, consider the following stretching and flexibility exercises to assist in the prevention of muscle stiffness and fatigue. These exercises will provide an improved range of motion and increased circulation for the fingers, hands, wrists and neck area. The first set of exercises are stretching exercises followed by three strengthening exercises.

As you do the exercises, be sure to only work to the point where you feel the muscle stretch (not the point of pain), and always complete the flexibility exercises before proceeding with the strengthening exercises. The last exercises mentioned are eye exercises; these will help comfort dry, itching, tired eyes.

Flexibility Exercises (6 different exercises)

The Whole Body and Arm Stretch

This general stretching exercise is good for the whole body. After sitting for a long period of time muscles tighten up, they need to be stretched and loosened to improve circulation.

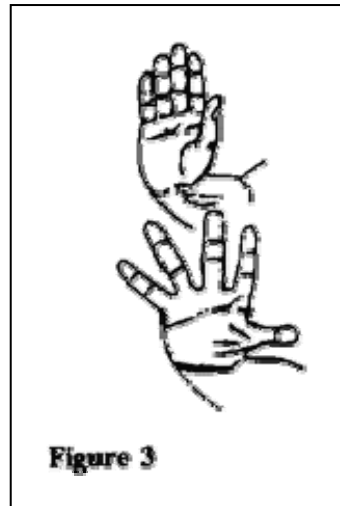
- Raise both hands over your head and reach for the ceiling raising up on your toes.
- Reach for five seconds and relax.
- Let arms rest comfortably at your sides.
- Now, raise both arms so that they are at right angles to your body and positioned in front of you.
- Stretching your arms out and keeping them at a right angle to your body, swing your arms back around your body as far as you can without bending over.
- Relax and repeat the first exercise again.
- Repeat each stretch five times alternating the exercises and relaxing between each stretch.

Shoulder Shrug

Relax your shoulders, arms at your sides. Pull your shoulders back until you feel a stretch. Raise your shoulders up toward your ears as far as you can. Now, push your shoulders toward the front making a complete circle with your shoulders. Repeat five times.

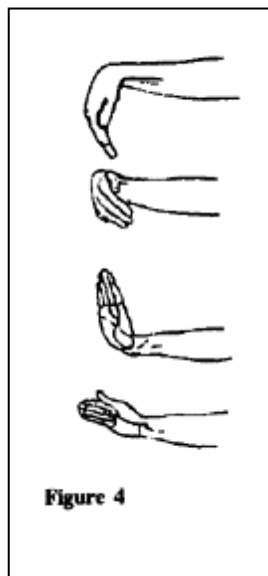
Finger Stretch

Spread the fingers of both hands far apart. Hold for five seconds, --relax-- and repeat for a total of three. (See Figure 3)



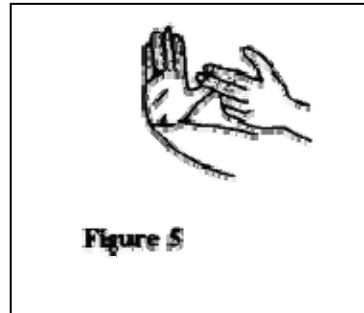
The Wrist Circle

With both arms stretched outward, draw a circle with your fingertips, five movements to the left, five to the right. (See Figure 4)



The Thumb Stretch

With the right hand outstretched in front of you, gently pull the thumb down and back until you feel the stretch. Hold for five seconds --relax-- and repeat twice more for a total of three. (See Figure 5)



Neck Flexion

Let your head hang from your neck, chin touching your chest (as much as possible). Let your head hang this way for five seconds. (If you want, clasp your hands together on the back of your neck and let the weight of your arms pull your head down even further.)

Relax. Repeat this exercise five times.

Strengthening Exercises (3 different exercises)

Strengthening exercises supplement the flexibility exercises to help develop muscle strength. These exercises will also aid in the prevention of stiffness and fatigue while using a VDT. The exercises are to be completed on each hand with a goal of twenty to thirty continuous repetitions per session.

The Hand Grip

Squeeze a stiff foam gripper (or a ball) as many times as possible with each hand.

Try to achieve the goal of twenty to thirty repetitions per hand per session. This exercise will develop the finger and hand muscles.

The Thumb Squeeze

With a soft ball located in the palm of your hand, press the ball with your thumb, toward the fingers. Do not press the ball with your fingers. This exercise will develop the thumb muscles.

Wrist Flexion and Extension

With the forearm on the table, hand over the edge and palm down, raise the hand up. Hold for ten counts. Rotate the hand so the palm is up (forearm still resting on the table), raise the hand up and hold for ten counts. Repeat ten times.

Eye Exercises

Change your focus by glancing across the room or look out a window and focus on objects at least twenty feet away. Then, lightly cup your eyes with your palms and relax for sixty seconds.

List of Equipment Suppliers

The Office of Environmental Health and Safety has compiled a list of suppliers of equipment (document holders, footrests, monitor stands, etc.) that can help you set up your workstation according to these guidelines. You may obtain the list by downloading the "Ergonomics Equipment Catalog" or by contacting the Office at 737-2121.

Two of the companies, AliMed and Softview offer their complete lines through the internet.