



THE IMPORTANCE OF ERGONOMICS IN REHABILITATION

By Paul Chek

Are you a highly trained therapist, doctor or corrective exercise specialist that has patients with seemingly *intractable* musculoskeletal aches and pains? Are you a patient that has been bouncing from doctor to doctor and therapist to therapist, yet no one has ever looked at the ergonomics of your home and work environment, or even provided you with a basic understanding of ergonomics? Unfortunately, answering “yes” to either of these questions places you in the *largest group of doctors, therapists and patients today!*

Today, there are more seated workers than standing workers worldwide. This presents a significant challenge to the body, because our bodies are simply *not designed to sit!* The chair is said to have entered into our life style thousands of years ago through Egyptian heritage. The chair, in Egyptian times, was a symbol of power; only the King was allowed to use a chair. As time passed, the King sat in the largest chair at the head of the table, the Queen in a slightly smaller and less intimidating chair at the opposite end of the table, and finally the underclassmen in smaller chairs around the table.

As you are aware, this same “power structure” can be found in households and board rooms all over the world today. Interestingly, two things have not changed since the advent of the chair, and one thing has; we still apply the persona of power to the “size of ones chair”, the human body has not changed at all since the chair was put into use, and finally, we are more sedentary than ever and **WE HAVE MORE BACK PAIN THAN EVER!**

The therapist treating a patient today must look carefully at the patient’s ergonomics and fully educate the patient so they can *control their environment*. The patient wanting full recovery from musculoskeletal injury and/or prevention of postural strain and repetitive stress disorders leading to chronic musculoskeletal disorder must seek assistance with ergonomic education.

It is critical to remember that we function in a field of gravity, *relentless gravity*, twenty-four hours a day. Some of you may say, “you don’t have to worry about gravity when you are sleeping though”. If you ever have a cervical spine injury, you will quickly learn that you may even have to take your ergonomics training to bed!



Sitting in a chair for hours at a time, bending over the hood of a car, or working over a work bench for hours at a time can be very taxing to the *postural muscles* of the body. When the postural muscles are chronically over worked, they tend to tighten and shorten, altering our natural spinal curvatures (Figure 1).

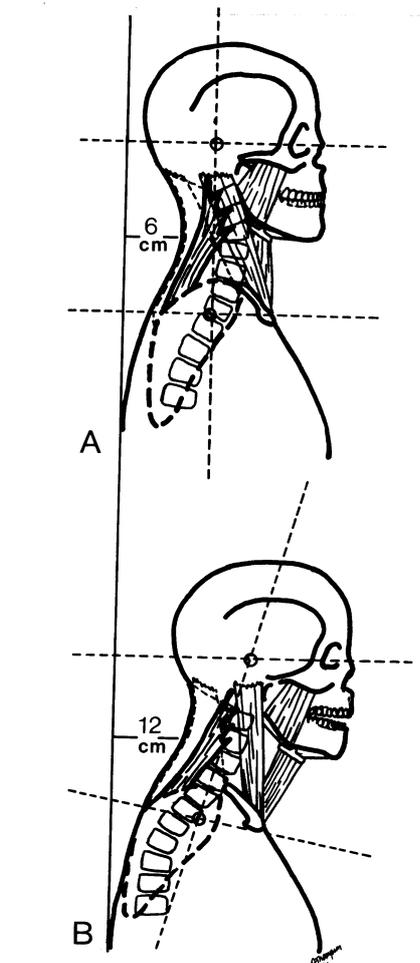


Figure 1

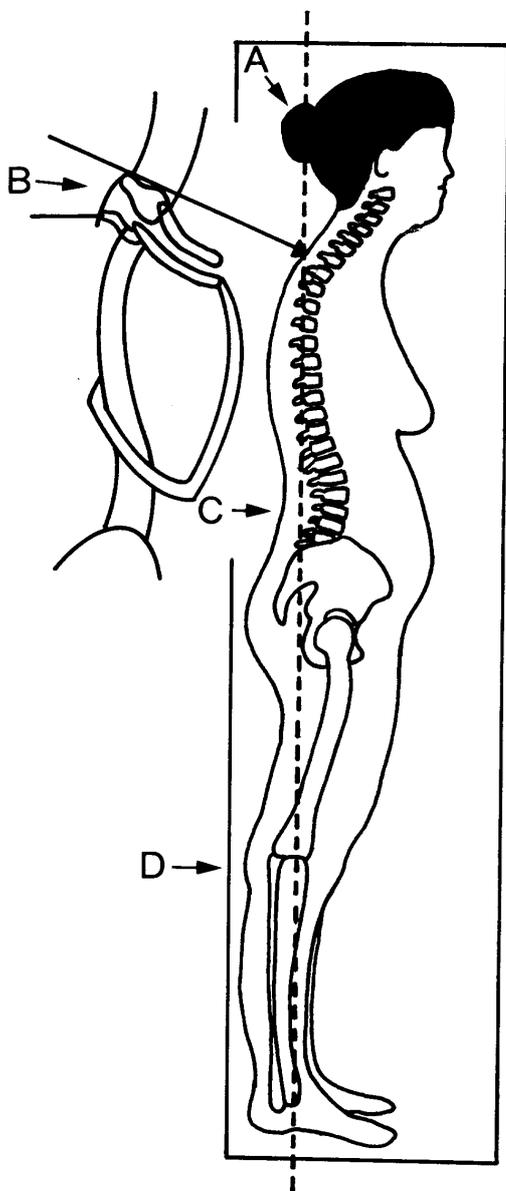
A: Normal structural relationships and optimal postural alignment results in minimal fatigue and unnecessary tissue disfunction while under the influence of gravity. **B:** When the postural muscles become overworked from poor ergonomics, they shorten and tighten, altering structural relationships, causing premature fatigue, increased incidence of injury and unnecessary lost time from work!

When the postural muscles become chronically fatigued, people tend to *hang* from their ligamentous structures (figure 2). This often results in the body adding tissue to areas of stress, such as the junction of the cervical and thoracic spines (see fig. 2-B), creating the unwanted appearance of a Dowager's Hump. If the ergonomic environment is not corrected and the patient taught proper posture and give corrective exercise, the ligaments eventually begin to breakdown, leading to pain referral syndromes; often mimicking Thoracic Outlet Syndrome. Additionally, because the body is a fully integrated kinetic chain system, the results of altered spinal curvatures at any segment of the spine result in altered biomechanical relationships throughout the entire body (Fig. 2 A-D).

As the body begins to deteriorate from poor posture and an unrelenting ergonomic environment, it becomes less and less able to handle the stresses of life, often leading to unwanted and unexpected injury. For the patient seeking help from a professional medical practitioner, their failure to educate you as to ideal ergonomics will only serve to progressively drain your finances, time and patients, often leading to unnecessary use of non steroidal antiinflammatory drugs and other pain masking medications. Eventually, the whole system begins to deteriorate, leaving you, the patient a bewildered, frustrated and confused mess!



At the C.H.E.K Institute we take great pride in providing our patients and clients with the best ergonomic education possible. Our ergonomic education covers such areas as how to set up a desk and a computer, as well as how to have optimal ergonomics while lifting objects at work, weights in the gym, or how to best adjust your particular work environment to your body.



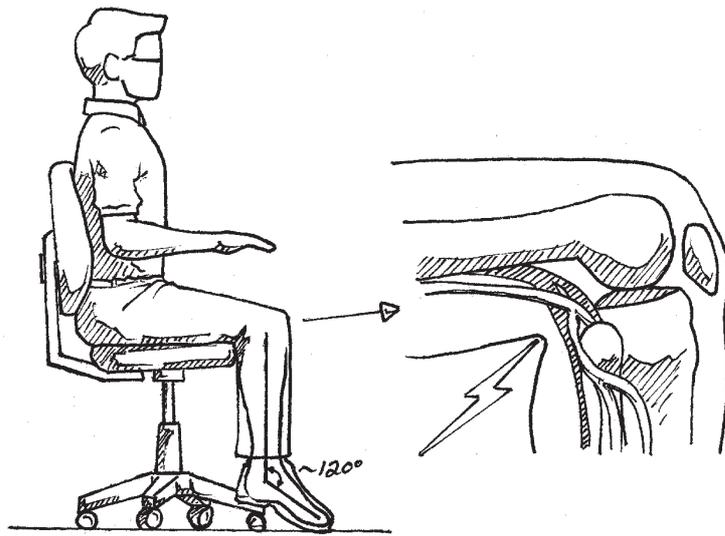
This ergonomic education form is provided to you by your C.H.E.K Practitioner and is for your immediate use, and for you to share with your friends and family. Any reproduction of this handout must be approved in writing by the C.H.E.K Institute. We sincerely hope you find it of great benefit to your recovery and toward prevention of unwanted and unnecessary ergonomics related injury.

Figure 2: Common posture of a patient with a Dowager's Hump. **A.** A forward head of 5cm or more is not uncommon. **B.** Strain of the supraspinous and interspinous ligaments results from increased angulation of first rib, often secondary to FHP, and loading of sternoclavicular joint as shown in Figure 7.6C. **C.** Increased lumbar lordosis and anterior pelvic tilt are common. **D.** Hyperextension of knees may either be a compensation for anterior pelvic tilt or may induce anterior pelvic tilt mechanically via the Y ligament.

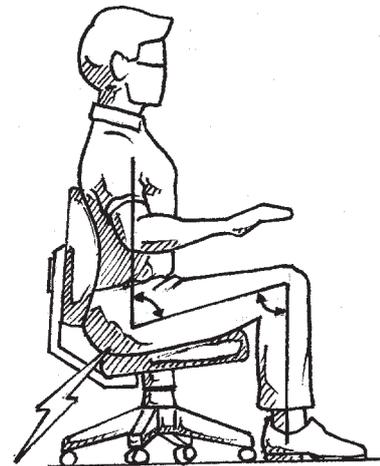
Figure 2



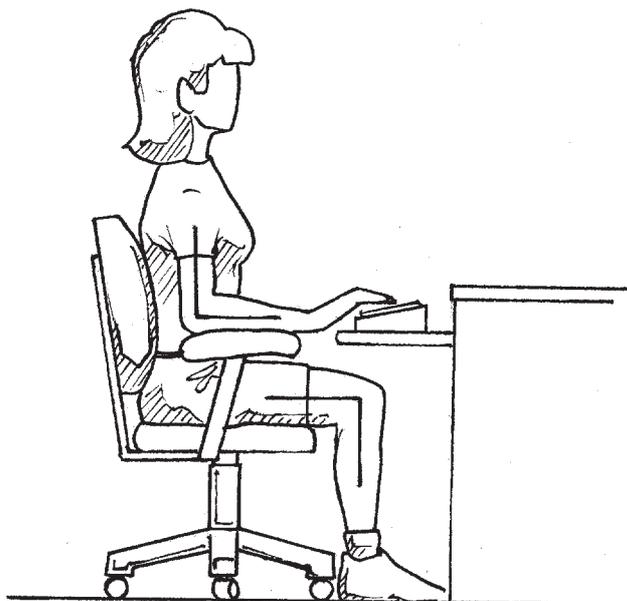
CHAIR HEIGHT



When your chair is too high, the space behind your knee (the popliteal fossae) becomes compressed. This frequently causes numbness in the lower leg and slows circulation to and from the lower leg, resulting in swollen feet.



When your chair is too low, the large nerve structure called the “sciatic” nerve often gets compressed. This leads to pain in the low back and legs and can result in numbness in one or both legs.



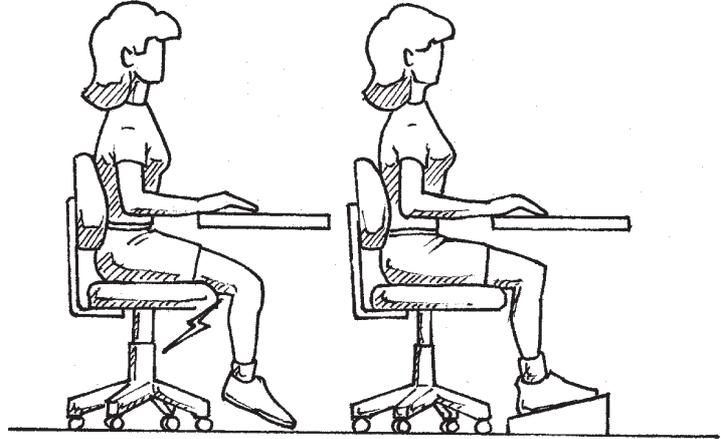
When your chair fits correctly, there is a 90° angle at the knee and there is no discomfort behind the knee or in the butt region. The feet should always rest flat on the floor unless you are using a footrest.

If for any reason you do place a footrest under your feet, always readjust your chair, keyboard, and video display unit height to maintain optimal working relationships as described in this handout.



Use of a Foot Rest

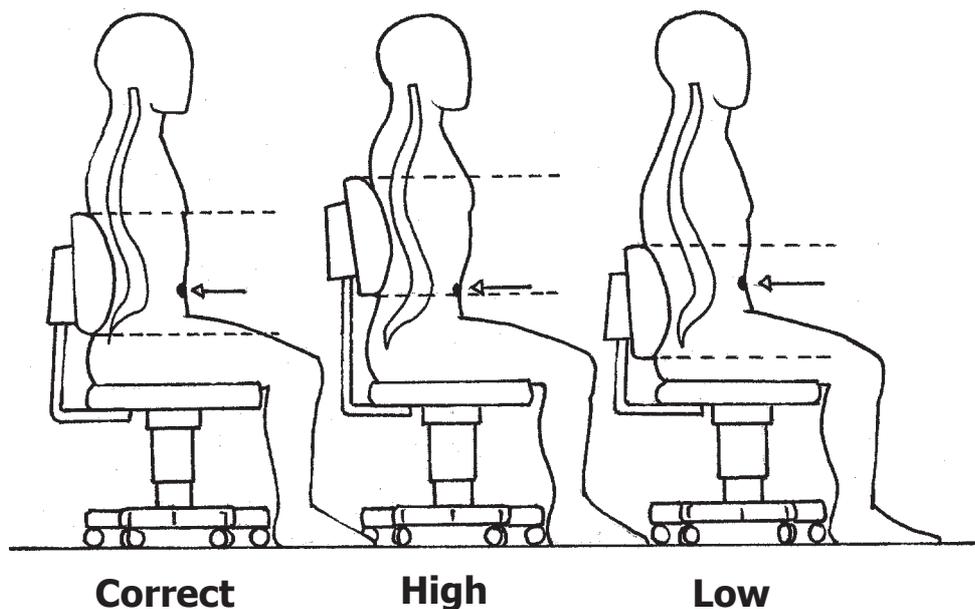
If you are short, and your working surface is high enough that you can't keep your feet on the ground without excessive pressure on the backs of your legs (Left), it will be necessary to use a foot rest.



To determine the height of your footrest, adjust your chair height until your arms are comfortably placed on the table and your elbow is bent to 90°. Once your arms are at the correct height, measure how high your footrest will have to be and then either have a carpenter custom build one for you or purchase an adjustable footrest from an office supply store.

How to Fit a Lumbar Support

When using a chair with an adjustable lumbar support, it is important to position it correctly. The apex of your lumbar curve is directly behind your belly button. Adjust





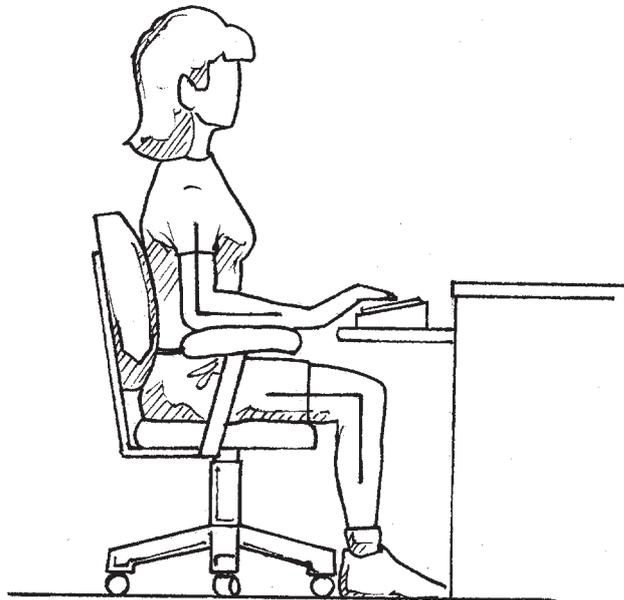
your lumbar support so that the most convex point of the lumbar support is directly behind your belly button.

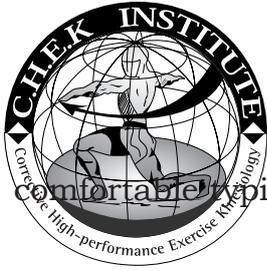
Arm Rest Adjustment

For those of you who must perform data entry tasks for extended periods of time, arm rests are suggested. An armrest, when adjusted to support your arms so they are parallel to the floor and level with your keyboard, will save you from muscle soreness in the upper back, shoulders and neck. A good chair has adjustable arm supports.

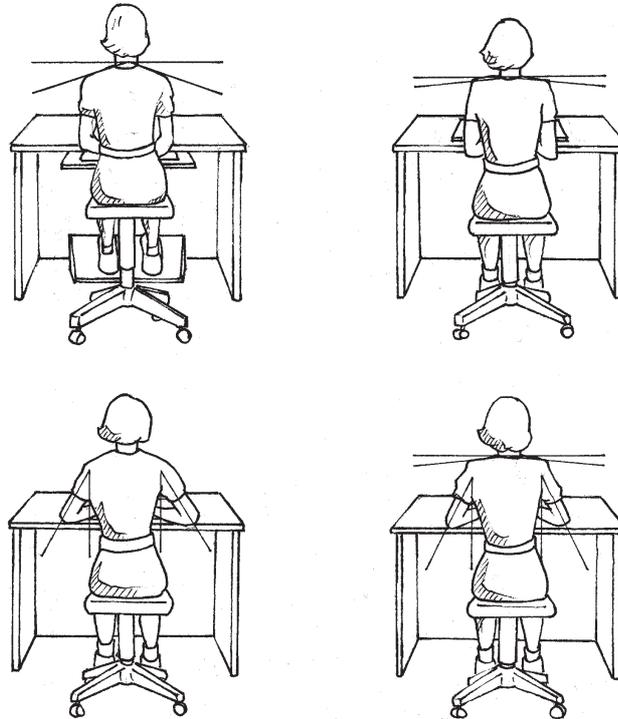
Keyboard Height

Because the keyboard height is fixed in most desks, it is critical that you adjust your chair to allow your forearms to be parallel to the floor when you hands are in a





comfortable working position and you are sitting in good upright posture, as seen in



the figure below.

Failure to adjust your body to your keyboard height:

A. When an individual is set-up correctly for writing at a desk with a keyboard the feet are supported as needed and the shoulders remain relaxed, allowing good ergonomics while writing. To adjust to the keyboard height for data entry work, the seat is lowered and the footrest removed to allow the forearms to be parallel to the keyboard while working.

B. If a writing desk is used for data entry, or if a short person attempts to use a writing desk for extended periods with too low a seat height, the shoulders will be held in an elevated position to accommodate optimal working relationships for the hand. This results in chronic loading of the shoulder girdle elevator muscles, commonly leading to tension headache and chronic soft tissue disfunction.

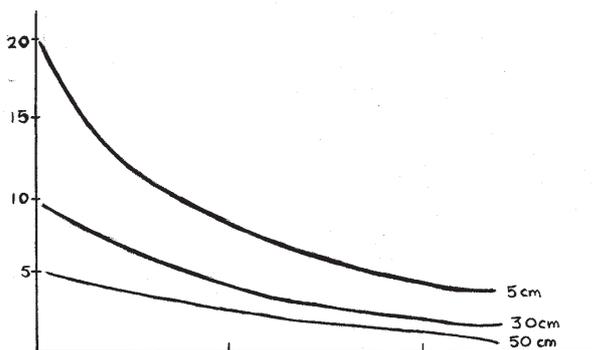
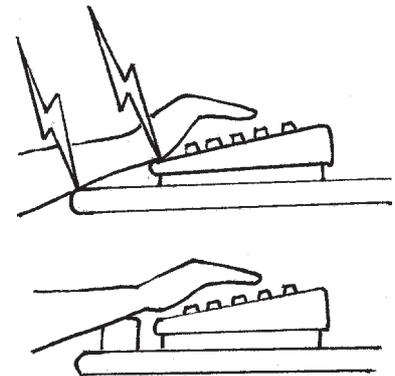
C. When the shoulder elevators become chronically fatigued, an abducted arm position is commonly adopted. This leads to rapid fatigue of the arm abductor and shoulder girdle elevator muscles because the large deltoid muscles are not suited to postural loading; they are best suited for movement.



D. In some cases, poor ergonomic set-up at the keyboard results in a combined adaptation, integrating elevation of the shoulder girdle and abduction of the arm. The result is the same, pain and chronic discomfort leading to decreased work performance in a very short time!

Keyboard Set-up

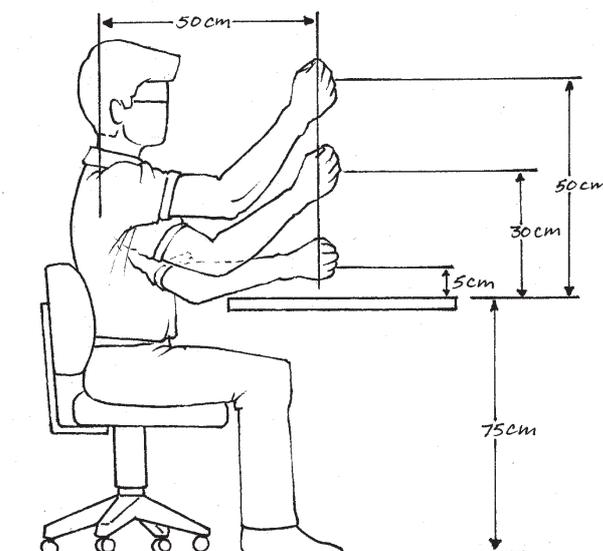
After you have determined the correct keyboard height, it is very important to set your body up correctly with respect to the distance from the keyboard and hand placement on the keyboard itself. If your keyboard is positioned such that your wrist flexor tendons touch the edge of your desk or keyboard tray, you are much



more likely to inflame your wrist flexor tendons. This is often a partial contributor to carpal tunnel syndrome. To prevent unwanted repetitive stress injuries, use a protective wrist pad. They can be purchased at most any computer or office supply store.

Don't sit too far away from your keyboard!

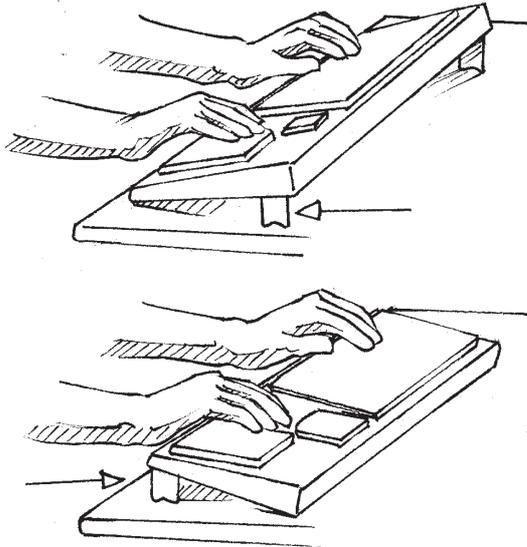
When setting yourself up at a keyboard or to do any work task, be it at a counter top in the garage, to cook in the kitchen, it is always best to minimize how much shoulder flexion you must maintain. As seen in Figure?, holding your arms in a position of shoulder flexion with your hand only five centimeters above the working surface produced severe pain in young men in only twenty minutes!



When positioning yourself at a desk or keyboard, it is best to try and keep the upper arm as vertical as possible when sitting with good upright posture. The



same principle applies to work environments that require prolonged standing at counter tops.



Keyboard tips for tall and short people

Those of you with short fingers will often find it easier to type with the back of the keyboard elevated. Those who are taller and have longer fingers often find they are more efficient and feel less cramped when elevat-

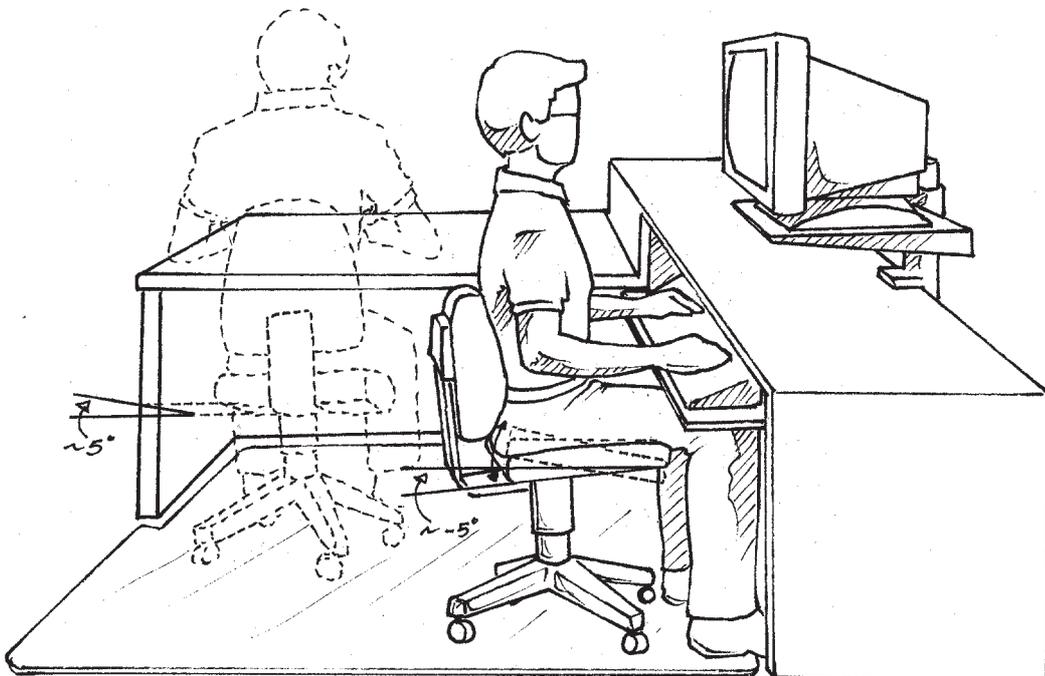
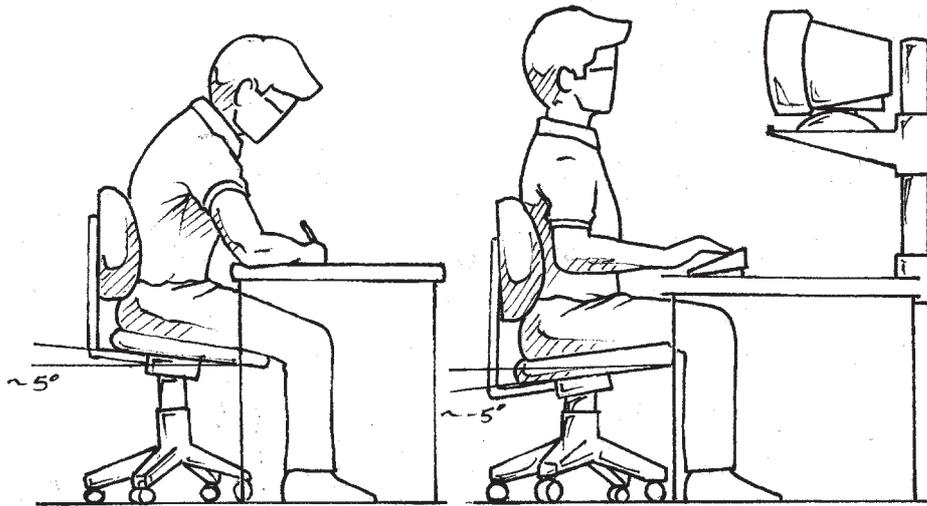
ing the front of the keyboard.

More tips on selecting a work chair

Research has shown that when in a work environment that requires a combination of writing and data entry, there is less strain on the back muscles when using a chair with a tilting seat pan. At the C.H.E.K Institute, we commonly recommend using a Swiss Ball as a chair because the Swiss Ball allows free mobility of the lumbar spine. This is very helpful to the lumbar discs because the mobility afforded by sitting on a Swiss Ball improves fluid and nutrition delivery to the discs of the lumbar spine, which may reduce the incidence of degenerative disc disease. Using the Swiss Ball as a chair also improves overall blood flow because it keeps the muscles of the legs and torso active. Many people feel they do well when alternating

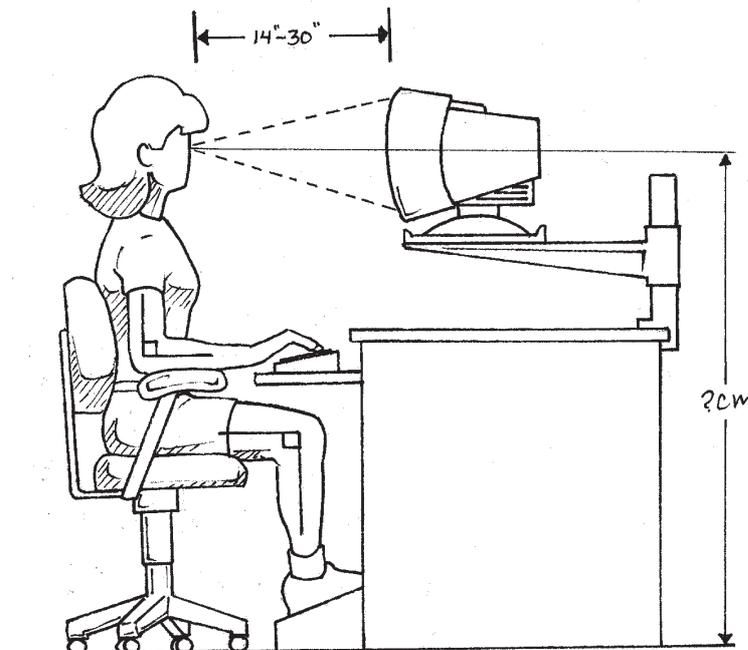


between their traditional desk chair and a Swiss Ball for periods of about thirty



minutes each throughout the day.

See figure on following page.



Selecting the correct height and distance for your video display unit

Once you have set your chair height so that you are properly set-up to your keyboard and you have chosen a footrest if needed, it is time to set your video display (VDU) height. To find the

optimal height for your VDU, sit at your ergonomically correct workstation. Have a friend or co-worker measure the distance from the outside corner of your eye to the floor. Use this measurement to determine how high the center of your VDU screen should be from the floor (see diagram).

By setting your VDU height so that you are looking directly into the center of the screen, you are more likely to maintain optimal posture throughout the day because your eyes dictate posture. If your eyes are focused below the center point most of the day, the tendency is to be drawn into flexion or forward. When your VDU is set-up correctly, your eyes will wander above and below the mid-point, which will encourage better postural alignment, improve blood flow to the head and improve productivity.

Visual Distance

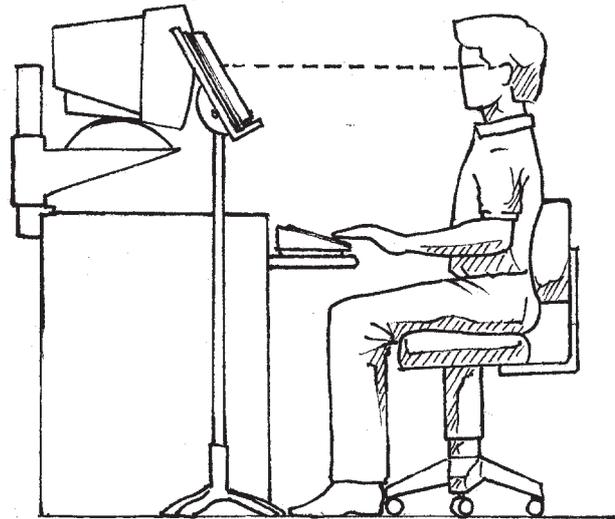
According to Scott Donkin, author of *Sitting on the Job*, optimal visual distance is no closer than fourteen inches and no further away than 30 inches from your VDU. Those that have a hard time focusing without staying in this suggested visual distance parameter are most likely to be suffering from an eye disorder and should see an eye doctor for a check-up. This is common when people have not had their prescrip-



tion checked for contact lenses or glasses in over one year. At the C.H.E.K. Institute, we always recommend those who need visual aids read *Better Eyesight Without Glasses* by W.H. Bates M.D.

Positioning Reference Material

At the C.H.E.K. Institute, we have found that a telescoping music stand is the best method for positioning reference materials at the correct height. When reference materials are needed during data entry, it is always important to position the reference materials such that when sitting in an ergonomically correct position, you are looking directly into the middle of the book, page, or diagram. As mentioned above, the eyes always dictate posture; if you are always looking down, your posture will follow.



It is also very important to keep the reference materials positioned as close as possible to your VDU. IF you have to spend too much time with your head turned, it may lead to trigger point development and associated soft tissue dysfunction in the neck. This only leads to reduced productivity and discomfort.

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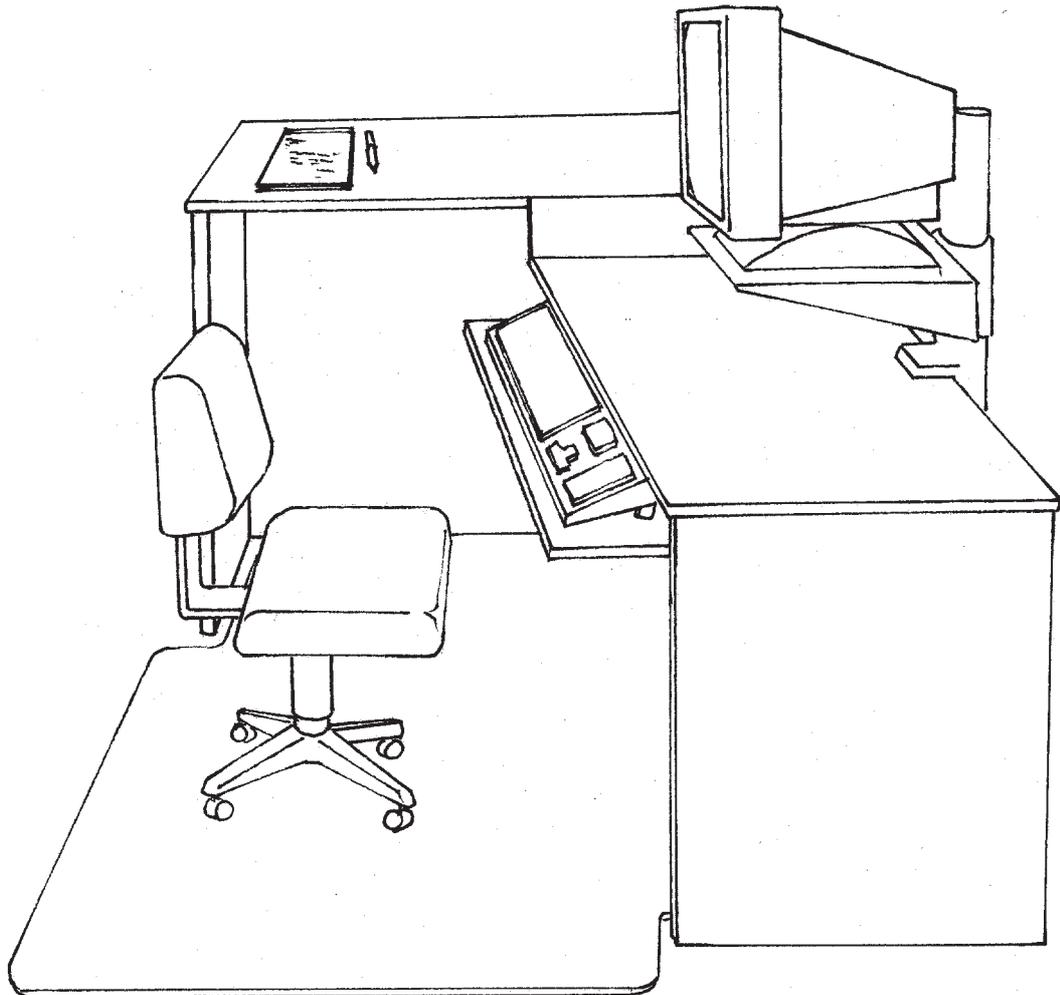
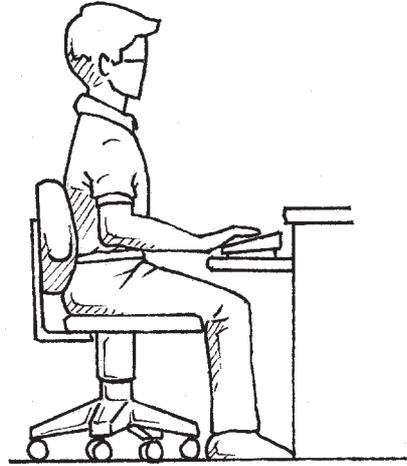
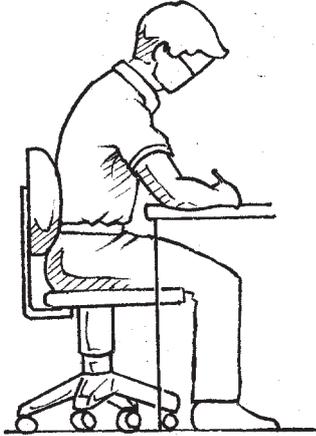
Selecting the correct work station:

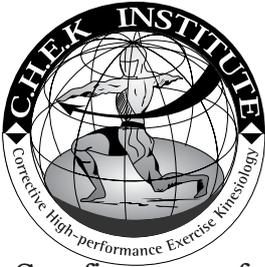
(A) Writing tables are generally 5-8 centimeters higher than is recommended for data entry (B). To prevent unwanted repetitive stress injury, it is always best to invest in a table or desk designed to suit the primary need of the workstation.

If your work requires a combination of both handwriting and data entry, a combination desk is highly recommended (C). These desks are readily available and inexpensive today. In fact, for the price of one visit to an orthopedic surgeon to find out what is wrong with your neck, you could probably pay for a combination desk at most office supply stores!

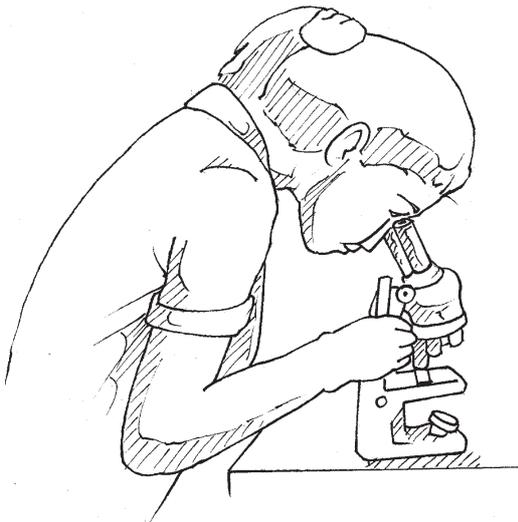


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See figure on following page.



The Standing Worker

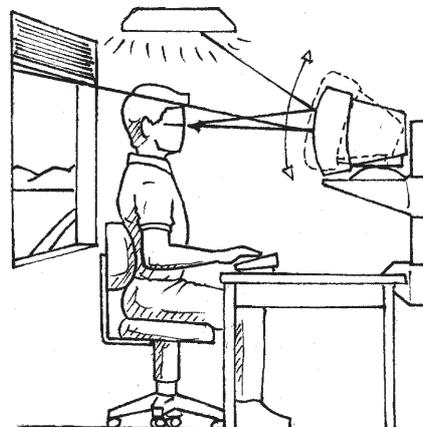
Those working in a standing work environment, such as those doing research in a laboratory must be very careful not to adapt their body to the environment if the environment does not match their body dimensions. For example, this researcher will most certainly finish the day with neck tension and/or headache; in due time she will also have forward head posture. To circumvent this problem, the microscope could easily be elevated, since that is much easier to do than rebuild the entire counter top! It is **CRITICAL** that all patients

learn to control their environment, or the environment will certainly control them – and the patient will always remain – “a patient”!

Avoiding unwanted reflections



A.



B.



A. When sitting at a desk with a shiny top or glass surface, you may have to use blinds to control incoming sunlight. If you are in an office that doesn't have blinds, it is often beneficial to wear sunglasses until the sun passes overhead.

B. In the office or home where you may get reflections from overhead lighting or incoming sunlight, you may have to control sunlight with blinds and overhead light source reflections by tilting your computer screen. Many computer stores sell anti-reflection screens that are also helpful. If you find your eyes being bothered by the flicker of your computer screen or from florescent lighting, the following actions can be taken to alleviate the problem:

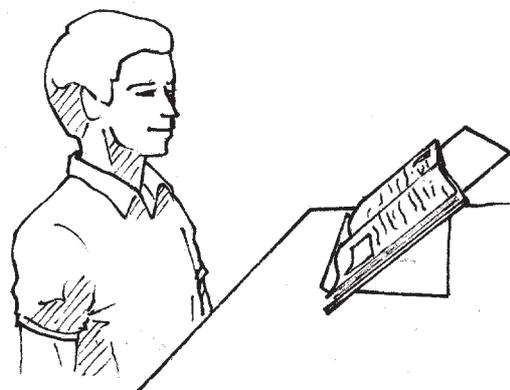
- ✓ Change the refresh rate on your VDU
- ✓ Change the ballast on your florescent lights from the standard 60 Hz to a Motorola 25,000 Hz ballast. According to David Getoff, N.D., wrapping lead tape around the distal 1 inch of the florescent tubes will block radiation emanating through the ends of the light tube; the radiation comes from the arc of the ballast. He states that using a 25,000 Hz Motorola ballast and taping the ends of the tubes may reduce fatigue, lethargy and even depression in some people.

Tips for students and those who like to read

A. Sitting at your dinner table or kitchen counter reading for extended periods of time can be very hard on your neck if your reading materials stay flat.



A.

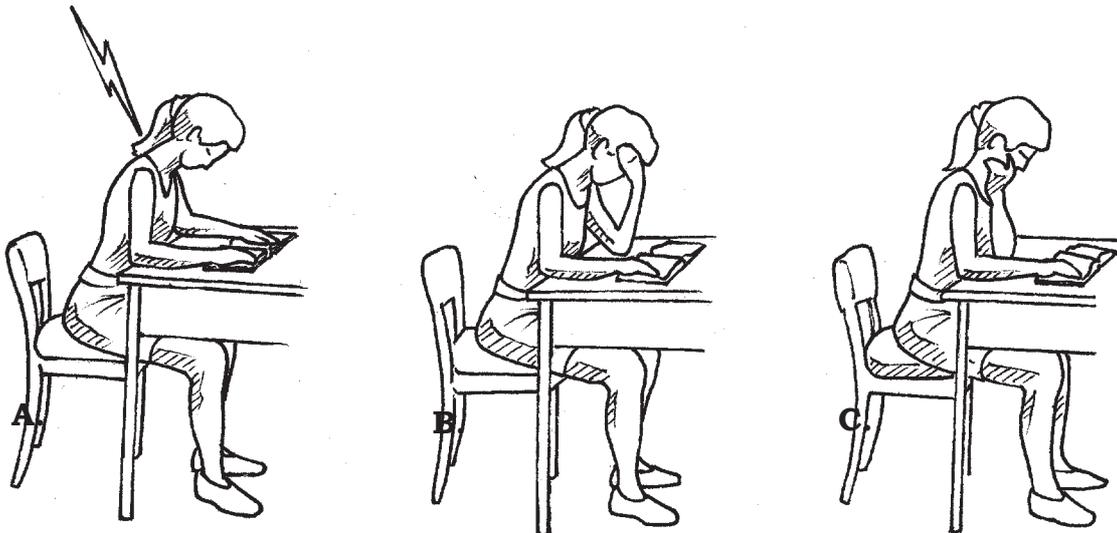


B.

B. To avoid unwanted neck stress and strain, use a reading stand. They can be purchased at most book can computer supply stores for as little as \$5.00; a far cry from the cost of antiinflammatory drugs and doctor visits!



For the student that must read for extended periods of time, keeping your reading materials laying flat will almost always lead to neck pain. (B-C) If you don't have access to a book stand, you can use what is called a cervical relief posture. By simply supporting your head at the forehead or placing your hand under your jaw, you can significantly reduce muscle contraction in the neck extensors. This allows better blood flow and slows the onset of fatigue. TIP: Propping the book you are





reading up with another book or two can make a tremendous difference in your comfort level!



HOW MUCH DID YOU LEARN?

Now that you have an understanding of the importance of ergonomics and how to set up your desk and control your environment, it is time to see what you have learned. In the diagram to the left, there are several things that need to be corrected or this lady will certainly be making BMW payments for her doctor! If you are really observant, you should be able to find 10 things wrong with her posture and desk set-up; GOOD LUCK!

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.



8.

9.

10.

Determine your proper seat height, keyboard height and VDU height:

Seat Height _____

Keyboard Height _____

VDU Height _____

Case Scenarios:

1. Your patient's chair height is adjusted to be correct (thighs and forearms parallel to floor), but the keyboard is too low. The keyboard on the desk is not adjustable. How will you make this desk fit your client?

2. Your patient is 5'2". When their chair is adjusted so that their arms and thighs are parallel to the floor, their feet begin to swell by lunch time every day. What will you do to correct this person's ergonomics?

3. Your son is 6' tall in seventh grade. He complains of back pain during class. What is the most likely cause?