

DESIGNING THE PERFECTLY ERGONOMIC WORKSTATION

Let's say you're about to design a user-friendly work station. It's important to remember that a well-designed office work environment is made up of several critical components:

1. The Chair.

Ergonomically, the most important piece of office equipment is the chair. 'Low back pain remains the most prevalent and costly work-related musculoskeletal disorder,' says a leading health insurer. Low back pain can be the direct result of sitting for days, months and years in poorly adjusted chairs. The typical office worker will spend more time sitting in an office chair than anywhere else, with the possible exception of bed. With all this time spent together, it's critical that task chairs meet these human criteria.

Task chairs should encourage movement. Frequent movement and position changes are critical to health and comfort. However, in order to get people moving, they must first know how to operate their chairs. And this is easier said than done. According to a 1995 study, less than two percent of the subjects were able to identify the purpose of the back tension adjustment knob--the most basic of chair controls--on a variety of chairs. The problem is that if the tension spring is set too firm, the chair won't recline and the user will be forced to sit in an upright posture. If the spring is set too loose, the chair will fall back to its most reclined position, where the user may sit for hours at a time. Even if set properly, the tension spring will only provide optimal support in the middle of the recline range.

To accommodate for these inherent failings of the tension spring, many chairs are equipped with recline locks. But locks can also be dangerous exactly because they're designed to keep the chair in a fixed position. The solution? Adjust the spring tension to best support the user. Also, use locks with caution and conscientiously unlock them on a frequent basis to change recline positions.

Recline is healthy. Nowadays, researchers everywhere agree that reclining is healthy. The renowned industrial designer once said, 'The more you recline, the more comfortable you get. Ergo, the best chair is a bed.' Essentially, the more work you can perform while reclining, the more of your body weight will be distributed to the backrest of your chair, and the less pressure your spine will have to endure. However, extended recline can put additional stress on your neck and shoulders while they work to maintain the upright position of your head. Therefore, it's wise to consider a chair with a headrest if you expect to perform extensive work in a reclining position.

Disc pressure in the spine varies with the different seated postures assumed during a typical work day. As shown, the spine sustains far less pressure when reclined, which translates into more comfort and less risk of injury.

Task chairs should fit the user. In addition to proper support, it's important that a task chair provide good body fit. No one would consider wearing a pair of shoes that didn't fit. Yet millions of office workers sit in chairs that are maladjusted to their body size and shape. Not surprisingly, such workers are at high risk of injury. Since office workers come in all shapes and sizes, it's vital that each worker's chair be sized to fit. The most common size adjustment is seat height. Ideally, the seat height should be set so the user's feet rest comfortably on the floor while the upper body is high enough to work comfortably at the desk. But because the height of most desks is fixed, petite users may need to raise the chair to a point where their feet are lifted off the floor. This puts undue stress on the undersides of the thighs, often causing circulation problems and potential nerve damage.

Placing a height-adjustable footrest under the desk solves the problem by giving petite workers proper support for their feet and legs.

Seat depth. Here the primary concern is to provide maximum surface area on which to distribute the body weight, while keeping the delicate area inside the knee clear of potential contact stress from the front of the seat. When sitting with your back properly supported, there should be approximately two to four inches of space between the front of the seat cushion and the inside of your knee.

Backrest height. As with seat depth, the idea of adjustable backrests is to maximize surface contact and minimize pressure points. While the curvature of the spine varies somewhat from person to person, it is the position of the curvature that matters. Thus, a contoured and height-adjustable backrest provides lumbar support while maximizing surface contact and weight distribution.

Armrests should be adjustable and kept level. Armrests should be quickly and easily adjustable. That's important because different tasks and different sized users require different armrest positions. In addition, users should be encouraged to keep their armrests level. Otherwise, they will sit, possibly for years, with one arm lower than the other and their spine therefore in a lateral curve. And that's a high risk posture for injury.

Ultimately, when it comes to seating, it's critical that users be trained to fully understand the features and operational controls on their chairs in order to gain the most benefit from this extremely important work tool.

2. The Keyboard and Mouse.

The thought of carpal tunnel syndrome (CTS) strikes fear into the hearts of most office workers, and for good reason. The statistics surrounding CTS are astonishing. In 1996, CTS cases resulted in the highest median number of days away from work for any injury or illnesses--25, compared to five days for all other injuries and illnesses combined. CTS is a painful and debilitating disorder that can take months and even years to heal. However, it can be avoided in most cases with some basic preventative measures.

Get the keyboard off the desk. Recent research shows that the keyboard should be angled away from the user and placed below desk level, so the user's wrists remain straight and the elbows open up to a greater-than-90-degree angle. The best way to achieve this position is with the use of an articulating keyboard holder with negative tilt adjustability. A 1995 Cornell study found that using a lowered keyboard holder on a preset tilt away from the user can help prevent carpal tunnel syndrome. This keyboard position also encourages a healthier seated posture. In addition, the palm support should only be used as a resting place for the palms between periods of typing. It should never, ever support the wrists during periods of typing.

Typical seated posture while keying; abducted shoulders, forward head, extended wrists, maximum disc pressure on spine.

A negative slope keyboard in a lowered position keeps wrists straight (neutral posture), opens up elbow angles and hip angles, keeps shoulders neutral and encourages recline, which reduces stress on the spine.

Movement is critical-II. As with seated postures, the ability to change positions frequently and easily is the foundation upon which a good ergonomics program is based. A keyboard platform should allow the user to easily change keyboard height and depth as different tasks necessitate.

Keep the mouse within the Neutral Reach Zone. With the phenomenal increase in graphics applications and Internet use, mousing has become a major cause of CTS. To combat these dangers, it is important to always mouse within the Neutral Reach Zone. Avoiding extreme postures minimizes the possibility of shoulder abduction and wrist flexion/extension.

Beware the bite of the mouse. In addition to position, the mouse itself also can be a major risk factor. Cornell University research suggests that a larger mouse can reduce wrist extension and CTS risks. Users should monitor their mousing hand and immediately begin mousing with their other hand at the first sign of any pain or tingling. Ideally, the mouse should be symmetrical so it can be used easily in both hands. Likewise, the keyboard platform should allow for mousing on both sides of the keyboard.

3. Monitor Placement.

Researchers overwhelmingly agree that the top line of text on the monitor should be at or slightly below eye level. That's because any portion of the monitor above eye level contributes to neck and shoulder strain. If your monitor is too high because it rests on top of the CPU, invest in a below-the-desk CPU holder. Placing the CPU below the desk not only allows for better positioning of the monitor, but also creates additional desk space. Alternatively, if the monitor is positioned too low, consider spacers or adjustable monitor arms to lift it off the desk.

The monitor also should be placed directly in line with the keyboard to minimize twisting of the neck and/or body. Again, maintaining body symmetry is a critical component of healthy work habits.

4. Document Placement.

Considering the importance of body symmetry, all reference documents should be positioned in line with the keyboard and monitor to avoid asymmetrical neck motion. If you do not have an in-line document holder and instead place input documents to one side of the monitor, alternate the placement of such documents from one side of the monitor to the other to avoid long-term one-directional injuries.

5. Lighting and Glare Issues.

Another major issue facing office workers today is computer vision syndrome (CVS), which can cause headaches, eyestrain, neck and back pain, and light sensitivity. According to OSHA, some studies estimate that 90 percent of the seventy million U.S. workers using computers for more than three hours per day experience CVS in some form.

There are several ways to reduce the risks of CVS. The most effective is to reduce or remove screen glare, which primarily affects vision but can also cause awkward postures as people move to avoid the glare. The first line of defence against screen glare is to position monitors away from windows and other light sources. Beyond that, says Dr. Hedge, 'Optical glass glare filters on computer monitors can dramatically reduce health and vision problems related to computer glare and help

boost productivity in full-time computer users.' While there are many screen filters on the market, some low-cost products can actually impair vision, so choosing a quality eye protection filter is critical.

Installing task lighting at each work station is another way to combat CVS. Office lighting is generally not bright enough for most desk work, particularly for the growing population of older office workers who require more light. Task lighting solves the problem by offering a direct source of light where it is needed most--on the task at hand. Good task lights provide a wide range of adjustability to avoid glare on the monitor, work surface and documents. The best ones also have an asymmetrical design, which reduces the glare by diffusing the light.

Implementing an ergonomics program using some or all of the above-mentioned guidelines will produce recordable, trackable results. In 1997, the city of Tucson, AZ, realized a 77 percent decrease in injury hours and a 16 percent decrease in injury occurrence after standardizing on an ergonomics program. Likewise, between 1992 and 1996 the New York Times reported an 84 percent decrease in MSDs, a 75 percent decrease in lost-time cases and a 91 percent decrease in total lost days as a direct result of creating ergonomic workspaces for their employees. In these instances, and countless others, the investment in ergonomics paid for itself in a relatively short amount of time, not to mention huge gains in productivity and overall employee satisfaction. When all is said and done, though employee health and comfort are the primary objectives of a well-designed ergonomics program, employers can be sure that such a program will make their bottom-line feel good too.

Ergonomics Explained Slouching, slumping or bending forward at the waist in a chair can lead to discomfort, fatigue and backache. Follow these guidelines to help prevent problems from occurring when sitting at your workstation. **A.** Top one-third of the screen at or below eye level; distance from operator a minimum of 18 inches, typically at arm's length. **B.** Wrists should be a natural extension of the forearm, not angled up or down. Elbow relaxed. Lower arm open at least 100° to upper arm. **C.** Elbow relaxed. Lower arm open at least 100° to upper arm. **D.** Adjustable back rest to accommodate the normal curve of the lower spine. **E.** Keyboard flat at elbow level with palm rest to support hands during rest. **F.** Thighs approximately parallel to the floor. **G.** Easily adjustable seat height. Seat pan short enough (front to back) for knee clearance and with a waterfall front edge. **H.** Swivel chair with 5-point base and casters. **I.** Feet resting firmly on the floor; footrest needed if feet are not supported by the floor. Document holder in line with front of monitor. Height and angle adjusted for the comfort of the user