

ERGONOMICS BASICS

Despite disagreements, much of ergonomics is a matter of common sense. You do not have to be an expert to know that sitting at a computer all day long or doing a lot of lifting can affect your body, and you should take measures to minimize injury and discomfort.

Although common sense may convince you to accept ergonomics as a priority in organizations, common sense should not be the basis for making decisions about specific problems. The organizations that approach ergonomics systematically, using a basics checklist to create ergonomically sound environments, fare better than those that rely solely on the common sense of employees and supervisors.

The following basics are common to almost all the texts in the field of ergonomics. These basics should also be provided to workers to monitor their own work activity.

Working at a Computer

Posture

Poor posture while working plays a major role in workplace injuries. Observe the following when someone is working at a computer:

- Feet should be on the floor or a footrest.
- Knees should be at an angle of 90 to 110 degrees.
- Thighs should be roughly parallel to the floor with knees slightly higher than the hips.
- Hips should be bent at a right angle.
- Back should be supported by the seat back.
- Shoulders should be in a relaxed position.
- Head should be tilted slightly forward.
- Upper arms should be hanging loosely at the side.
- Elbows should be bent at a 90 degree angle if typing. (In contrast, elbows should be bent at 110 degrees if working with tools or machines such as photocopiers or scanners).
- Forearms should be parallel to the floor if typing. (In contrast, they should be slanted slightly downward if working with tools or machines such as photocopiers or scanners).
- If typing, at least 6 inches of the forearms should be supported.
- Wrists should be straight. Wrists bent in any direction—up, down, left, or right—may lead to discomfort and eventually to injury.
- Fingers should be angling slightly downward if typing.
- There should be no twisting of the body when moving into a writing

position. There should be space to write directly in front of the writer, whether on the desktop or on a return (the extension that creates an L-shaped workstation), with the chair to be swiveled so that the writing position is straight on.

Although many people have less than ideal posture, the chair, workstation, position of the personal computer components, and other workplace equipment also can create problems. For example, the seat pan of the chair may be too deep to allow a person to sit with his or her back in contact with the chair back; the workstation may be too high, or the monitor may be too far away.

Chair

The adjustment of the chair is one of the most important aspects of ergonomics.

Ensure the base has four or five feet or casters to provide a stable support. The casters should be suited for the flooring: soft casters on hard flooring and hard casters for soft flooring.

The seat pan should be of a depth that allows the person to sit snugly against the chair back, but leaves room for a clenched fist between the front of the seat pan and the back of the knees. The seat pan should be covered with a breathable fabric over a padding that does not compress much. The seat pan should be tilted three degrees so that the front is slightly higher than the back. The front edges should be rounded.

The chair back should be adjustable so the lumbar support fits properly into the curve of the lower back. The chair back should be contoured both horizontally and vertically to provide substantial support. The chair back should be slightly sprung so that it follows as the occupant moves forward and backward in the chair.

The arms, if any, must not interfere with drawing the chair up to the work surface and should be adjusted so they are about 1/2 inch below the forearms.

The seat height, seat pan tilt, arm height, seat pan depth, and back height should all be adjustable. And, most importantly, supervisors or technicians should check the chair periodically to verify the chair is properly adjusted to the person.

Most inexpensive office chairs do not meet the foregoing criteria. Although a few chairs priced under \$300 do, the majority of ergonomically sound chairs are priced at \$400 to \$800.

One of the major problems with staff chairs in libraries is that many chairs, especially those at public service desks, are occupied by more than one person because most libraries are open 50 to 100 hours per week. To accommodate multiple shifts, chairs at public service desks should be particularly easy to adjust, and all staff should be trained in making those adjustments.

Workstation

The workstation, typically an office desk, should be wide enough and deep enough to accommodate a keyboard, mouse, and monitor, and provide room for writing. The minimum desk size should be 60 by 30 inches with a return (the extension that creates an L-shaped workstation) of 36 by 24 inches. Many ergonomists prefer oval desks because the shape eliminates the unreachable corners, but such designs tend to cost substantially more.

The height should be appropriate to body dimensions while seated in a good posture position. The proper height for a computer work surface (the level of the mouse and keyboard) is about 3 or 4 inches lower than the average writing desk, about 25 to 26 inches in case of the typical 28- to 29-inch desk. People under 5 feet or over 6 feet in height, however, require different heights. Full-time employees who do not share their workstations should, therefore, have their workstations sized for them. Workstations shared by employees of different sizes should be height-adjustable. If the work surface is not height-adjustable, the chair should be raised and a footrest used for proper support as required.

Ensure ample knee clearance and room to stretch the legs out under the workstation. There should be a footrest if raising the chair to place the hands over the keyboard in the proper position lifts the feet off the floor.

Monitor Height and Position

The position of the head and neck is key to comfortable computer use because the blood must flow through the neck and shoulders to get to the arm muscles that are doing the work.

- The monitor should be directly in front of the person, not to the side.
- Monitor height should be adjusted so that the top row of characters on the screen is at or slightly below eye height. (A lower position may be required in the case of bifocal or trifocal wearers.)
- The monitor should be at arm's length, typically 18 to 28 inches.
- The screen should be tilted back 10 to 20 degrees to place it at right angles to the line of sight.
- Brightness should be adjusted to provide comfortable viewing.
- The monitor should be placed to avoid glare by not having a window or bright light directly behind the monitor or the user.
- The document from which typing is being done should be to the left or right of the screen in the same plane as the screen. The document from which typing is being done should be held in place with a document holder, secured on the left or right of the display in the same plane as the screen, facing the user.

Keyboard and Mouse

- The keyboard should be directly in front of the user.

- The keyboard should be tilted so the top plane of the keyboard falls away from the computer user to avoid the need to raise the fingers and bend the wrists to use the keyboard. (The failure to tilt keyboards is the most common problem the author has observed in libraries).
- The fleshy part of the palms, not the wrists, should be resting on a resilient surface, such as a wrist rest, when not typing.
- The palms should come up from the rest while typing.
- If a keyboard tray is used, it should be adjustable in height and tilt.
- The mouse should be immediately beside the keyboard and at the same level as the keyboard.
- The mouse should be shaped to accommodate different shapes and sizes of hands. An organization should have several different mouse designs available so that a person who experiences discomfort with one design can substitute another.
- Mousing should not be done with the wrist bent in either the horizontal or vertical planes.

Telephone

Workers who regularly keyboard should have an alternative to holding a telephone under the chin.

- A headset should be available for heavy telephone users.
- A speakerphone should be available for heavy telephone users in private offices.

Vision and Lighting

Staring at a computer screen is a demanding visual task. The American Optometric Association has developed the following recommendations for reducing eyestrain to avoid what it calls Computer Vision Syndrome (CVS):

- Check for glare. While looking at the computer screen, use a hand to shield the eyes from any light sources, including windows and lamps. If that action immediately relaxes or soothes the eyes, there is a glare problem.
- Reduce glare by drawing the blinds or wearing a visor.
- Check to see if the ambient light in the room has the same perceived luminance (intensity of light from the screen) as the monitor itself. If the ambient light is brighter, seek to disconnect some of the lights. Another option is to install egg crate diffusers, the type that look like an egg crate when seen from below.)
- Avoid flickering light from fluorescent tubes by installing two or more tubes in the mounting in such a way that they alternate out of phase.
- Check for reflection in the monitor. If you can see yourself, hold a manila folder so as to block the reflections. Then tape the folder in place or install an antiglare screen. (The antiglare screen cuts down on the screen's brightness. It should not be used unless nothing else works).

- Check the distance between the eyes and the monitor. If it is under 18 inches or over 26 inches, adjust the distance.
- If reading text at a distance of 18 to 26 inches is difficult, switch the monitor to a lower resolution, which increases the size of everything on the screen.
- Check the height of the monitor. The top line of the on-screen text should be at eye level. Tilting the chin up to look at the screen is potentially injurious to the neck.
- Dust the screen regularly.

Temperature

The temperature for stationary workers should be between 65° and 75° F.

- Avoid sitting directly under an air vent.
- Keep arms and hands warm, using a sweater and finger-less gloves if necessary.

Noise

The noise level in a library reading area typically is 30 to 35 decibels (dB); in an office, 55 dB. Because the decibel scale is logarithmic, a 20 dB increase represents a 100,000 times intensity increase. Studies show that 30 to 35 dB is much more comfortable over an extended period of time than 55 dB.

- Separate quiet and noisy work areas.
- Use acoustical materials on floors, walls, and ceilings to keep the dB level below 35 dB in a library reading area, below 55 dB in an office area and ideally below 45 dB in the latter.
- Mask intermittent noise by introducing white noise or low background music.
- Isolate noisy equipment, especially that which produces a noise level of more than 45 dB. (A sound hood is an alternative to a separate room.)

Fumes and Chemicals

Fumes and chemicals in conservation and preservation areas are a potential hazard. Fumigants, adhesives, shellacs, and deacidifying agents are among the products used by libraries. Make provision to limit their effects:

- Use the least toxic substances that are suitable for the work.
- Provide good ventilation and exhaust.
- Use personal protective equipment: gloves, masks, and so on.
- Limit the duration of exposure.
- Have first-aid supplies at hand.

The most comprehensive source of information on lifting is the applications manual for the revised NIOSH lifting equation, a publication of the Centers for Disease Control, available at <http://aepo-xdv-www.epo.edc.gov/wonder/oervguid/p0000427/p0000427.asp>.

(NIOSH is the National Institute for Occupational Safety and Health.)

Exercises

Several areas of the body need to be stretched or relaxed periodically during computer use:

- Neck
- Hands and wrists
- Upper back and shoulders
- Lower back
- Legs
- Eyes

Take a brief break of 15 seconds every few minutes, and one of five minutes each hour. During the short breaks, shrugging the shoulders and focusing on an object at least 20 feet away will relax the neck, upper back, and eyes. During the longer breaks, all the foregoing should be exercised by moving them for at least 30 seconds each.

Lifting

The basics of lifting are the following:

- Do not seek to lift or stack anything weighing more than 50 pounds by yourself because doing so dramatically increases the risk of injury. (Note: full book boxes weigh less than 50 pounds each, but injury is still possible if boxes are not handled properly).
- Make sure the worker's path has no obstacles. Anything that may obstruct the feet or the object being moved may result in a shift of posture during the lifting or stacking.
- Spread the feet apart to increase balance and improve the posture.
- Get a secure grip to lessen the chance of the weight suddenly shifting and straining the body.
- Squat and lift to put the weight on the legs rather than the lower back.
- Lift and stack as close to the body as possible. Holding an object away from the body increases the strain on the back. When stacking, move objects to the stack first, then lift.
- Do not twist the body when lifting or stacking; face the object(s). A twisting motion strains the back muscles.
- Avoid jerky motions. Jerky motions are particularly common when stacking or removing an object from a stack. Such motions may significantly shift the weight's impact and cause injury.
- Never lift with just one arm. Lifting with one arm results in more weight put on one side of the body, not only increasing the total weight on that side, but also straining the muscles on the other side of the back.
- Use equipment whenever possible. The use of equipment not only reduces the effects of weight, but also lessens the effects of poor pos-

ture or motion. Although hand trucks are useful for moving heavy objects, more useful are portable lifts—hand trucks equipped with a foot pump to lift the platform up to 4 or 5 feet.

- Alternate lifting and stacking with lighter work tasks.

There is a cumulative effect in lifting, therefore, lighter work tasks should be alternated with lifting and stacking. This guideline is true even if the weights are well under 50 pounds. A worker who daily moves 150 pieces that weigh an average of 20 pounds, moves 3,000 pounds a day, or 7.5 tons per week.

Don't expect a back belt to protect the back. As popular as they are, back belts do not appear to help. Several carefully controlled studies by the National Institute for Occupational Safety and Health (NIOSH), a unit of the Centers for Disease Control, have established that they benefit only experienced weight lifters handling hundreds of pounds.

NIOSH
www.cdc.gov/niosh

