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All the Right Moves

Ergonomic principles can keep work and health under control

By Steve Reinecke, CPHIMS, and Carrie Schmitz

THE USE OF COMPUTERS as diagnostic tools produces long-range implications for the clinicians who use them. As overall benefits to patient care rise, so too does the risk to healthcare professionals who work for extended periods of time in front of a computer.

The radiology department is a case in point. Over the last decade, the emergence of PACS has changed the way radiologists work. As the dust settles, new approaches must be tested, verified, and adopted – without skipping a beat in the quest for treatment excellence.

Helping radiology staff carry out their duties efficiently with minimum short- and long-term physical and mental strain is where ergonomics enters the picture. Upheaval accompanies the transition from film-based (hard) to film-less (soft) images. As old-style light boxes give way to digital technology, multiple computer displays are needed to run software systems that are often incompatible. Digital imaging has created new tasks, just as it has made other tasks unnecessary. For instance, PACS workstations offer the means to manipulate images (cropping, rotating, zooming) and put control in the hands of the radiologist.

But new technology is a double-edged sword for those who are scrambling to bring film-based records into line with the new generation of film-less imagery. Maintaining dual systems until backwards compatibility efforts have been accomplished along with storage issues are part of a new classification of procedures that have fallen into the laps of already busy technicians.

On the facility side, soft imaging requires a complex infrastructure to support the numerous CPUs, displays, and communication devices typically employed in radiology reading rooms. The logistics governing electrical, phone, and network cabling, not to mention physical “real estate” can stretch the ability to cope for some facilities. It’s not surprising to find cutting-edge IT equipment being used in cramped, stuffy rooms with inadequate furniture, mounting surfaces, and storage. Proper ergonomics and ergonomic devices are the answers.

ERGONOMIC EFFORTS

Ergonomics is the application of scientific knowledge to a workplace to improve the well-being and efficiency of workers. An ergonomic workplace increases workers’ efficiency and productivity, while reducing fatigue, exertion, and musculoskeletal disorders. Studies have shown that a good ergonomics program also cuts costs by reducing injuries and absenteeism, and contributes to overall employee wellness. Ergonomic efforts should include:

- ☀ Educating employees on how their behavior and lifestyle contribute to their wellness.
- ☀ Providing ergonomic computer support equipment and the proper environment.
- ☀ Training employees to safely use the computer and support equipment.



Using the work surface to support the forearm while mousing is easier with small-footprint, multiple screen stands.

- ☀ Providing ongoing monitoring and metering of employees to account for changes that may affect their well-being.

For people to adhere to safe computer use, they must understand what their bodies require in terms of posture, motion, and rest. The optimum neutral posture for computer operators is a multifaceted arrangement. For example, whether standing or sitting, the head should be positioned directly over the shoulders, not straining forward or backward, and approximately an arm’s length from the screen. The neck should be extended and relaxed, the shoulders kept down, and the chest held open and wide.

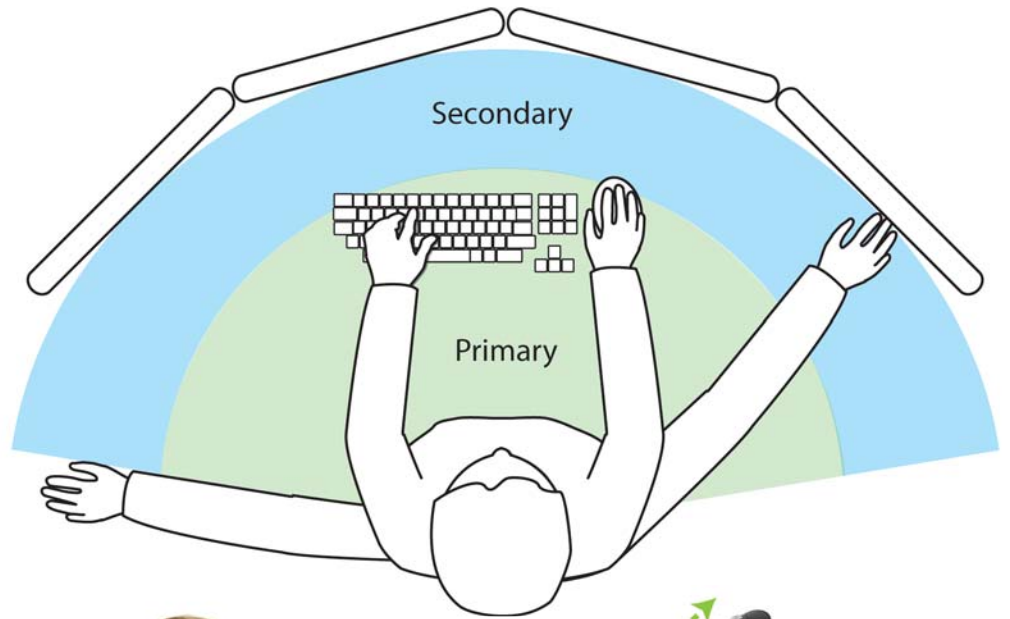
The elbows should be relaxed and positioned at approximately a 90° right angle. Wrists should be in a neutral, relaxed position without flexing up or down. Fingers should be gently curved.

Rather than forcing a worker to adapt, a workstation should be designed to adjust to each person. All employees, including data entry clerks, surgeons, and medical technologists, can benefit.

An ergonomic computer mounting system is a step in this direction. With this type or set of devices, a computer monitor and keyboard can be adjusted with personalized precision, whether an employee is sitting or standing.

READING ROOM RULES

Ergonomic guidelines for radiologists who use computers are essentially the same as any computer user. But if the ergonomic prescription is the same, the portion must be greater in a radiol-



Creating ergonomically sound work stations means considering specific abilities of equipment, such as an extendable keyboard, height and pan adjustment, multiple displays and movements, full range of motion, and mounting solutions.

(Photos by Ergotron Inc.)

ogy reading room. With several workstations in close proximity, the importance of ergonomic design reaches a critical level.

Given the circumstances under which radiologists commonly work and the serious repercussions of fatigue-related errors, the level of risk for musculoskeletal disorders registers on the extreme end of the scale. A reading room workstation should be designed to support workflow, and workflow, to a large extent, is determined by variations of human-machine interactions.

Aside from computer displays, a keyboard, and mouse or joystick, a modern radiologist workstation includes input and output devices for a speech recognition system, a hospital medical record system, paging system, intranet and Internet, video and a telephone. Each radiologist should have dedicated access to this equipment, and it should be arranged on the work surface within the work zone that corresponds to the frequency of use.

To evaluate the ergonomics of a radiology reading room, begin by describing every task and procedure, and use the information to develop a work flow. Then, check every aspect of work accomplished in that space against the following variables:

Display resolution. An accurate image interpretation hinges on correct resolution. The correct resolution depends on the modality.

Display illumination. Mitigating visual fatigue is a priority.

Ambient lighting. Consider a combination of lighting solutions.

Ambient sound. Ambient sound should not breach the integrity of voice recognition and dictation activities.

Air flow. Air flow should not be compromised by room and work surface design.

Room temperature. Room temperature should be consistent, given the quantity of electrical equipment.

Work surface space. Input devices must be accessible when needed.

Room arrangement. The arrangement should accommodate several radiologists at once.

Open architecture computer supports. These computer supports allow you to keep up with changing technologies.

In a published document on computer use, the American National Standards Institute (ANSI) recommends that the width of a computer user's work surface should be at least 27.6 inches wide. Since radiologists often use four or more displays at a time, that dimension should be adjusted accordingly. Support equipment must offer a range of motion in order for the on-duty radiologist to relocate the display, keyboard, and mouse into the posture-neutral position that is right for him. In addition, radiologists should be trained and educated about crucial adjustments like height, depth, tilt, and pan. Adjustments with forces that are too high or mechanisms that are complicated or simply inaccessible prohibit use. Ergonomic mounting solutions must encompass the principals of universal design and provide "on-the-fly" customizing based on all variables, from the weight and shape of the display to the size of the user and the surrounding environment.

TO STAND OR SIT

A traditional computer working posture is seated and upright, probably because typewriters were the default model for the primary input device: the computer keyboard. The current trend among some human factor professionals turns a critical eye toward prolonged sitting versus standing at a computer.

The answer to this polarizing issue lies somewhere in the middle. Offering people the choice to sit or stand is the key. When not

"tethered" in a chair, computer users have a greater range of motion and can interact with an array of displays outside normal work zones associated with seated computer work. On the other hand, some types of work activities lend themselves to sitting. ANSI computer workstation recommendations included reclined and declined sitting to upright sitting.

With the option to stand, radiology technologists earn bonus workspace on the vertical plane. Wall mounted, articulating arms are suited for stacked screens, keyboards, tablets, and video and audio equipment.

MAXIMIZING EFFICIENCY

An advantage of PACS in modern hospitals and clinics is that a single image can reach beyond the reading room without compromise. Urgent care clinics, treatment rooms, hospital corridors and operating rooms are enhanced by the presence of a digital radiology display, but they are subject to stringent requirements for low profile, small foot print support equipment. Image delivery can be managed through stationary and mobile devices attached to walls and mounted to desks.

Whatever the form, the requirements are the same: a small footprint, maximum viewing size, and quick and easy access. In procedure rooms, lab data can be accessed with positioned screen mounts. Carts can accommodate room layouts that constantly change and move information where it's needed. Multi-screen solutions enhance access to PACS images, and all devices must be easy to clean.

Yet radiologists are under pressure to interpret images quickly and accurately. The right hardware and software can reduce image viewing times and the number of image manipulations. However, this doesn't mean the average number of images that can be processed in the course of an 8-hour shift has an unlimited ceiling. Frequent, regular breaks are a trade-off to productivity.

Radiology staff must be encouraged to rest. This prescription for rest applies to anyone who works at a computer.

Several basic strategies include taking a 2- or 3-minute break every 20 minutes. During this time, reduce visual strain by focusing the eyes 20 feet ahead for 20 seconds. Breathe deeply through the nose, expelling air through the mouth. Drink water and shake out stiff limbs. Also, check posture and correct to neutral.

In addition, take a 15- to 20-minute break every 2 hours and walk around, stretch muscles, drink water, and snack on raw vegetables to maintain energy levels.

Healthcare organizations are being challenged to provide quality care while improving accuracy, efficiency, and accountability. With the additional stress of staff shortages, space constraints, and advances in science and medicine competing with new federal and state regulations, the delineation between theory and practice becomes critical.

Applying ergonomic principals in "extreme" user settings, such as a hospital radiology department, can serve as a model for other healthcare sectors. Despite mind-bending changes occurring all around, the most important thing to recognize may simply be that work loads remain constant, and the ability to handle them is really the only thing that remains in your control.

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