

THE VALUE OF ERGONOMICALLY DESIGNED ULTRASOUND SYSTEMS

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Ergonomics, the science of adapting the job to the employee, strives to prevent occupational injuries by removing barriers to quality, productivity and human performance. Ergonomics is an applied, design-oriented science that fits products, tasks, and environments to people, thus reducing the occurrence of musculoskeletal disorders by reducing the presence of workplace hazards. Injury prevention controls, including ergonomic equipment designs, are the optimal method of reducing exposure to injury. Ergonomics can be utilized to increase productivity, improve quality, and increase employee retention, ultimately improving profits.

Equipment design can directly affect the presence of risk factors for the sonographer by influencing the level of awkward postures required during scanning. This can also have an economic impact on an ultrasound department. The average yearly salary for a staff sonographer is \$50,000. However, the yearly cost to replace an injured sonographer with a per diem worker averages \$73,000. The average reimbursement for an ultrasound examination is \$2000-\$4800 per day. Loss of productive staff can have a substantial impact on a department's revenue. Additional costs incurred by ultrasound facilities include medical care costs averaging \$1700 per month and Worker's Compensation wages of approximately \$2500 per month. The gross loss of revenue due to sonographer absence is between \$40,000-\$96,000 monthly.

Work-related musculoskeletal disorders (WRMSD) are a group of neuromusculoskeletal disorders caused by or aggravated by workplace activities. These disorders account for between 40% to 60% of all recorded work-related illnesses and 70% of all hospital injuries. WRMSD's cost industry \$100 billion a year in lost work time. A 1997 survey of Diagnostic Medical

Sonographers found that 84% of sonographers suffer from some form of WRMSD, the effects of which range in severity from temporary pain and discomfort to permanent and career-ending injury.

WRMSD risk factors include forceful exertions, awkward postures, repetitive motions, "pinch" grip, and exposure to environmental factors such as extreme heat, cold, humidity or vibrations. The accumulated exposure to one or more of these risk factors over time leads to injury, as repeated exposure interferes with the ability of the body to recover. WRMSD's cause pain inflammation, swelling, and deterioration of tendons and ligaments. Muscles and joints are further stressed once their support structures are weakened. In sonographers, the most common injuries are carpal and cubital tunnel syndrome, epicondylitis of the elbow, shoulder capsulitis and tendonitis, and neck and back strains.

Treatment for WRMSD's ranges from rest and reduced workload to surgery. However, the outcome of treatment for work-related musculoskeletal injuries is poor since the sonographer is often sent back to the same job hazards that initially produced the injury. It is imperative, therefore, that these injuries be prevented.

The costs of work-related injuries include direct costs – Worker's Compensation and health care costs – and indirect costs – costs due to lost productivity and replacement staff. OSHA reports that indirect costs can be up to 5 times more than direct costs and estimates the total WRMSD expenses to be up to \$54 billion per year.

As the awareness of occupational injury in the sonography profession increases, employers are realizing the benefits of including ergonomics in their capital equipment purchasing decisions.

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When ultrasound departments replace equipment, managers should consider ergonomic design when choosing equipment. Manufacturers of ultrasound equipment are including many ergonomic features in their designs.

The monitor of the ultrasound machine should be adjustable to provide the most comfortable viewing position. The normal viewing angle for a seated sonographer should be no more than 15 degrees below the horizon and the viewing angles from left to right should be 30 degrees. The sonographer should be able to maintain approximately a 24-inch distance from the monitor.

The equipment should be lightweight with wheels appropriate for the flooring in the ultrasound facility. The wheels should have steering and locking capability. Equipment should be low enough in height to allow for good visibility during transportation.



Keyboards should be adjustable to obtain an elbow angle of 90 degrees, whether the sonographer is sitting or standing. The sonographer should be able to position the keyboard so as to avoid reaching. The greater the reach, the shorter the endurance time. For example, in a reach of 50 cm. from the body, significant shoulder muscle fatigue will occur in less than 10 minutes. Frequently used keys should be easily accessible with the distance between keys & toggle switches no greater than 50 mm.

Transducers and cables should be lightweight with an appropriate balance point to reduce strain on the sonographer's hand & wrist. The shape and width of the transducer should allow for a comfortable, relaxed grip. Four to five times more muscle & tendon force is needed to "pinch" something than to "grip" it.

Ultrasound equipment should be designed so as to allow a sonographer to keep his or her head balanced over the shoulders and looking forward. Shoulders should be relaxed and comfortable. The wrists should be straight, and the arm should be no more than 30 cm. from the body.

Among employers surveyed, a Liberty Mutual Safety Index Study revealed:

- 95% believe workplace safety has a positive impact on a company's financial performance
- 24% report a substantial positive impact
- 86% feel workplace safety provides a return on investment
- 61% feel that \$3 or more is saved for each \$1 invested
- 13% report \$10 is returned for each \$1 invested

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Both employees and employers benefit from the practice of ergonomics because injuries and the costs of treating them are reduced. People will be able to work longer, be healthier, and lead more productive lives; and employers realize the benefits in terms of improved productivity, better patient care and increased reimbursement revenue.

Many risk factors can be reduced or eliminated by informed equipment purchases. An ergonomic workplace increases the productivity of an operator by reducing fatigue, exertion, and musculoskeletal disorders. This can ultimately have a significant impact on profits and employee retention, an issue of great concern as sonographer shortages become more critical.

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