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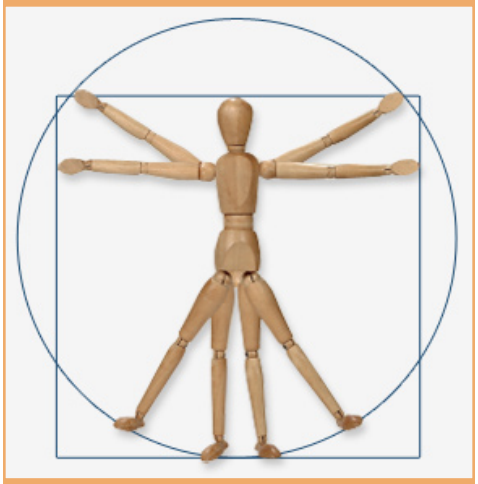

this issue

Histology Laboratory Ergonomics and Occupational Risk Factors

Michigan Society of Histotechnologists
Tech Points

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A discussion of the hazardous working conditions in the histology lab was once limited to chemical exposures and various biohazards. Today we must also consider more insidious threats, such as general working conditions and ergonomic issues. These factors, even seemingly small ones, combined with a normal active lifestyle, have impacted the delicate ergonomic balance in histology labs; sending workers home at night with aches and pains they never had before. Some conditions being reported include carpal tunnel syndrome, tendinitis, tenosynovitis, headaches and chronic back, shoulder or neck pain.

Possible causes of these conditions may include the following:

- Inappropriate workstations designed for other tasks, i.e., Data entry, specimen identification and workload recording have advanced from being manual to computerized, but there isn't a comfortable location for the keyboard.
- Lack of equipment to automate repetitive tasks due to budget constraints or because it makes the workspace more crowded.
- Inability to find qualified personnel means longer gaps in replacing technical personnel and supervisors, leaving the lab chronically short staffed.
- Fewer workers who are trying to keep up with increasing workloads are working faster, taking fewer breaks and performing the same tasks for an extended period of time.
- Elevated stress levels due to demands of decreasing turn-around time, eliminating any potential for error and maintaining superior quality.

To top it all off, the age of the average laboratory worker has increased and, even though we don't like to admit it, aging causes changes. Age can affect our height, quality of vision, physical strength, tolerance levels and the ability to recover quickly from an accident or injury.

Histotechnology professionals need to be aware of these new conditions that could adversely affect their wellbeing. Any existing symptoms should be reported and treated immediately. Finding solutions to the problems posed by ergonomic risk factors is a significant workplace safety and health issue. Employers and employees must make good planning and preventative measures a priority.

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UNDERSTANDING MUSCULOSKELETAL DISORDERS

What are they?

According to the The National Institute for Occupational Safety and Health (NIOSH), musculoskeletal disorders (MSDs) are defined as *"injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and supporting structures of the upper and lower limbs, neck, and lower back that are caused, precipitated or exacerbated by sudden exertion or prolonged exposure to physical factors such as repetition, force, vibration, or awkward posture. This definition specifically excludes those conditions such as fractures, contusions, abrasions, and lacerations resulting from sudden physical contact of the body with external objects."*

In simple medical terms, musculoskeletal disorders (MSD) stem from prolonged repetitive, forceful, or awkward movements. They are not typically the result of an instantaneous or acute event, but reflect a more gradual or chronic development. They can occur in many forms in many different areas of the body and involve damage to the spinal discs, cartilage, tendons, tendon sheaths, muscles, joints, blood vessels, or nerves.

How do they happen?

MSD can occur when muscles and tendons perform repetitive motions combined with other stressors. This can cause microscopic tears. The injured muscles tend to contract, decreasing the range of motion necessary for stress free work. Tendon sheaths run out of lubrication because they aren't given time to rest, so tendon and sheath chafe and tissues become painful and swollen. Continued overuse leads to numbness, tingling and hypersensitivity to the touch. Other conditions can contribute to individuals' susceptibility to MSD, such as genetic predisposition, previous medical history, prior surgery or trauma, fluid retention, obesity, poor posture, and gravity.

Repetitive movements, in and of themselves, are not the cause of MSD. The human body is designed for movement, much of which is repetitive, such as walking. For movement to occur, specific muscle fibers contract causing the fascia that wraps around the muscle tissue to pull on its attached ends, the tendons. The tendons, which are connected to bone, cause the bone to move. Opposing muscles and connective tissue must release or lengthen, creating a constant give and take. When everything works correctly the body exhibits strength and agility through a full range of motion. Even with overuse the body will recover if it is given enough time.

Some of the stressors mentioned above are considered "biomechanical risk factors", which include exposures to excessive force, awkward posture, repetitive movement and vibration. Each of these risk factors becomes more hazardous depending on how often you perform the movement, how many times you repeat it, how long it takes to perform it each time and how much time per day you spend doing it. The degree of risk is proportionate to the combination of all of the risk factors.

Motions to Avoid

Some of the most common motions used in histology can cause physical problems.

- Wrists are commonly injured from repeatedly bending them up and down (trimming by rocking the handwheel of the microtome) or inward and outward (embedding, coverslipping and keyboarding).
- Shoulder and arm injuries could be caused by holding the upper arms out to the side, above shoulder level, or in a wing position with the elbow away from the body. These are very common movements when performing microtomy, cryotomy, coverslipping, embedding and keyboarding.
- The neck, which supports the weight of your head, will tire quickly if you work with your head tilted backwards. This is a common position for people who wear bifocals or progressive lenses when they are looking at a monitor, using a microscope or doing close work. Bending your head to the side (holding a phone while working) is also hard on the neck. Working with the head bent slightly forward is the easiest position for the neck.
- The lower back can be very sensitive when you do a lot of bending and twisting at the waist (laying ribbons on the water bath and staining) and may become aggravated when you bend or twist while you are lifting something or if you make sudden jarring movements.

What can be done to help you work safely?

- Work with your joints in a natural or neutral position, which is near the middle of your full range of motion
- Rotate tasks often so you will not be doing the same task for long periods of time
- Plan a rest break every 20 to 30 minutes, even if the break is only for 15 seconds, so muscles can relax and circulation can be renewed
- Do strengthening exercises
- Use ergonomic tools and furniture
- Have your work space and habits evaluated by a professional

What are the risk factors for the upper extremities?

- Repetitive and /or prolonged activities
- Forceful exertions, usually with the hands (including pinch grips using thumb and forefinger)
- Prolonged static postures
- Awkward postures of the upper body, including reaching above the shoulders or behind the back, and twisting the wrists and other joints to perform tasks

- Continued physical contact with work surfaces; e.g., contact with edges
- Excessive vibration from power tools
- Cold temperatures
- Inappropriate or inadequate hand tools

What are the risk factors for back disorders?

- Bad body mechanics such as continued bending at the waist, lifting from below the knuckles or above the shoulders, and twisting at the waist, especially while lifting
- Lifting or moving objects of excessive weight or asymmetric size
- Prolonged sitting, especially with poor posture
- Lack of adjustable chairs, footrests, body supports, and work surfaces
- Slippery footing

What are some of the warning signs for MSD?

- Pain (may or may not have), burning, aching, or shooting pain anywhere in extremity
- Fatigue or lack of endurance
- Weakness in hands or forearms
- Tingling, numbness, or loss of sensation
- Clumsiness, stiffness, heaviness
- Difficulty using hands
- Lack of control or coordination
- Cold hands or fingertips
- Heightened awareness
- Hypersensitivity
- Frequent self-massage
- Sympathy pains when thinking about use

What are some of the options to treat a MSD?

- Application of heat (neck tension or muscle strain) or cold (tendon or joint pain/swelling)
- Medications (non-steroidal anti-inflammatory, steroid injections, diuretics)
- Physical therapy
- Splints or supports (off job or night or occupational)
- Surgery
- **CHANGE YOUR WORK HABITS**

MOST COMMON CLASSIFICATIONS OF MSD

Disorders associated with tendons

Ganglion Cysts occur on the tendon, tendon sheath, or synovial lining of the joint. They present as an ovoid bump beneath the skin surface. They are associated with aching or weakness and are not usually dangerous unless they compress a nerve. They are a sign of wear and tear and are associated with repetitive wrist motion. They used to be called “bible bumps” because, before modern medical techniques, people used bibles (the most available book at that time) to smash them.

Tendinitis–Tendons have little stretch or rebound and they are highly susceptible to MSD. If taxed beyond their strength by overuse or being held rigidly for long periods of time, tiny tears will occur. Friction will also cause tendinitis. Resting the wrists on the edge of a work surface can overload the tiny muscles and tendons of the hand and forearm by decreasing the use of the powerful muscles of the shoulders and back.

Tenosynovitis–Tendons that curve around bone or change directions run through tendon sheaths. The sheath creates synovial fluid for lubrication. Friction causes the sheath to overproduce fluid. If swelling occurs, nerve compression can result.

- **Stenosing tenosynovitis** occurs, mostly in chronic cases, if the tendon surface becomes rough, inflaming the sheath. The tendon moves with great difficulty through the sheath, causing very painful conditions.
- **DeQuervain’s Disease** occurs where the tendons on the side of the wrist and at the base of the thumb become constricted. It causes acute pain when the thumb is moved or when a twisting motion is attempted. It can be caused by holding the thumb up when working or using for a forceful action.
- **Trigger Finger (Flexor Tenosynovitis)** is the locking of any digit in a bent position. It occurs when a nodule or ganglion cyst that has formed on a tendon gets caught in the sheath. The pain is extreme. It is associated with hard handles on tools and equipment.

Shoulder Tendinitis

- **Bicipital Tendinitis** occurs where the biceps muscle inserts into the shoulder joint causing discomfort when the arms are raised to the front. It occurs as a result of poor posture (shoulders slumped forward), or repeatedly moving the arm over a surface too high or too far away.
- **Rotator Cuff Tendinitis** affects the group of muscles and tendons near the shoulder joint that turn the arm in and out and move it away from the body. It would cause discomfort reaching into the hip pocket or fastening a bra. It is associated with overusing the arm with the elbows “winged” away from the body.

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Forearm Tendinitis

- **Flexor Carpi Radialis Tendinitis** affects the wrist, producing tenderness at the base of the thumb muscle. The flexor carpi radialis muscle pulls the wrist down.
- **Extensor Tendinitis** affects the muscles used to straighten the fingers. Pain appears at the top of the hand near the wrist probably because the hands are held for prolonged periods in dorsiflexion (bent upward at the wrist).
- **Flexor Tendinitis** affects the muscles used to bend the fingers. Pain is usually in the fingers. It is developed from excessive finger motion or gripping.
- **Epicondylitis** can occur laterally (outside the elbow) and medially (inside the elbow). It is commonly called *tennis, bowler's or pitcher's* elbow if it is lateral and *golfer's elbow* if it is medial. It results from working with the elbows in a raised position and causes severe pain when the arm is straightened or contracted against resistance. The area over the elbow is tender to the touch.

Disorders associated with nerves

Carpal Tunnel Syndrome–Approximately one out of every 1,000 workers develops CTS, however the rate for workers doing routine histotechnology seems to be higher. Women develop CTS at a rate of 3:1 over men. Older people are more likely to develop CTS, possibly because nerve velocity slows down as people age. Obese workers are 3.5 to 4.1 times more likely to have abnormal median nerve conduction than slender people. Cigarette smoking, poor nutrition, previous injuries, and stress can increase the risk.

The carpal tunnel is a passageway formed by bone and tough ligament just below the wrist at the heel of the hand. Through this rigid structure pass nine finger tendons, connective tissue, arteries and veins, and the median nerve, which conducts impulses from the brain down the arm to the thumb, forefinger, middle finger, and half the ring finger. Excessive up and down wrist and finger movement eventually irritates the synovium causing swelling. Because the carpal tunnel cannot expand to accommodate this swelling, the pressure on the median nerve causes numbness and tingling. Symptoms can escalate from soreness to pain that is severe enough to awaken a person at night. A loss of power when gripping or constantly dropping objects are also signs of CTS.

Bone dislocations and fractures can also narrow the carpal tunnel causing pressure on the median nerve. Fluid retention during pregnancy or due to the hormonal changes associated with menopause can cause swelling and symptoms of CTS. Inflammation can also occur with other medical conditions, such as rheumatoid arthritis, diabetes, and thyroid hormone deficiency.

CTS can range from a minor inconvenience to a disabling condition. Many cases are mild, and some resolve on their own. If severe cases are left untreated the muscles at the base of the thumb may atrophy and sensation may be permanently lost.

While carpal tunnel release surgery has been reported to be 80% to 90% effective in decreasing or relieving the pain, its effectiveness in returning employees to their original jobs is 40% to 50% at best. Surgery should only be considered after conservative therapy has failed and a second opinion verifies that there are no other alternatives.

Ulnar Nerve Disorders

The ulnar nerve, which controls the ring and little fingers, can also become trapped as a result of repetitive stress. This will cause loss of sensation in these fingers and the outer half of the palm. Compression of the ulnar nerve can occur as a separate disorder or with CTS, and it can also be affected at the elbow. Surgery for CTS will usually relieve the ulnar nerve entrapment.

Sulcus Ulnaris Syndrome refers to a problem in a bone groove near the inside of the elbow. People with a shallow groove on the ulnar bone (the funny bone), who lean on their elbows, put pressure on the ulnar nerve and cut off the blood flow. Symptoms include loss of sensation, numbness, tingling, muscle atrophy, and a claw-like appearance of the ring and pinkie fingers.

Cubital Tunnel Syndrome, also known as flexor carpi ulnaris muscle syndrome, strikes people who work with their elbows bent at right angles for long periods of time, such as computer workers. It involves possible nerve entrapment that occurs in the underarm over the nerves' pathway. It can be confused with epicondylitis. Symptoms include loss of sensation, numbness, tingling, and muscle atrophy.

Guyon's Canal Syndrome, also known as ulnar tunnel syndrome, is compression of the ulnar nerve in the wrist in another tunnel, near the carpal tunnel. It may be associated with trauma to the ulnar nerve caused by repeated radial deviation or dorsiflexion. Symptoms include numbness in the ring and little fingers and difficulty grasping. Both dorsiflexion and flexion usually aggravate pain.

Disorders associated with Nerves and Blood Vessels

Thoracic Outlet Syndrome occurs when both arteries and nerves are compressed creating a diminished supply of oxygen-rich blood to the muscles. Signs include pain in the entire arm and numbness, coldness, and weakness in the fingers, hand, and forearm. Carrying heavy loads or working with the arms elevated can provoke symptoms.

Raynaud's disease or phenomenon causes cold, pale fingers due to blood vessel constriction. There can also be painful sensitivity, tingling, and numbness.

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Secondary Raynaud's phenomenon occurs in the presence of an underlying disorder. Primary Raynaud's phenomenon (sometimes called Raynaud's disease) occurs when predisposing causes are absent and is five times more common in women, usually affecting both hands. Raynaud's disease is associated with vibrating tools, and is sometimes called "vibration syndrome". Smoking increases the symptoms by further constricting the blood vessels. Beta-blockers could induce or aggravate the disease and should be avoided.

Associated Disorders such as Reflex Sympathetic Dysfunction (RSD), Degenerative Joint Disease (Osteoarthritis), Fibromyalgia, and Dupuytren's Contracture may accompany, result from, be mistaken for, or complicate MSD.

Prevention

No single mode of prevention exists, however common sense and ergonomic controls should be used to help minimize risk factors. Attention should be given to adjusting the work area, correct handling of tools, and performing tasks in ways that put less stress on the hands and wrists. Exercise programs to strengthen the fingers, hands, wrists, forearms, shoulders and neck may help prevent MSD. If the underlying cause is a medical condition, controlling that problem can prevent MSD.

DON'T IGNORE SYMPTOMS!

MSD ARE EASIER TO TREAT THAN TO CURE!

ERGONOMICS

The word "ergonomics" is derived from the Greek word *ergon,* meaning *work*, and *nomos,* meaning *principal* or *law.* It is a synonym for "human factors engineering." Ergonomics is a body of knowledge about human abilities, limitations and other characteristics that are relevant to design. It is based on one simple principle: Make the task fit the person performing it without overly stressing the person's abilities or ignoring limitations. Ergonomic design is the application of this body of knowledge to the design of tools, machines, systems, tasks, jobs, and environments for safe, comfortable and effective human use. Designs that consider human abilities often make work more productive, efficient, reliable, and safe. Ergonomic considerations should include postures, work habits, furniture, work arrangement, instrumentation, tools, lighting, noise levels, temperatures, and vibration.

Factors to Consider for Improved Ergonomics

Posture

While sitting, the spine should be against the back of the chair with the shoulders relaxed, the elbows along the sides of the body and the wrists straight. The back needs to be supported by the backrest while working. The most prominent part of the backrest should be in the lumbar region, at waist height or slightly lower. The backrest should be high enough to support the back just above shoulder blade height. The neck should remain flexible and the head should be upright to maintain circulation and nerve function to the arms and hands.

The thighs should be well supported and the backs of the knees free from any pressure created by the seat edge. There should be comfortable clearance for the thighs in the leg well area. The feet must be supported on the floor or on a footrest in order to keep the knees level with the hips. Use caution if the feet are tucked under the chair, resting on the base or rails, because the hips tilt and move the back away from the back support. It is desirable to vary the position of the feet from time to time to spread the load on the back and leg muscles.

As many as one third of the population may be inflicted with back pain at some point in their lifetime. According to OSHA, 80% of all back injuries are the result of cumulative trauma assaults. When the cause of a minor, undetectable injury is repeated many times, the injury can worsen into a major debilitating injury. Disc deterioration, which is a natural occurrence that begins as early as age 20, also contributes to injuries. Good posture and proper lifting and bending techniques will save a lot of discomfort.

Stand with one foot propped up; change positions often. Stand with your back's three natural curves in their normal, balanced alignment. Avoid a swayback. Walk with good posture, keeping the head high, chin tucked in and toes straight ahead. Wear comfortable, low-heeled shoes.

Force

It is possible to be unaware of the force necessary to accomplish a task, and force can contribute importantly to MSD. To alleviate the effect of force on the wrist, the wrist position should be maintained in a neutral position as if the arms dangled in a relaxed manner at the sides. It is dangerous to work with the wrist deviated from side to side or to remain flexed or highly extended for long periods. Also, remember that a pinch grip (using the thumb and forefinger) requires force combined with an awkward posture. It is better to use a power grip whenever possible.

Repetition

Spending more than 50% of the workday performing repetitive motions that take 30 seconds or less to complete is considered extremely high risk. Also, remember that your body can't tell whether you are at work or home, so if you participate in sports or hobbies that involve risk factors, your body will add those movements to what you did at work. Anyone who does repetitive tasks should begin with a short warm-up period, take frequent breaks and avoid overexertion of the hand and finger muscles. Tasks should be rotated and the work content varied. Automation should be considered if possible.

Environmental Factors

Sedentary workers are particularly susceptible to the effects of the environment. Drafts, temperature extremes, poor air quality, inadequate lighting and noise are all factors that affect comfort and performance. The ambient room temperature should be between 68°F to 73°F, and temperature variances between floor level and head level should be avoided. The humidity should be maintained between 40% and 60% to avoid dry eyes. Air movement should be kept to a minimum around workstations. Avoid working at low temperatures if possible because you will have reduced sensation in the hands and fingers.

Human Factors

Studies show that individuals have an optimal pace of work when doing tasks within their physical capacity, where the expenditure of energy is minimized and strength is conserved. A person's actual work capacity begins to decrease in the 20's, though the loss is not usually noticeable until the late 30's. The inability to pace work produces job stress and fatigue, and increases the risk of injury.

Accident rates are higher for individuals between the ages of 35 and the mid-50's and almost twice as common in males. There are also statistics that show that more accidents occur to employees who have worked for an employer for 1-5 years and the rates are slightly higher on Monday between 8AM and 12PM after 2-4 hours on their shift. Due largely to weaker upper body strength, shoulder-neck injuries are more common among females. On average, females have less strength than similar sized males (40-70% weaker in upper body strength and 5% weaker in lower body strength).

As the "baby boomer" generation ages, ergonomic studies have focused on older workers. Even in healthy people, joint mobility tends to decrease between the ages of 20 and 60, and age-related health threats have further impact on these areas. Range of motion in the lumbar spine area is significantly reduced with age. After age 30, there is a general decline in strength for most people, which accelerates after age 40. The loss of strength in the trunk and legs is greater than the loss in the arms for both sexes, but even finger and arm strength begins to ebb for most around the age of 40. Once injured, older workers require longer periods of recovery.

Work Areas

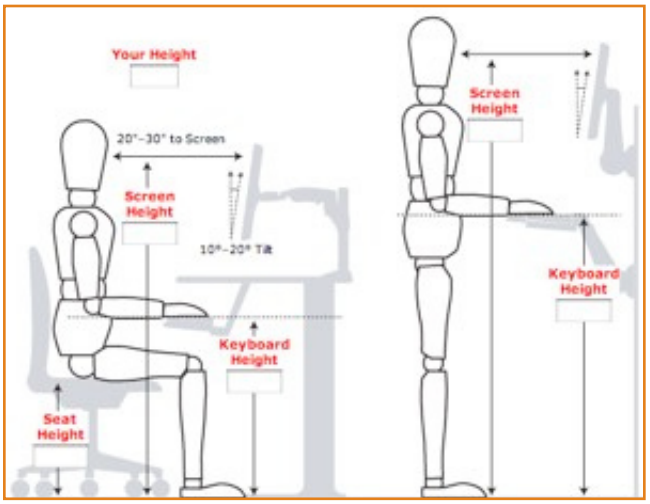
One of the most commonly overlooked details is that workstations are designed for the "average" person (i.e. sitting workbenches are typically designed for individuals who are between 5' 8" and 5' 10" in height). Take a good look at yourself and your coworkers. Are all of you identical or "average"? Do you have the same bone structure, weight distribution, limb length, body contours and propensity for right or left-handedness? These and other physical differences cause each worker to experience a different level of comfort (or discomfort) when sharing a workstation.

To optimize comfort, work should be positioned directly in front of you and frequently used objects should be kept within easy reach. The height of the work (not counter height) should be approximately elbow height for routine tasks. Precision work can be performed slightly higher and heavy work requiring physical strength should be performed at a slightly lower level. Adjustable workstations are ideal for accommodating various people and tasks, but they are not always available. An alternative is to be able to adjust the position of the worker, using things like adjustable ergonomic chairs, platforms for the work or the worker, or adjusting the work using workbench cutouts or tilted work surfaces. Lighting, noise levels, temperatures, and vibration are also very important ergonomic considerations.

Heavy materials should be stored at low levels. Bend with your knees and lift with your legs. Hold objects close to your body and lift objects only chest high. Stand on a stool to reach something above shoulder height. Don't be afraid to ask for help if you feel that you may be injured.

Equipment

Automated equipment is finally gaining acceptance in histology laboratories but maintaining the proper balance between people and machines is sometimes hard. Although human interaction is invaluable for performing multiple tasks simultaneously and making quick decisions, automation is very beneficial. Automation of repetitive tasks relieves workers of biomechanical stresses that can lead to musculoskeletal disorders, especially those requiring force or speed. Automation is typically accurate and consistent so it is also excellent for tasks requiring standardization.



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HISTOLOGY TASK RECOMMENDATIONS

COMPUTER KEYBOARD OPERATION

1. Maintain correct sitting posture.
2. Keep your wrist in a neutral position, floating above the keyboard and only rest them on a cushioned surface when not typing.
3. Use a gentle touch on the keys—don't bang on keys or press hard when scrolling
4. Do not hold your thumb or pinkie in the air
5. When using a mouse, remember that the burden is on one finger of one hand
6. Do not cradle the phone on your shoulder while using the computer because it throws the spine out of alignment.
7. Use glasses that are made specifically for viewing 20 to 28 inches away, i.e., reading glasses instead of bifocals or progressive lenses that can cause you to lean your head back to properly view a monitor
8. Light sources should be adjusted to eliminate reflections and glare from the monitor screen and from the background

MANUALLY LABELING CASSETTES AND SLIDES

1. Rest wrists or elbows on a padded surface when writing
2. Take mini breaks
3. Vary tasks
4. Avoid excessive reaching
5. Use ergonomic writing utensils
6. Do not use excessive force to write or type
7. Automate as soon as possible

CHANGING THE SOLUTIONS ON THE PROCESSOR

1. Use proper lifting and bending techniques--squat down instead of leaning over when removing or replacing heavy containers
2. Use a power grip when carrying containers; i.e. use the whole hand or both hands
3. Get a stool with safe footing to reach above chest height
4. Use caution when moving stock storage containers
5. Investigate a processor that has been designed to assist with the transfer of fluids

EMBEDDING

1. Evaluate the types of forceps you are using and recognize the amount of force needed to hold them closed—change to reverse grip forceps or pad the grip area with foam to increase the size
2. Try not to use the same motion repeatedly to open the cassette lids
3. Keep as many things as possible within your reach area
4. Do not lean your arms on the edges of the countertop or equipment
5. Be aware of how long your hands are in dorsiflexion, take breaks and exercise your wrists and fingers
6. Maintain good posture
7. Get up periodically and walk around if you are embedding for long periods
8. Alternate tasks

SECTIONING

1. Use your arm to make complete revolutions of the handwheel. **DO NOT ROCK THE HANDWHEEL!**
2. Increase the fine advance handle size to 1.5 cm. in diameter–if you cover it with something, make sure it is slightly compressible and smooth

3. Keep your arms close to your body and do not bend your elbows out
4. Keep your arms off the edges of the countertop or any other hard, sharp surface
5. Keep your shoulders in a neutral position while sectioning and do not raise them
6. Keep the muscles in your neck relaxed to avoid cutting off the circulation and creating pressure on nerves
7. Evaluate your reach envelope and keep side motions should be within 14-18 inches (try positioning the waterbath on an L-shaped extension from the microtomy area so that it can be reached by swiveling the chair instead of leaning over
8. Use an ergonomic chair and adjust it so that you can comfortably reach the equipment and see the specimen alignment without compromising the legroom
9. Use a footrest, especially if your feet do not reach the floor
10. Take mini breaks as often as possible and do exercises and self massage to restore circulation and relieve tension
11. Automate if possible

MANUAL STAINING

1. Avoid repeatedly dipping the slides during manual staining procedures
2. Purchase a slide holder for slides to be stained in coplin jars to avoid the use of forceps
3. Avoid using pressure to squeeze small reagent bottles and squirt bottles
4. Be aware of your reach zone and use caution in getting materials from underneath the counter and on overhead shelves
5. Prop one foot up or stand with one foot forward if you will be standing for long periods of time and alternate feet often to relieve the pressure on the lower back
6. Automate if possible

MANUAL COVERSLIPPING

1. Automate as soon as possible
2. Alternate duties
3. Take multiple mini-breaks and do stretching exercises for your wrists and fingers
4. Use forceps that don't require force to hold an object
5. Be aware of the position of your wrists and try to keep them in a neutral position.

CRYOTOMY

1. Operating the instrument in a comfortable sitting or standing position
2. Protect your hands from the cold temperatures that can reduce feeling and sensitivity
3. Do not lean into the chamber, or stretch to reach things
4. Use the same microtomy skills that are detailed under "sectioning"

MICROSCOPY

1. Avoid static postures that are characterized by contraction of muscles over extended periods of time
2. Work with the head slightly bent down instead of bent back because the head weights from 15 to 20 pounds and the neck and shoulders hold, secure and balance the weight
3. Use arm rests for a soft, smooth surface with no sharp edges
4. Microscope focus and stage movement controls should be ergonomically positioned within your reach
5. Use eyepieces that can be tilted
6. Request extenders for the body if the eyepieces are still not high enough and do not elevate the microscope if it moves the controls out of a comfortable reach
7. Position the work area in a quiet place away from drafts and noise

ERGONOMIC DATA SPECIFIC TO HISTOLOGY LABORATORY PROFESSIONALS

The first article reporting the rising incidence of carpal tunnel syndrome in histotechnologists was written by Pearl Gervais and published in the Louisiana Society for Histotechnology newsletter in 1991. Following that article, the growing interest in the number of injuries within the profession prompted a nationwide survey of histotechnologists. The results of that survey appeared in the first part of a three-part article published in the *Journal of Histotechnology* Vol. 18, p139, 1995. The articles were written by a group of professionals from the University of Michigan. Carpal tunnel syndrome (CTS) was used as the model for potential musculoskeletal disorders (MSD) and microtomy was assumed to be the major contributor.

Of the 1,000 randomly distributed questionnaires, 253 were completed and returned. The responses indicated that there were 157 respondents who complained of pain potentially related to MSD. There were 22 who had a clinical diagnosis of carpal tunnel syndrome (CTS), 36 with a clinical diagnosis of MSD other than CTS, 27 under a physician's care with no specific diagnosis, and 63 who experienced pain but had not sought medical attention. After evaluating the data, the parameters were determined that correlated with the presence of pain in specific groups.

The data indicated that microtomy and coverslipping were associated with pain, however there was no direct association with microtomy in clinically proven CTS and only a possible correlation with reports of other physician-diagnosed MSD. For technologists reporting clinically diagnosed CTS, coverslipping and computer data entry were statistically significant. Embedding and computer data entry were significant among respondents with clinically diagnosed MSD other than CTS.

The third article (JOH, vol.19, No.1, 3/96) compared the characteristics of manual and motorized microtomes. The authors estimated that approximately 41 revolutions of the handwheel were required for the preparation of a single glass slide. Using 50 blocks a day as an average, a technologist would turn the fine advance handwheel more than half a million revolutions per year. It is not possible to determine the frequency of use of the coarse handwheel, however the motions necessary to trim and exchange the blocks in the block holders have also been linked to MSD.

It was emphasized that improper techniques while manually performing microtomy may improperly distribute mechanical stress to musculoskeletal regions susceptible to trauma and, that during the course of years, an individual may be at risk for the development of overuse syndrome associated with chronic repetitive trauma. It was also stated that when incorrect body movements were used to compensate for a movement that caused pain, the disorder could be transferred from one location to the other.

The study demonstrated that motorized microtomes produced slides that were equal to, if not better than, those prepared by manual microtomes. The acceptance level was high, the training period was relatively short, and the time per block eventually decreased. The number of recuts for poor section quality decreased. Overall, the opinion was that even though the initial purchase expense was higher than that of the manual model, the motorized unit left the technologists with more energy for completing other tasks. It also eliminated one source of repetitive motion, thereby reducing the chance for overuse syndromes.

A second survey was conducted In New South Wales Australia in 2002 (Table A). There were 170 questionnaires mailed out and a total of 100 were returned from 60 females and 40 males. The questionnaires requested personal details, task details, MSD occurrence, symptom information and general health information. There was also an area for free text and comments. 63% of the respondents complained of MSD symptoms and the symptoms were broken down by gender because females were responsible for the majority of the bench work and many of the males held management positions.

Another finding was the relationship of microtomy and embedding tasks to symptom locations (Table B).

TABLE A. REPORTED MSD SYMPTOMS

FEMALES	71.7% reported having symptoms
	57% had up to 4 symptoms
	Almost half reported neck and right shoulder symptoms
	38% lower back
	31.7% left shoulder
	30% wrist
MALES:	50% reported symptoms
	37.5% had up to 4 symptoms
	Two times the number of elbow symptoms as females
	Under half as many neck and back symptoms
	Significantly less shoulder, arm, wrist, hand and finger symptoms

TABLE B. TASK/ SYMPTOM RELATIONSHIP

TASK	SYMPTOM LOCATION
Blocks cut per day	Lower back, hands and fingers
Hours per day doing microtomy	Left shoulder
Years doing microtomy	Elbow
Cassettes embedded per day	Left shoulder
Blocks embedded per session	Wrist

The surveys verified that *many* routine histology job functions contribute to the potential for MSD, and that proper laboratory workspace design, use of automated instruments and proper ergonomics would reduce the risk. *Non-ergonomic work methods are extremely hazardous and very common.*

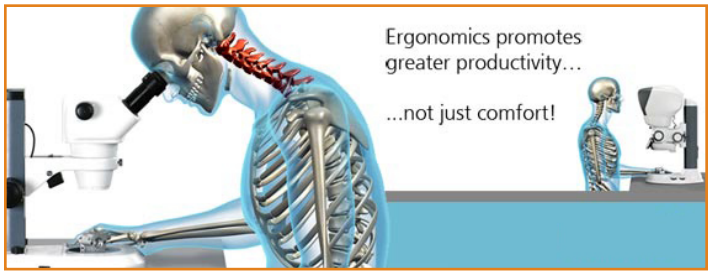
CONCLUSION

To protect employees from workplace hazards, OSHA issues and enforces workplace standards. They also provide information, technical assistance or work with employers and employees in a manner that rewards compliance. Because no specific standard currently exists for MSD, federal and state-operated OSHA programs have generally relied on what is referred to as the *"general duty clause of the Occupational Safety and Health Act of 1970"* or its state equivalent. This clause requires employers to provide a workplace "free from recognized hazards that are causing or are likely to cause death or serious physical harm."

Regulatory agencies cannot do everything and be everywhere so it is up to the employer and the employee to share the responsibilities to create a plan that addresses potentially hazardous conditions and tasks and develop a means to provide a safe working environment. Employers should attempt to minimize job stress and moderate the work pace, encourage task rotation and employee fitness and allow workers to feel free to offer suggestions without fear of repercussion. Employees must contribute to safe work performance in a non-threatening way. They should study and practice the principles of proper body mechanics, accept recommendations for safe work methods and be willing to replace bad habits with safer ones. Potential MSD symptoms should be reported as soon as they are noticed and helpful suggestions should be made to eliminate the source of the problem. It is also imperative that good work habits be taught to students.

Fears that automated equipment will replace the work force need to be put aside. Develop a dialog with manufacturers and offer suggestions if a task or a specific piece of equipment is causing a problem. Request a demonstration to try equipment and furniture before it is purchased. If a problem exists, consult with the manufacturer to see if there is another version or if modifications can be made.

Most of all, keep an open mind and be receptive to new ideas. It may take a little longer to become proficient when using a new methodology, but it will certainly be well worth the time and effort if it prevents even one potential injury.



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WEBSITES RELATING TO ERGONOMICS

- OSHA
- http://www.osha.gov/
- Bureau of Labor Statistics – Injuries Illnesses and Fatalities
- http://stats.bls.gov/blshome.html
- US Department of Labor – Injury and Illness Prevention Program
- http://www.osha.gov/dsg/topics/safetyhealth/index.html
- BLS Workplace – Injury and Illness Summary 10.25.2012
- http://www.bls.gov/news.release/osh.nr0.htm
- NIOSH
- http://www.cdc.gov/niosh/homepage.html
- http://www.cdc.gov/niosh/programs/msd/default.html
- ErgoWeb
- http://www.ergoweb.com/Pub/ewhome.shlmb
- CTD News (Subscription based newsletter offering free info)
- http://ctdnews.com