

Microscopy's dangers: From wear and tear to disabling injury

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April 2019—When pathologist Sandra Ewaskow, MD, was asked at a recent medical conference what topic she would choose if she were to write a book in her field, she thought of her own experience with musculoskeletal pain and of her mother, who had recently been hospitalized for occupational therapy after a hip fracture. “It was very much on my mind, the kinds of things she had to do to get comfortable and retrain her body to move,” says Dr. Ewaskow, of Pacific Pathology Partners in Seattle. “I said I would write a book on pathology and ergonomics.”

The idea touched a nerve. “The rest of the meeting, for days, different specialists in pathology, primary care, orthopedics, and surgery kept coming up and saying, ‘You’ve got to write that book. We sit at a computer all day and we have those issues in our practice.’”

In fact, she notes, people in any immobile, static position all day are likely to encounter problems. From the standpoint of ergonomics, it’s not only the microscope but also other elements of pathology work that are hard on the body. “Practitioners are spending so much time at the computer now—much more than a few years ago. We can now access surgical reports and imaging at our desk where in the old days, we would have to get up and could stretch. Now there is less need for us to move from our workstations.”

Prolonged microscope use has been known for almost four decades to be associated with developing chronic pain syndromes, says Evan George, MD, clinical associate professor in the Department of Anatomic Pathology, University of Washington. He published an article in 2010 that addressed microscopy as an occupational hazard of pathology practice (*Am J Clin Pathol.* 2010;133[4]:543–548), but he believes the knowledge gap remains sizable. “It’s a subject that pathologists don’t talk about a lot,” Dr. George says.

Ergonomics caught his attention because of pain he experienced during his anatomic pathology work. When he began to have problems while practicing in a community hospital setting, he noticed that symptoms were most intense when he was working at the microscope—to the extent that it was difficult to concentrate and complete his daily work. “There wasn’t a specific event, and because I used to lift weights for exercise, I first consulted an orthopedist. Symptoms did not improve with anti-inflammatory medications, and there were no radiographic abnormalities. The orthopedic physician was puzzled, and I hadn’t made the connection that the pain might be *from* the microscope work.”

After confiding his symptoms to other pathologists in his group, several of them told him they too had experienced musculoskeletal symptoms at some point in their careers, which improved with physical therapy or workstation modifications, or both. One colleague had herniated discs in the cervical spine that required surgery and a month or two away from work.

Luckily, Dr. George happened to mention his symptoms to a physical medicine doctor at his hospital who offered to visit his office. “He made an almost instantaneous diagnosis of repetitive stress syndrome.” After Dr. George obtained an ergonomically designed microscope, allowing him to gaze straight ahead, as one would do with a periscope, “My symptoms diminished a lot.”

The neck and upper back are the areas most intensely affected by microscope use, Dr. George has found. Surface electromyography has confirmed that “the neck and back muscles truly are working when we are sitting down viewing slides at the microscope or staring at a computer,” he writes in his 2010 article. But since microscope work includes repetitive movement of the arms and hands and because the body’s joints and muscles are connected in such complex ways, pain in the shoulders, arms, wrists, hands, and lower back can also result. For example, “I notice that if you’re a short stature pathologist and your feet don’t reach the floor when you are sitting, it brings a lot of excess stress to the shoulders.”

Repetitive stress syndrome, also known as cumulative trauma disorder, refers to wear and tear on tendons, muscles, and sensitive nerve tissue caused by continuous use over an extended period. The exact pathophysiology of cumulative trauma disorder and its associated musculoskeletal disorders is not established, but possible mechanisms include repetitive mechanical irritation, microischemia, and accumulation of metabolic products that promote inflammation and fibrosis or interfere with neuromuscular function, according to Dr. George. With time, he says, muscle fiber shortening and fibrosis may lead to postural imbalances, which, if uncorrected, cause additional strain on affected tissue or injury at previously uninvolved anatomic sites.

The risk factors for symptoms in pathology and cytotechnology practice are better known: hours of microscope work, duration of work without breaks, fast work pace, and poor workstation ergonomic conditions. Over the years, these can steadily add up, leading to disabling injury. "There are a variety of types of medical problems or injuries, probably resulting from recurrent microtrauma to myofascial tissue that occurs so gradually most people don't realize it until a critical threshold is reached and symptoms become severe," he explains.

Marilyn Bui, MD, PhD, was one such person. On her first job in pathology, she routinely put in 10- to 12-hour days and exercised regularly after work. "You feel young and invincible. You just keep working until you are exhausted," says Dr. Bui, who is now senior member of pathology and president of the medical staff, Moffitt Cancer Center, Tampa, Fla.

But one day, after three years on the job, she discovered she couldn't get out of bed. "My back muscle was frozen. I couldn't walk." As radiology testing confirmed, "It was a very bad back muscle spasm." She saw a chiropractor who surmised that her work on the microscope was creating a posture problem and advised her to stop wearing high heels, to correct the bad postures, and to start walking every hour. She complied with most of that advice and started getting back adjustments and deep muscle massages. "It went well for one or two years with treatment, then it happened again. My back was completely frozen one day when I was trying to pick up something very light."



Dr. Ewaskow

One provider explained to her that the repetitive stress of her working environment was like a million small paper cuts on the body, and the body was defending itself, in her case with back pain. The advice she received this time was sobering: "As long as you are doing your job," the provider told her, "if you don't change your behavior, this pain will not go away. And when you get older, it will get worse."

In anatomic pathology, there can be considerable repetitive motion beyond the microscopy arena, Dr. Ewaskow points out. "The typical workflow will consistently go from one side to another. Pathologists will have a specific place to set up slides, they'll pick them up the same way, put them on the scope in the same way, and move the slides with the same hand."

The effects of repetitive motion may not become apparent for years, but then they can make themselves known in subtle or unexpected ways. "I remember a conversation with another pathologist who found after seven years of this kind of practice full time that he noticed a change when looking at a rear-view mirror while driving. He perceived just looking over his shoulder as being difficult," Dr. Ewaskow says.

Kay Ballen, OTR/L, is an occupational therapist and ergonomic specialist for employees at EvergreenHealth, Kirkland, Wash. Her job is not to diagnose musculoskeletal disorders but to evaluate office setups and provide recommendations to improve postures, positioning, and comfort, and to overall reduce the risk for musculoskeletal

disorders. “Generally, when we have a request for an evaluation, it is because someone is reporting discomfort or pain or a new employee is making sure their workstation is set up properly,” Ballen says. “There are several laboratories within our hospital, and most often those employees using a microscope during the majority of their shift request an ergonomic evaluation due to having neck, back, and shoulder discomfort or pain.”



Ballen

When a chair is not properly adjusted or a desk, table, monitor, or microscope is not at the proper height, Ballen finds that the faulty positioning may induce leaning or flexing of the neck. But a behavior pattern with possibly even greater impact is the increased amount of sitting that people are doing during the day. “Sitting has increased tenfold in the last four years because people are going paperless, and people are working more 10-hour or 12-hour shifts at a computer instead of five eight-hour shifts. As their day progresses, their body becomes more fatigued the longer they are sitting. We start to see a lot of postural issues and upper body or neck pain.”

Ballen’s professional focus when conducting ergonomic in-service training for clinics and departments at EvergreenHealth is on prevention. New employees receive information regarding proper sitting postures and positioning and ergonomic contact information as part of their one-week orientation.

When employees request an ergonomic evaluation, “we evaluate their desk height and the need for chair adjustments, including seat depth and armrests. We evaluate the computer screen viewing distance, screen height, keyboard and mouse types and their placement, microscope height, positioning of the scope, and how a person’s arms are placed on the table or desk.” In addition, they evaluate tasks that are done repetitively during the work shift that could contribute to discomfort or pain, including the length of time a person is sitting. “Would they benefit from a certain kind of workstation or elevated desk? Do they need improved lighting?”

These considerations reflect a central idea: Work has to move with the human body, not vice versa. “Instead of us adjusting to a camera or an angle of a desk or a chair, somehow the design has to be more fluid. It has to coordinate more with the natural inclination or movement of our body,” Dr. Ewaskow says.

For Donna Hansel, MD, PhD, interest in ergonomics also stemmed from an injury: a massive lumbar disc herniation she experienced after surgery when she worked as an assistant professor of anatomic pathology at Cleveland Clinic, leading to two years of rehabilitation. “It became difficult just to walk, I lost a lot of range of motion with my leg, and it was almost impossible to sit.”



Dr. Hansel

When she approached a friend in ergonomics for help, it led to several changes in her office layout. “He photographed me while I was sitting and made a range of modifications. We raised the desk an inch, got something to put my feet on and a place to rest my elbow, changed the way the microscope was positioned, and changed the type of chair and how I sat in it. He prescribed all of that, set it up, and said, ‘Do not change it.’” Despite initial discomfort, the setup brought relief, and she was sold on ergonomics as a solution. “I became a

believer," she says.

Later, as chief of the Division of Anatomic Pathology at UC San Diego Health, Dr. Hansel negotiated for space in La Jolla for a new faculty office and made sure ergonomic design was a priority. Although some faculty were wedded to their traditional wooden desks and insisted on keeping them through the move, the majority went along with new tables where microscopy and the computer could go from fully standing to sitting, with experts advising on the optimal heights. "The style that had arm supports was by far the most popular, and they put these in all the faculty offices," Dr. Hansel says. In the end, "no one ever wanted their old desk back."

"About half of the faculty will do sign-outs standing up and half will do them sitting down but with the option to adjust to proper heights. The ergonomics experts come in to make final adjustments, including appropriate ancillary items such as foot and elbow rests, and to make sure all the residents and attendings have adjustable eyepieces for the microscopes, eliminating the need to bend. With the cutout we did in the table surface, you can sit straight up in your chair and be close enough to the scope to see through it. That was part of the design of the table." A large sign-out space with several six-headed scopes and projection capability for group consults also has an adjustable table.

The perils of using a scope are only a few of the potential ergonomics issues, she says. "Another is how you position your arms when moving slides. Many times, people develop shoulder problems because of having to use slides without proper arm support." In fact, she has had a few friends who ended up retiring early because their shoulders were such a problem. "This is really where an expert in ergonomics can come in and make adjustments if you need them. That's made a big difference for me. I feel if I have shoulder pain, it's because I haven't positioned things correctly."

One faculty member, Dr. Hansel adds, had severe sciatica, causing great difficulty with sitting for sign-outs. "She is one who often uses the desk standing up, and that helps a lot. She does physical therapy, stretches, and massage, and she has expressed interest in teaching other faculty and trainees stretches that can help with some of the muscles that are overused during sign-out."

Protecting the body from musculoskeletal pain caused by pathology and laboratory technology work requires taking proactive steps, and that involves more than appropriate equipment, Dr. Hansel says. "It's also making sure you have an expert who evaluates how you are using the equipment, whether it's the proper height, and so on. It involves personal care, stretching exercises, and making those a priority."

Ask people what they do to stay healthy and they're likely to mention diet and exercise, not body position and posture. That voice from childhood reminding us to sit up straight might have seemed more related to comportment than to health. But Elizabeth DeMarse, PT, DPT, MTC, rehabilitation specialist at Moffitt Cancer Center, considers that a mistake (though she advises that people aim for a "neutral spine" with a concave curve in the lumbar spine when they are seated). From her standpoint, the spine is central to overall health. Work in the laboratory can insidiously, gradually, often without notice, take a toll on the spine, she says, and from there, a toll on many other structures of the body.

Dr. DeMarse specializes in manual therapy, a physical treatment that involves manipulation of muscles, fascia, and joints. Her practice includes work, geared to Moffitt's cancer patients and employees, on posture, breath, and preservation of structures of the body. Where the employees' problems are concerned, ergonomics is often integral to treatment.

Her colleague Dr. Bui has been open about her experience with myofascial pain caused by her work and about the treatment Dr. DeMarse provided. "In addition to her chronic back pain, Dr. Bui was having constant pain in her scapular area, and it was related to her positioning with occupational tasks because she was looking into a microscope and typing on a computer on a regular basis," Dr. DeMarse says. She worked with Dr. Bui by using specialized manual treatment to mobilize the scapular area and surrounding muscles and by giving her supplemental exercises.



Dr. DeMarse

Dr. DeMarse and Nancy Keating, Moffitt's injury prevention supervisor, also evaluated Dr. Bui's workspace and how it could be reconfigured to prevent it from exacerbating her condition. Changes based on ergonomics were essential. "When I saw her over a two-month period of time, we were able to keep her pain managed so she did not have to miss work because of the pain," Dr. DeMarse says.

Usually the employees she sees for physical therapy have back problems, but the hips and shoulders can also be a main source of pain, she says. "It might be something that has started outside of work but because their work requires them to be sitting at a desk all day, we would want to intervene and address both areas." Commonly, it is the sitting posture that perpetuates the problem, whether it involves shoulders, hips, or back. "The spine is meant to move dynamically with the arms and legs. But when you aren't moving the arms and legs and are sitting for extended periods of time, that is where the downfall begins."

Making sure the employees are aware of how their sitting position relates to spine mechanics and how they can reduce the amount of strain on the spine and its related structures is an important part of preventing and treating ergonomic problems. "Sometimes when they have a back problem and get to work, they are on the phone and their phone is off to the left and their computer is in front of them. Always moving to one side will alter the balance between the right and left sides, which will ultimately affect the spine."

"You may want to move it to the center so that you are not twisting to use it," Dr. DeMarse says of the phone, "making sure that repetitive motions are balanced out and not focused on one side or the other." For the same reason, she encourages people who are right-handed to use the left hand occasionally.

Pathologists may need a certain position to get close to the microscope. In the case of Dr. Bui, "She was leaning forward and using her arm to adjust the microscope, so we made certain adjustments to her workspace. She was able to get an extension on the eyepiece of the microscope, changing the screen position so she did not have to turn so far from place to place. And we adjusted her computer because she was going from her microscope to her computer and they were at different heights." She also got an additional monitor to reduce the head turning motions, Dr. DeMarse says. Keating gave Dr. Bui an ergo chair, which Dr. Bui says made a big difference in her musculoskeletal health.

Reinforcing and keeping posture awareness at the forefront of employees' activities are priorities. "Bending forward is one of the worst things they can do," Dr. DeMarse says. "It is usually the thing that causes them pain. Sometimes they don't realize that is what is causing the pain because it comes a little bit after the activity, so they don't put it together with stress on their spine structures." For example, disc issues are common, and forward bending will make them worse because of where the disc protrudes, causing a herniation. With some of the younger patients, she says—and that includes people in their 30s—"that ergonomic assessment is huge over the long term. If they are not aware of this at a young age, it is the kind of thing that could debilitate them later in life."

Without the necessary awareness, people can perpetuate a problem year after year with poor posture habits, which can weaken the back and the ligaments that support the lower back—one reason why people chronically throw their back out. It's similar to what happens after the first time a person sprains an ankle; they often have chronic sprains of the same ankle. "Once you have sprained your ankle, you have changed the integrity of the ligaments in the ankle, especially if you have not strengthened the muscles around the ankle. The same is true of the ligaments around the spine. But someone with an ankle sprain can wear a brace and stay off the ankle. You cannot stay off your back."

In addition, the wrong posture can increase the likelihood of arthritis, which is essentially an irregularity in the joint surface, she explains. "As we age, the ligaments get even tighter because of the dehydration that happens in our body over time. The synovial fluid is not as viscous after people are in their 30s or 40s, and the ligaments aren't as supportive. There are 96 joints in the spine and 96 opportunities for them to have arthritis. Having some knowledge of how to maintain spinal health will help prevent people from having back problems in their future."

It's easy to see how manual laborers doing heavy lifting could degrade their spine, but over time, occupational tasks from a sedentary position can result in the same damage, Dr. DeMarse says. "Joints have to move to stay healthy," she says. "The synovial fluid lubricates the bone surfaces with movement." To encourage this lubrication, she advocates use of standing desks and mobile workstations such as computers on wheels that are not too heavy. "Even just standing in front of a computer and shifting your weight from one leg to the other is excellent." Eliminating trash cans under desks is another way to get people to stand up and walk, further facilitating lubricated joints.

When Dr. George wrote his article almost 10 years ago on microscopy as an occupational hazard of pathology, there was little more than a few anecdotal accounts of stress injury in the pathology literature, plus some surveys of industry workers and cytotechnologists who use microscopes. "But there wasn't really a global discussion of the issues in the pathology literature, and that's why I thought it would be helpful." He finds conference planners are still approaching him about appearing as a speaker based on the article, which he takes as a sign that not enough other research has been conducted over the past decade and more voices are needed to raise the alarm.

Dr. George gives new residents a talk every year on the topic of repetitive stress syndrome as part of their orientation. "And if I see someone doing something that definitely looks awkward in terms of posture, I'll offer suggestions. If they have sustained problems, I'll recommend they go to the residency director and employee health office and probably get an ergonomics evaluation or a physical therapy evaluation." In addition to the ergonomics adaptations, physical therapy, including sustained gentle stretching over time, has brought him relief from some of his symptoms and, he believes, has helped prevent new problems.

As a warning not to delay attending to ergonomics issues, Dr. George says that for some problems he has experienced, the opportunity for prevention or cure is gone for good. "I've never returned to a painless life," he says. For Dr. Bui, the work-related musculoskeletal issue may never go away. But after three acute episodes, she says, it became clear she needs to be "mindful about prevention," every day and in every activity.

Anne Paxton is a writer and attorney in Seattle. For prevention of repetitive stress syndrome or cumulative trauma disorder from microscopy, Dr. George lists modified suggestions of the Centers for Disease Control and Prevention in his article "Occupational hazard for pathologists: microscope use and musculoskeletal disorders" (Am J Clin Pathol. 2010;133[4]:543-548). Other suggestions of medical providers for easing and preventing symptoms are also included.