

Identifying the ergonomic risk factors of a job

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Musculoskeletal injuries involve overexertions of muscles and joints and, often, related tissues such as tendons, ligaments, nerves, bones, and blood vessels. We can trigger musculoskeletal injuries by a direct trauma (such as a slip or fall), by a single overexertion, or by accumulating damage from repetitive strain.

When we experience overexertion of muscles and joints, common symptoms include soreness, pain, discomfort, redness and swelling, limited range of motion, stiffness in joints, weakness and clumsiness, numbing/ tingling sensations (“pins and needles”), popping and cracking noises in the joints, and “burning” sensations in muscles. We need to pay attention to these warnings and act quickly to prevent trauma from becoming more serious. For repetitive jobs, over time, cumulative trauma injuries can develop.

- At first, our symptoms of pain and/or weakness are felt during work and disappear during off-hours or rest. Usually the body recovers and the problem is completely reversible at this stage.
- But, if the workplace conditions of the task are not changed, the injury can progress to the point that our symptoms no longer disappear completely between work shifts. This means that our bodies are unable to completely repair the affected tissues during rest. We may find that our symptoms are beginning to interfere with our ability to perform our usual work activities. We might find that we are moving more slowly, taking care how we bend or reach, conserving our movements just to get through the day.
- But, if the work conditions are still not changed and the trauma is allowed to continue, we may find that the pain persists even at rest, even to the point that we have trouble sleeping. At this stage, severe pain, limited mobility, loss of sensation or muscle weakness can make it impossible to perform most tasks. We find both our work and our home life affected – brushing teeth, combing hair, picking up objects, getting up and down on the toilet – everyday life is impacted.

Insufficient healing due to repetitive strain is also typical of the majority of workplace back disorders. Also, keep in mind that cumulative trauma can be aggravated by the slower rate of healing typical for us as we age. Reporting injuries at their earliest stages enables the risk factors of the job or task to be evaluated and modified or eliminated. So, to get started, what should we be looking for? Whether we are diagnosing or trying to prevent workplace musculoskeletal injury, we can begin by observing ergonomic risk factors. What is the body actually doing while we perform a job or task? And what aspects of the job put the body at risk?

Are any of the joints in a non-neutral position? This means any joints in the body, including the back. If you imagine yourself standing, relaxed, with your arms at your sides – this is considered a neutral position for the body. The further our joints are from this neutral position, the more that the surrounding muscles are stretched – this makes them weaker and easier to injure. Sometimes tasks involve joints as far from neutral as they can possibly go. **How could we keep the joints in a more neutral position?** So, we look at a job and see where any part or parts of the body are not neutral. For many jobs, we could alternate standing and sitting, move around and change position to use different muscles, or use ergonomically-designed tools which put the bend in the tool (rather than bent joints in the user). For example, a job that involves loosening or tightening a large nut located at head-height on a machine has the worker's arms extended above the shoulders, putting the shoulder joints in a weak position. Pushing hard on the wrench puts the shoulder joints at considerable risk of rotator cuff injury. Putting a stable platform in place at the machine raises up the worker so that the wrench is now at waist-height and the worker can lean into the wrench with his body weight – this lowers the arms and puts the task in a position of strength for the body.

Is the work or load too far out from the body? We are strongest when we keep the work or load close to the body. The further away it is, the more our back muscles tighten to support us – squeezing down on the disks in the spine. If a task requires us to stretch out far from the body to reach something, our muscles have to compensate. **How could we reduce this risky position?** For any lifting job, we need to bring the load as close to the body as possible. It is especially helpful to also keep lifts between shoulder and knee height and avoid lifting from the ground or above the shoulders. Maybe the reason you couldn't use a squat lift was because the load cannot be brought close to the body, such as a wide object that will not fit between the knees. It may be possible to get others to help with a lift, but some lifts simply require the use of a machine. If we have to reach out to obtain something or activate a control, we need to bring these items closer to us or perhaps use a tool to do the reach for us.

Does the job require that the body be bent forward? This is similar to the previous risk factor because, when we bend forward, so much of our body weight is being suspended from the lower back. The surrounding muscles are stretched and weaker, easier to injure. Rounding the back places considerable pressure on the disks in the spine. **How could we reduce this risky position?** If we are lifting something, we should use a squat position rather than a bent back. Why are we bending? Maybe we can raise the height of the task or tilt the work surface.

Is the trunk of the body twisting? If you really want to screw up your back, twist or lift while twisting. Twisting the back really places considerable strain on muscles, tendons, and discs; lifting and twisting combine to produce a high risk for back injury. **Avoid any twisting.** If lifting and carrying an object, lift while facing forward and then take steps with your feet to turn your body and face a different direction. Sometimes, if we are rushed to get a job done or are working to match the speed of a machine, we may feel

that twisting the body is helping us to work faster – but taking a few steps with the feet, instead, is a far safer way to do the job.

Is the body making sudden movements? Using the body ballistically, such as swinging the limbs or swinging a lifted weight, can be very dangerous. Our muscles are forced to stretch faster than they are able to respond, producing over-stretching or even tearing of muscles or tendons. Swinging something is often the way someone will lift a heavier-than-usual object – sometimes to put the item onto the hip or shoulder. **Avoid swinging motions.** If an item is too heavy to lift alone, get help or use a machine.

For how long a time is the body holding a posture or repeating a movement? When we hold a body in one position for a long period of time, the muscles are kept tight – clamping down on the blood vessels supplying them with oxygen and food and carrying away waste products. Over time, this is damaging to tissues. A similar problem, called contact stress, involves pressing or leaning the body, hands, or wrists against a hard or sharp edge like the edge of a table or the handle of a tool. Also damaging to tissues over time is performing repetitive movements. When we are moving, rather than holding still, we alternate muscles – this gives some relief to this tissue starvation problem. But, recent research shows that repetitiveness can actually damage tissue gradually, causing inflammation, and even bone loss, as injury accumulates. **How could we reduce this effect of time on static positions, contact stress, or on repetitiveness?** We need to move around, change position, not just sitting or standing all the time. We need our work time to include breaks and recovery/rest periods. Job rotation can help by dividing the risky task among several people, so no one person does it for very long. We can put padding on sharp edges or change tool handle shapes from multi-sided to round with knurling. For standing jobs, gel mats on the floor and sit-stands can help, as well.

Does the task overwork a few muscles producing localized muscle fatigue? Sometimes a job or task involves using just a few muscles, but working them a lot. Some examples could include keyboarding, assembly line work, digging a hole with a shovel, reshelving books, or packaging products for shipment. **How could we avoid overworking a group of muscles?** We could change position frequently, alternate sitting and standing, or take breaks to reduce fatigue. Is equipment antiquated? More modern equipment, unlike older models, may have designs which conform to the body's needs and produce better positions for the joints and back.

Is the body being worked to the point of exhaustion? Fatigue, like hunger and thirst, is a warning -- the body is telling us we have reached a limit and need to take some action. As our muscles become tired, they can suffer from insufficient oxygen supply and they build up waste products; once exhaustion occurs, muscle injury is more likely. Also, when we become exhausted yet must continue working, we will simply get work done any way we can and often swing a lifted object, twist the back – anything to keep on going -- further increasing the risk of injury. **How do we put limits to prevent**

exhaustion? Our work hours and scheduling need to take human limits into account; we need breaks and recovery/rest periods and we need to keep our muscles hydrated by drinking enough water. Usually, frequent short rest periods reduce our fatigue better than a few long breaks with long work intervals between them. It is especially risky to work through breaks so that you can go home early, but exhausted -- over time, this can take a heavy toll on the body. This risk factor may also be reduced by dividing the tasks among several people to reduce the fatigue of any one person. It also helps to vary your tasks so as to use different postures and muscles – along the lines of the idea that “a change is as good as a rest.”

Is the body exposed to vibration? We could be using vibrating tools, handling vibrating machine controls, or sitting on vibrating equipment such as driving a truck or operating a forklift. Prolonged vibration can produce damage to tiny nerves and blood vessels, such as in the hands (Raynaud’s syndrome or “white finger disease”), or in the back.

How do we reduce or avoid vibration? There are padded or gel-filled gloves for vibrating tools or machine controls. Good seat cushions and a proper seat shape with lumbar support can help to protect the lower back. Work scheduling needs to include breaks and recovery/rest periods to vary the posture and muscles used and break up the intervals of vibration exposure. Some new equipment designs have been able to damp out most or all vibration.

While we have been exploring these risk factors individually, the **interaction of these factors has recently been shown to increase risk dramatically**. The damage from the force used by our bodies -- to grip tools, lift objects, push/pull items -- can be multiplied in its extent by the risk factors of repetition, non-neutral postures, and/or vibration.

There are many ergonomic evaluation tools which can quantify these risk factors, but our simple, direct observations of a job can go a long way toward identifying problems so that they can be reduced or eliminated. Often the best ideas come from the shop floor as we learn to recognize these risk factors and propose solutions.

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