

# Repetitive Strain Injury (RSI)

## Review of proactive measures to reduce costs and future injury rates

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### ABSTRACT

According to the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), repetitive strain injuries are the nation's most common and costly occupational health problem, affecting hundreds of thousands of American workers, and costing more than \$20 billion a year in workers compensation. According to the U.S. Bureau of Labor Statistics, nearly two-thirds of all occupational illnesses reported, were caused by exposure to repeated trauma to workers' upper body (the wrist, elbow or shoulder). One common example of such an injury is carpal tunnel syndrome. Carpal tunnel syndrome is the most common nerve compression disorder of the upper extremity. This process affects one percent of the general population and five percent of the working population who must undergo repetitive use of their hands and wrists in daily living. Furthermore, surgical treatment for carpal tunnel syndrome is the most frequent surgery of the hand and wrist, with 463,637 carpal tunnel releases annually in the United States, accounting for \$1 billion in direct costs. Carpal tunnel syndrome results in the highest number of days lost among all work related injuries. Almost half of the carpal tunnel cases result in 31 days or more of work loss and ONLY 23% of all Carpal Tunnel Syndrome (CTS) patients returned to their previous professions following surgery, according to the Bureau of Labor & Statistics and the National Institute for Occupational Safety & Health.

One may wonder how seemingly innocuous activities such as typing and clicking a mouse button could possibly be harmful. Fine hand movements, repeated hour after hour, day after day, thousands upon thousands of times, eventually strain the muscles and tendons



of the forearms, wrists, and fingers, causing microscopic tears. Injured muscles tend to contract, decreasing the range of motion necessary for stress free work. The sheaths that cover delicate tendons run out of lubrication because they aren't given time to rest, so tendon and sheath chafe, resulting in pain. Due to this abrasion, tendons become inflamed, and begin to pinch neighboring nerves. This can result in numbness, tingling, or hypersensitivity to touch. Unless this cycle is interrupted, it repeats itself over and over, and a long-term, chronic problem results. Repetitive strain injury can affect more than just your hands and wrists. Poor posture can lead to severe neck and back injuries. Staring at a computer screen can lead to eye strain. Repetitive reaching for a mouse can lead to arm and neck strain as well as spinal asymmetry.

Repetitive strain injury or RSI, also known as repetitive stress injury, repetitive motion injuries, repetitive motion disorder (RMD), cumulative trauma disorder (CTD), occupational overuse syndrome, overuse syndrome, and regional musculoskeletal disorder is a range of painful or uncomfortable conditions of the muscles, tendons, nerves and other soft tissues. RSI is usually caused by repetitive use of a certain part of the body, often somewhere in the upper limbs (arms). Repetitive strain injury is typically related to an occupation (job), but may also be linked to some kinds of leisure activity. As opposed to a sudden or 'normal' injury, RSI signs and symptoms may continue for much longer. Experts say that repetitive strain injury is an injury of the musculoskeletal and nervous systems that may be the result of repetitive tasks, forceful exertions, vibrations, pressing against hard surfaces (mechanical compression), or sustained or awkward positions. Conditions such as RSI tend to be linked to both physical and psychosocial stressors.

### Causes

We know that often repetitive movements of a part of the body are linked to symptoms, but the precise reason for RSI is not clear. Neither do we know why some people develop RSI and others don't, when doing the same tasks for similar periods.

#### The following are seen as causes of RSI:

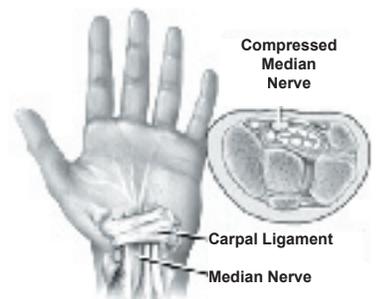
- The overuse of muscles in our hands, wrists, arms, shoulders, neck and back
- The area is affected by repeated actions, which are usually performed on a daily basis over a long period
- The repetitive actions are done in a cold place
- The individual has to use vibrating equipment
- Forceful movements are involved
- Workstations are poorly organized
- Equipment is badly designed
- The individual commonly adopts an awkward posture
- There are not enough rest breaks

### Symptoms

Signs and symptoms vary, depending on which part of the body is affected, and what caused the problem in the first place. Initially, symptoms may only occur when the individual is doing the repetitive task - they will slowly go away when the person rests. Eventually, though, symptoms may be present all the time (and worsen during the repetitive task) if left untreated.

#### The most common RSI signs and symptoms include:

- Tenderness in the affected muscle or joint
- Pain in the affected muscle or joint
- A throbbing (pulsating) sensation in the affected area
- Pins and needles (tingling) in the affected area, especially the hand or arm
- Loss of sensation in the hand
- Loss of strength in the hand
- Weakness, lack of endurance



In contrast to carpal tunnel syndrome, the symptoms tend to be diffuse and non-anatomical, crossing the distribution of nerves, tendons, etc. They tend not to be characteristic of any discrete pathological conditions.

#### Types of RSI:

Many health care professionals refer to RSI as ULD (upper limb disorder) because it frequently involves the forearm, elbow, wrist or hands. RSI often affects the neck as well.

#### Experts often refer to two main types of RSI:

**Type 1 RSI** - usually caused by repetitive tasks, but not always; some people who do not perform repetitive tasks may have Type 1 RSI. The muscles and tendons swell. *Examples of Type 1 RSI include:* Carpal tunnel syndrome, Tendinitis (tendonitis), Tenosynovitis.

**Type 2 RSI** - there is a feeling of pain but no obvious inflammation or swelling in the area where symptoms are felt. Often referred to as “when a person’s symptoms do not fit into one of the (above listed) conditions,” also called non-specific pain syndrome.

#### Examples of repetitive strain injuries:

**Bursitis** - happens when the bursa is inflamed. The bursa acts as a cushion between bones, tendons, joints and muscles - bursae are fluid-filled sacs (the plural of bursa is bursae). People with bursitis will feel pain at the site of inflammation.

**Carpal tunnel syndrome (CTS)** - caused by the compression of the median nerve through the carpal tunnel in the wrist area. When constricted, blood cannot flow freely through the hand to the fingers causing individuals with CTS to experience numbness and pain in the hand.

**Diffuse RSI** - conditions are where the patient complains of pain and yet, on examination by a health care professional, nothing physical can be found to be wrong.



**Dupuytren's contracture** - a condition that affects the hands and fingers.

It is an uncommon hand deformity in which the connective tissue under the skin of the palm contract and toughen over time. It causes one or more of the fingers on one or both hands to bend into the palm of the hand.

**Epicondylitis** - often occurs as a result of strenuous overuse of the muscles and tendons where the bone and tendon join. Tennis elbow and golfer's elbow are examples.

**Ganglion** - fluid-filled swellings that tend to form on top of joints or tendons in the wrists, hands, and feet. They have the appearance of firm or spongy sacs of liquid and their insides consist of a sticky, clear, thick, jelly-like fluid.

**Rotator cuff syndrome** - inflammation of tendons and muscles in the shoulder.

**Tendinitis** - also known as tendonitis, is the inflammation of a tendon.

**Tenosynovitis** - the sheath around the tendon becomes inflamed, specifically the inner lining of the tendon sheath.

**Trigger finger** - a condition in which one of your fingers or your thumb catches in a bent position. The tendon sheaths of the fingers or thumb become inflamed - the tendon is also inflamed.

**Nerve Entrapment Disorders** - repetitive work can cause pressure on the median nerve in locations other than the wrist and can also affect other nerves in the arm and hand. The branch of the median nerve that runs through the palm of the hand can be damaged directly by repeated pounding or by the use of certain tools requiring a strong grip using the palm, such as small pliers.

**Ulnar tunnel syndrome** - the ulnar nerve supplies sensation to the ring and little fingers. Like the median nerve, it too can become trapped as a result of repetitive stress, with subsequent loss of sensation in these fingers and the outer half of the palm.

#### Who is at risk?

The three primary risk factors are poor posture, poor technique, and overuse. In addition to these, there are several other risk factors to be aware of. While they may not cause RSI on their own, they can increase your risk if you already possess one of the three primary risk factors. Examples are: poor posture, poor technique, have a job that requires constant computer use, especially heavy input, you don't take frequent breaks, are loose-jointed, you don't exercise regularly, you work in a high-pressure environment, you have arthritis, diabetes, or another serious medical condition, you have an unhealthy, stressful, or sedentary lifestyle and if you don't sleep well.

#### What Tests Should Be Performed To Diagnose CTS or other Nerve entrapments from RSI?

Because carpal tunnel syndrome often affects a person's work and may also involve worker's compensation benefits, it is very important to achieve, if possible an accurate diagnosis for carpal tunnel syndrome.

#### Medical and Personal History

One of the first steps in a diagnosis of carpal tunnel syndrome is to evaluate the possible association between the disorder and the patient's job. The physician will also rule out any other medical conditions, such as arthritis or diabetes.

#### Physical Examination

During a physical examination, the doctor will perform simple maneuvers called provocative tests that help distinguish between CTS and other problems. In one test, the physician taps over the median nerve to produce a tingling or mild shock-sensation (called Tinel's sign). The patient may also be asked to try and reproduce CTS symptoms by using so-called wrist-flexion tests. In Phalen's test, the patient rests the elbows on a table and lets the wrists dangle with fingers pointing down and the backs of the hands pressed together (like backward praying). If symptoms develop within a minute, CTS is indicated. The physician may also test for muscle weakness by pressing on the thumb as the patient holds it and the little finger together.

#### Laboratory Tests

If the doctor suspects that an underlying medical condition may be exacerbating the symptoms, laboratory tests will be performed. The doctor may take an x-ray, for example, to check for arthritis or fractured bones.

#### Electro diagnostic Tests (EDX)

Carpal tunnel syndrome can be identified with some accuracy using simple physical and self-assessment tests along with a medical history and when similar medical conditions or underlying disorders have been ruled out. If, however, there is a history of pain, unusual symptoms, earlier fractures, or a need to confirm the diagnosis, then the doctor may arrange for electro diagnostic tests. There are two common types of electro diagnostic tests: nerve conduction studies and electromyography's. The tests analyze the electric waveforms of nerves and muscles to detect median nerve compression in the carpal tunnel. Both tests are

fairly accurate and can detect a high percentage of people who have carpal tunnel syndrome, and eliminate 95% of cases that are not true carpal tunnel syndrome. They can also detect causes of symptoms that mimic CTS but should be attributed to other problems, such as pinched nerves in the neck or elbow or thoracic outlet syndrome. Ruling out other causes is extremely important in order to avoid unnecessary surgery for CTS. This type of testing is performed in many physician offices across the country. Such tests are growing in their utilization across the United States. One company that is helping expand the application and utilization of electro diagnostic testing is Rehab Management Group, or RMG ([www.RMGRehab.com](http://www.RMGRehab.com)).

According the RMG's Medical Director, Dr. Mark Lee, RMG focuses on 3 elements to make the electro diagnostic testing more accurate and successful: ***"First, we train the physicians and staff on how to properly order, perform and interpret these types of test. Then we ensure there is quality control of every test performed done, and finally a test over read is performed by Board certified and licensed Neurologists or Psychiatrists with extensive experience in this area."***

#### Did you know...

RSI is also used as an alternative or an umbrella term for other non-specific illnesses or general terms defined in part by unverifiable pathology such as reflex sympathetic dystrophy syndrome (RSDS), Blackberry thumb, disputed thoracic outlet syndrome, radial tunnel syndrome, "gamers' thumb" (a slight swelling of the thumb caused by excessive use of a gamepad), "Rubik's wrist" or "cuber's thumb" (tendinitis, carpal tunnel syndrome, or other ailments associated with repetitive use of a Rubik's Cube for speed cubing), "stylus finger" (swelling of the hand caused by repetitive use of mobile devices and mobile device testing.), "raver's wrist", caused by repeated rotation of the hands for many hours (for example holding glow sticks during a rave).



#### Treatment

On their own, most RSIs will resolve spontaneously provided the area is first given enough rest and then exercised (mildly at first, then more vigorously). However, without such care, some RSIs have been known to persist for years. The most often prescribed treatments for repetitive strain injuries are rest, exercise, braces and massage.

Below is a list of conservative treatment techniques that are being utilized for Repetitive Strain Injuries:

**Rest** the Affected Area. This is often the first recommendation. Moving the affected area is important, but avoid stressing the joint. In conservation, this is often not practical without taking time-off from work. Too much inactivity can cause atrophy of muscles and increase the severity of the disorder.

**Stretching** Routines are implemented to help reduce hypertonic muscles and increase their flexibility and dexterity.

**Splinting** and Analgesics may help "mask" symptoms for a while, but unless the "real" cause of dysfunction is eliminated, the symptoms come right back. The long-term success rate of Splints and Anti-Inflammatory

Medications is extremely low. Wrist **Braces** and Splints are not effective in treating carpal tunnel syndrome and repetitive strain injuries, but can assist if worn during nighttime only. These devices are meant to keep the wrist from dropping into flexion so that the wrist stays in the straight, neutral position in order to reduce impingement of the carpal tunnel. But instead, wrist braces often increase the symptoms of carpal tunnel syndrome and repetitive strain injuries, especially if worn during the daytime.

**Squeezing and Gripping Devices** tout themselves as the cure-all for Carpal Tunnel Syndrome and Repetitive Strain Injuries, but they exercise and strengthen the flexor muscle group that is commonly already overdeveloped from performing repetitive and static flexion activities that require "closing" of the hand. Using gripping and squeezing devices duplicate the exact same motion that caused the muscle imbalance, and will only continue to increase the strength and rigidity of the flexor muscles; exacerbating the injury even further.

**Vitamin B6 Therapy** can help increase the health of damaged nerves, although it does not correct the real cause of dysfunction; which is a "muscle imbalance" between the stronger, shorter and tighter flexor muscles that "close" the hand and the weak, underdeveloped extensor muscles that "open" the hand. The tight, restrictive flexor muscles compress/impinge the underlying nerve(s) blood vessels, causing the nerve "signal" to travel at a much slower speed. If the muscle imbalance is treated/corrected, nerve conduction/velocity is normal and the symptoms disappear.

**Anti-Inflammatory Medications** to reduce swelling and relieve pressure on the median nerve, but again do not correct the underlying cause of dysfunction. (Extended use of Anti-inflammatory medications often leads to irritation of the stomach lining.) Steroid Injections into the wrist may be prescribed, but are usually painful and not effective. Steroid injections cause the tendons to develop a "rubber-like" consistency, which can easily be damaged further (Usually due to being overstretched), if the individual continues to perform the same tasks that caused the original injury. If steroid injections are utilized, the injury needs to be immediately addressed / corrected through a conservative physical therapy program utilizing stretching and strengthening techniques. (This form of treatment is suggested for all areas of injury.)

**Contrast Baths** (Hot/Cold) (contrast baths) are often recommended by a physical or occupational therapist. Typical treatment protocol is approximately three (3) minutes of heat followed by one (1) minute of cold alternating 3x, ending in cold. Heat alone is not recommended.

**Ultrasound** is okay if used in conjunction with a treatment program that includes soft-tissue work, stretching of the flexor muscle group, and the strengthening of the extensor muscle group. Ultrasound can help reduce inflammation in an acute case of tendonitis, carpal tunnel syndrome, or other form of injury, but does no good when used alone.

**Massage** is good to have the flexor muscles massaged and stretched-out, but unless followed immediately with strengthening exercises for the extensor muscles that extend the fingers, elbow and wrist, and the abductor muscles of the fingers, it will have little effect on correcting the muscle imbalance that causes carpal tunnel syndrome and repetitive strain injuries.

**Extension Exercise Devices:** There are a number of extension exercise devices on the market that almost provide the correct motion in order to treat the dysfunction of Carpal Tunnel Syndrome and Repetitive Strain Injuries. But they all fail in providing the correct biomechanical hand, wrist and elbow movements, and varied resistance levels that will result in the successful treatment of these injuries.



### Ten easy ways to reduce your risk of developing RSI

- TAKE BREAKS when using your computer. Every hour or so, get up and walk around, get a drink of water, stretch whatever muscles are tight, and look out the window at a far off object (to rest your eyes). As explained in above.
- Use good posture. If you can't hold good posture, it probably means it's time for you to take a break from typing. If you are perpetually struggling to maintain good posture, you probably need to adjust your workstation or chair, or develop some of the support muscles necessary for good posture.
- Use an ergonomically optimized workstation to reduce strain on your body.
- Exercise regularly. Include strengthening, stretching, and aerobic exercises. I find yoga and Pilates especially helpful.
- Only use the computer as much as you have to. Don't email people when you could walk down the hall or pick up the phone and talk to them. It's not only better for your hands - it's friendlier. Think before you type to avoid unnecessary editing.
- Don't stretch for the hard-to-reach keys, e.g. BACKSPACE, ENTER, SHIFT, and CONTROL... basically everything but the letters. Instead, move your entire hand so that you may press the desired key with ease. This is crucial when you are programming or typing something in LaTeX, where non-letter keys are used extensively.
- Let your hands float above the keyboard when you type, and move your entire arm when moving your mouse or typing hard-to-reach keys, keeping the wrist joint straight at all times. This lets the big muscles in your arm, shoulder, and back do most of the work, instead of the smaller, weaker, and more vulnerable muscles in your hand and wrist. If you find it difficult to do this, then your shoulder and back muscles are probably too weak. It is OK, and in fact a good idea, to rest your elbows/wrists when you are not typing.
- Use two hands to type combination key strokes, such as those involving the SHIFT and CONTROL keys.
- When writing, avoid gripping the writing utensil tightly. Someone should be able to easily pull the writing utensil out of your hand when you are writing. If your pen or pencil requires you to press too hard, get a new one (my favorite is Dr. Grip Gel Ink)
- In general, your doctor/therapist should prescribe treatment that focuses on the cause of your symptoms, rather than the symptoms themselves. In other words, the treatment should not be focused on pain management, although that may be one aspect. Rather, it should be focused on correcting your posture, and improving your anatomical function, so that, with time, your body will heal itself. Treatment should typically consist of visits to a physical therapist, coupled with a home exercise program. The focus of this program is to stretch overly tight muscles, and strengthen weak ones. Remember however, that no amount of physical therapy and strengthening/stretching can overcome excessive typing, poor posture, a bad workstation, or poor typing technique.

### In Conclusion

RSI and CTS are both common and painful conditions that are on the rise. This increase is most likely with the advent of our usage of technology assisted devices such as mobile computers and pads, cellular devices and texting. Understanding how to control your exposure and how to ultimately treat and diagnose is important and critical in recovery. Choosing your right partner in physical therapy and of course the right physician is also an integral part of the care process.

*The information noted above is a summary of one of the components of Fit2WRK by USPh. This integrated model is available through USPh in close to 400 facilities and 44 states nationally. For additional information on how the Fit2WRK Model could help your organization, visit; [www.Fit2WRK.com](http://www.Fit2WRK.com) or call 1-877-Fit-2WRK.*

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