New opinions are always suspected, and usually opposed, without any other reason but because they are not already common.


To catch RSI before it becomes a more serious or debilitating illness, it is important to recognize its early signs. There are many risk factors, and every worker should know them. If you understand what happens to the soft tissues as posture deteriorates, you have come a long way toward understanding RSI.

This disorder is insidious—it creeps up on you over a period of weeks, months, or even years. Often patients only recall the day they couldn’t take the pain anymore or couldn’t continue to work. The process is like a dam that slowly fills with water and then suddenly overflows. In a survey of nearly five hundred of my patients, the most common early signs of RSI were aching or pain in the forearms or hands, numbness and tingling in the hands, weakness in the arms, and spasms or twitching in the forearms. The physician evaluating a person with RSI needs to get a detailed history to assess these symptoms.
Repetitive strain injury is not a diagnosis, but a term used to describe a very complicated, many-faceted soft tissue problem. One reason why RSI is so complicated is that the pain or symptom site is not necessarily where the problem lies. You need a complete physical examination to find out the true cause of the problem.

When you see hundreds of patients, it becomes easier to understand how the many combinations of factors can come together to create RSI. Still, your symptoms may be unique, and unless you get a thorough examination, your physician may not find the cause of your RSI. Without knowing the cause, there can be no effective treatment.

Just as a combination of numbers in the right order is necessary to unlock a safe, so the successful combination in RSI requires the right procedures in the right order. This usually means a complete physical exam, biomechanical and ergonomic intervention, a prescribed treatment program of physical or occupational therapy including a home exercise program, and psychological intervention when needed.

This book devotes a chapter to each of these topics, and our goal is to give you enough information to enable you to get the treatment you need. Essentially, RSI is the result of stress, strain, overuse, and overloading of soft tissues, causing one muscle group to work against another. Sometimes, quirks or anomalies in your anatomy can make you more likely to get injured. How these combine to cause RSI is most easily grasped by beginning with the body’s anatomy.

**Basic Anatomy**

Below are brief descriptions of the most important terms in anatomy that you will come across when you begin seeking help for RSI. Take the time to read this and you will become knowledgeable enough to discuss soft tissue injury with any health professional. Any term not defined here will be found in chapter 2 or the glossary.
The Skeletal System

The skeletal system is the framework that supports the soft tissues. Usually the skeletal system is not directly affected in RSI, with the exception of its most severe complication, late stage reflex sympathetic dystrophy/complex regional pain syndrome.

Figure 1. The skeletal system of the upper extremity, the framework that supports the soft tissues.
(RSD/CRPS), where bones lose calcium. The ravages of time, arthritis, or injuries to the skeletal system can also make RSI worse.

The Spinal Column

The spinal column has thirty-three individual vertebrae separated by cushioning discs, and it divides into five sections. The upper three sections are movable, while the lower two are fixed. The upper vertebrae connect with one another to form a strong, movable pillar for the support of the head, neck, and trunk. Vertebrae also form a protective ring through which the spinal cord travels to and from the brain. The side arches of two adjacent vertebrae form tunnels (foramina) through which nerves from the spinal cord exit and travel to all parts of the body and return from peripheral sites. If a foramen is partly closed because of injury or arthritic changes, it can squeeze the nerve fiber, causing dysfunction of that nerve. With a slipped disc, the same type of
compression occurs where the nerve exits or enters the spinal column. These types of injury are called radiculopathy.

Nerve compression occurs in RSI, usually because of poor posture. After the nerves leave the spinal column they can get caught between tight muscles. This can happen in three areas: in muscles of the neck (scalene muscles), in a space between the collarbone and your first rib, or in a tight space under the smaller pectoral (chest) muscle. When this occurs it is called neurogenic thoracic outlet syndrome (TOS) or brachial plexopathy.

The Shoulder, Back, Neck, and Upper Arm

Your shoulder is the hub around which your arm and hand move. The upper arm bone (humerus), as it rotates in the shoul-

![Figure 3. The main musculature of the shoulder and back. The shoulder is the hub around which the arm and hand move.](image)
der socket, forms the most mobile joint in your body. Usually, if posture is poor, the shoulder joint doesn’t function properly. When normal shoulder use is lost, the forearm and hand must do more work. Impaired shoulder movement is common in RSI and is a major contributor to symptoms.

The Forearm and the Elbow

As you can see in figure 4, the upper arm and the forearm meet to form the elbow joint. The elbow joint flexes, extends, or rotates the forearm palm up (supination) or palm down (pronation). Repetitive movement can irritate the ulnar nerve at several

Figure 4. Supination and pronation are mainly a function of the elbow, although supination is also controlled by the biceps when the arm is extended.
points, as it runs from the spinal column through the neck muscles, under the collarbone, then over the first rib and under the small pectoral muscle. The nerve then passes through a bony notch at the elbow joint on its way to the hand. The ulnar nerve normally glides or moves in the neck area. If the nerve is pinched at the neck due to poor posture and tight muscles, then it loses its ability to glide and is pulled tightly through the elbow, causing traction and nerve damage. Think of the ulnar nerve as a long rubber band that is caught and stretched at the neck and that must stretch even tighter as you bend your elbow. This overstretching or traction is called cubital tunnel syndrome. The ulnar nerve can also be caught at the wrist, where it is called ulnar tunnel syndrome.

A less frequent injury, radial tunnel syndrome, happens when another nerve in the arm, the radial nerve, passes by the elbow, then through muscles and ligaments, where it can get compressed. The main difference between these syndromes is that cubital tunnel syndrome happens when the ulnar nerve passes and is stretched around bone, while radial tunnel syndrome happens when the radial nerve passes through tight soft tissue and is squeezed.

The third major nerve in the arm is the median nerve, which can be compressed at the carpal tunnel in the wrist, causing carpal tunnel syndrome. This same nerve can also be compressed by muscles below the elbow and is then called pronator muscle syndrome, which can be mistaken for carpal tunnel syndrome.

The Wrist

The wrist is a complex structure, and a stable and mobile wrist is important for normal use. Fractures, dislocations, or tears of the ligaments of the wrist bones can lead to instability and pain. So can osteoarthritis of the wrist joints. In patients with RSI, wrist mobility is often impaired because the forearm muscles contract and tighten due to injury.

On the palm side of the wrist, there are nine wrist flexor tendons, which must pass through the same tight carpal tunnel as the
Figure 5. The wrist is a complex structure consisting of an intricate relationship between the forearm and the hand.

Figure 6. The transverse carpal ligament acts as a pulley guiding the nine flexor tendons of the fingers. The median nerve travels through the same space, making it vulnerable to the injury seen in carpal tunnel syndrome.
median nerve. The combination of shortened muscles in the fore-
arm and tightened tendons at the wrist can cause friction, leading
to inflammation, pain and swelling, and carpal tunnel syndrome.

Lying next to the carpal tunnel along the fifth finger side of
the wrist is the ulnar tunnel (Guyon's canal). The ulnar nerve
can be pinched as it passes by a hooklike bump on the hamate
bone of the wrist. This is called *ulnar tunnel syndrome*.

**Nerves**

Nerves play an important role in RSI because it is the nerves that
get trapped or pulled in the injured soft tissues, causing pain, the
most common symptom of RSI. Nerves carry pain messages
from the site of tissue damage to the brain and have a critical role
in muscle regeneration. In the most serious injuries of reflex
sympathetic dystrophy/complex regional pain syndrome
(RSD/CRPS), the sympathetic branch of the involuntary nerv-
ous system, which regulates basic body functions, triggers severe
symptoms of pain, temperature and skin color change, swelling,
and sweating. And, of course, all this affects motor function.

**Muscles**

Muscles are the engines that drive all of the movements in the
body. For muscles to do their job, they must be well supplied with
nutrients and must be connected to functioning nerves. Good per-
formance requires that muscle attachments to tendons, ligaments,
and bones are intact and that the joints they move are in good
condition. Muscles that are not in balance with other muscles can
instigate events that can cause damage to soft tissues. The cas-
cading factors in postural deterioration damage nerves, other soft
tissues, and ultimately many other muscles of the body.

**Tendons and Ligaments**

Tendons are attached between muscle and bone and carry
the movement of the muscle to the bone. Tendons are dynamic
structures with a rich supply of nerves that permit you to perceive the degree of tension when you move. This perception of tension is called proprioception. Tendons also have specific blood supplies, which can vary in different areas of the tendon. The areas with less blood supply are more likely to be injured when subjected to sustained, repetitive forces.

The term ligament implies that things are tied together, and ligaments do in fact tie muscle to bone, bone to bone, and bone to other soft tissue. But ligaments are also dynamic structures that play an active role in maintaining joint stability and sending signals to the brain regarding their status, another example of proprioception. Ligaments control the limits of joint movements and prohibit exaggerated ones.

**Anomalies or Quirks of the Body**

Anomalies or quirks are anatomical structures that are not typical in most people. In RSI they cause difficulty by disturbing normal nerve function or making body movement inefficient. The quirk usually known as double-jointedness is one of these. Double-jointedness can be found in the elbow, hands, and fingers, making retraining and therapy more difficult because of the lack of stability in these joints. Double-jointedness is more common in women. People who are double-jointed have to work harder

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**Figure 7.** Hyperlaxity, or double-jointedness, in the fingers, makes it more difficult to stabilize the hand while working.
to keep their finger joints stable and curved over their keyboard. Scalene bands are another anomaly. These are fibrous bands formed between the scalene muscles in the neck. They are only detectable during surgery and are thought to occur in up to 60 percent of the general population. When these bands are present, they create bridges of tissue over which the nerves are stretched and irritated, causing them to stick and not glide as necessary. Thoracic outlet syndrome (TOS), a major problem in RSI, can be caused by these bands.

Anatomy Is Not Always Destiny

There is a saying in medicine that “Anatomy is destiny.” In RSI, most anatomical problems can be adequately treated by correcting imbalances in the soft tissues and working around anomalies. With a proper approach to treatment, most of these imbalances are reversible. Steadfast attention to postural retraining, physical and occupational therapy, lifestyle changes, ergonomic and biomechanical modification, and a personal commitment to home exercise programs have proved very effective in my patients.
When the problem is severe and long-term, some soft tissue injuries may be irreversible. When there is severe damage to tissues, healing may never be complete because of scarring, impairment of circulation, or nerve injury. The sooner RSI is diagnosed and treated, the quicker and more complete the comeback. Surgery should be the last resort in most cases.

The Most Frequent Symptoms of RSI

Here are the most common symptoms found in 485 of my patients. Some of the subjects had multiple simultaneous symptoms.

- Pain, aching, “spasm” in extremities: 329 (68 percent)
- Hand and finger numbness: 55 (11 percent)
- Weakness and fatigue: 44 (9 percent)
- Tenderness/swelling/inflammation: 43 (9 percent)
- Tingling in the fingers: 42 (9 percent)
- Tightness/stiffness/rigidity of upper body and neck: 34 (7 percent)
- Loss of motor control: 5 (1 percent)

What Your Examination Is Likely to Reveal

Typically, there are several findings for any patient with complaints related to RSI. We’ll list the most common here.

Poor Posture

By far the most frequent physical finding in RSI is a characteristic postural misalignment. Typically the head, which weighs
about 10 pounds (as much as a bowling ball), is thrust or cantilevered forward and stretches and weakens the upper back and neck muscles, which in turn react by going into a chronic state of contraction. Changes occur in the upper back muscles as they attempt to compensate for this added, constant burden. This cascades into the shoulders, which become hunched and pulled forward. Other muscles in the front of the body such as the scalenes, sternocleidomastoids, and pectoralis minors react by shortening, which sets the stage for nerve damage.

**Thoracic Outlet Syndrome**

The next most common physical finding is neurogenic thoracic outlet syndrome (TOS). Some people argue that it is more anatomically correct to call it thoracic inlet syndrome (TIS), but we’ll stick to the more common term to avoid confusion. As the nerves emerge from the spinal column, they combine into networks. Poor posture causes a soft tissue obstacle as the nerves go through the shortened and tightened scalene muscles. These muscles act like a pair of pincers, squeezing the nerves and causing numbness, tingling, and weakness. This diminishes the ability of the muscles in the extremities to recuperate. In RSI there is a continuing cycle of poor posture leading to nerve damage, which leads to even worse posture and further nerve and muscle compromise. If you understand this process, then you understand how RSI can cascade from minor aches and pains to a totally disabling syndrome. To reverse the process—and it can be reversed for most people—requires your dedication and that of your therapist or therapists.

**Reflex Sympathetic Dysfunction**

The nerve traction injury of TOS can also involve the sympathetic nerves (involuntary nerves) of the upper body, because the sympathetic nerves become part of this network of nerves in its lower portion near the collarbone. Sympathetic nerve fibers
automatically control glands, blood vessels, and smooth muscles. The sympathetic nervous system is part of the autonomic nervous system and therefore is not under our conscious control. Patients’ hands are cold and sometimes sweaty, and their perception of pain is usually very high. This condition is called reflex sympathetic dysfunction. Rapid intervention is important, because these patients are nearing the more serious complication known as reflex sympathetic dystrophy/complex regional pain syndrome (RSD/CRPS). See chapters 2 and 5 for more on this.

Loss of Shoulder Range of Motion

The shoulder is the most mobile joint in the body. Many of my patients have evidence of shoulder range of motion impairment, which is related to postural misalignment. This restricted shoulder movement becomes painful when extreme movements are attempted. Correcting these conditions is critical because performing activities with limited shoulder movement shifts the workload to the more delicate forearm and hand muscles. Bicipital tendinitis occurs when the tendons of the biceps muscle become irritated in a groove at the shoulder. Postural misalignment is usually associated with this condition.

Cubital Tunnel Syndrome

Cubital tunnel syndrome is far more common than carpal tunnel syndrome. As we follow the ulnar nerve down the arm to the elbow from the neck, we come to an area where the ulnar nerve must pass over a bony cleft or notch at the elbow, which is covered by an arched ligament, creating a tunnel (the cubital tunnel). If the compression at the elbow persists even for just a few months, it can cause a painful condition known as tardy ulnar nerve palsy.

Carpal Tunnel Syndrome

The median nerve runs from the elbow down to the wrist, where it encounters another anatomic tunnel made up of bone
and an all-important inelastic roof called the *transverse carpal ligament*. The heavy traffic through this tunnel consists of nine tendons, blood vessels, and the median nerve, which at this point supplies the thumb, index, and middle finger. The transverse carpal ligament (roof) acts like a pulley against which the tendons glide or rub as they move to curl the fingers. The symptoms of carpal tunnel syndrome include sensory complaints such as night pain or numbness and tingling in the first three fingers of the hand. Grasping and pinching are sometimes difficult.

**Radial Tunnel Syndrome**

Radial tunnel syndrome, also called supinator syndrome, is most likely the result of traction and compression of the radial nerve as it enters a tight canal near the elbow. Basically, the nerve gets caught between two layers of the supinator muscle on its way to the hand. This can result in deep forearm pain followed by gradual fist weakness. This same area is affected in tennis elbow.

**Medial Epicondylitis (Golfer’s Elbow)**

The most common form of tendinitis in persons with RSI is often called golfer’s elbow. The *medial epicondyle* is the bony bump at the elbow, where the tendons of the pronator muscles attach. Repetitive pulling on the tendon insertion (where the tendon enters bone) by a damaged or contracted muscle causes inflammation and results in extreme tenderness when pressure is applied.

**Lateral Epicondylitis (Tennis Elbow)**

Slightly less common than medial epicondylitis in persons with RSI, lateral epicondylitis has similar origins. It occurs in persons who pursue activities with their wrists extended, such as typists, tennis players, and guitarists. Excessive pull at the lateral epicondyle bony bump by tendons can cause inflammation and pain. About 30 percent of the time, tennis elbow and radial
tunnel syndrome occur simultaneously, leading some health professionals to call it resistant tennis elbow. When radial tunnel syndrome occurs alone, it can be mistaken for tennis elbow. Only thorough clinical evaluation can clear this up.

DeQuervain’s Tenosynovitis

This is a form of tendinitis of the muscles that move the thumb. As the thumb changes direction in use, it can irritate the tendons as they pass through their sheaths, causing inflammation and pain. People who continually lift one thumb to accommodate the

![Figure 9. DeQuervain’s disease. DeQuervain’s disease is a tenosynovitis at the base of the thumb that affects the abductor pollicis longus and the extensor pollicis brevis. It is characterized by the inflammation, thickening, and tenderness of these tendons and their sheaths.](c01.qxd 4/5/04 10:40 AM Page 24)
other thumb’s use of the space bar, who hit the space bar too forcefully, or who grip their mouse too tightly are at risk for DeQuervain’s tenosynovitis.

Myofascial Pain Syndrome

When muscles are injured, they release chemicals that stimulate nerve fibers, causing pain, soreness, and contraction in the hands, forearms, neck, and upper back. With more severe injury, swelling and inflammation occur. Myofascial pain syndrome is a common finding in people with RSI.

Now you have a broad picture of the typical findings in RSI. The next chapter discusses how to help your physician get the diagnosis right.