Conservative Management of Carpal Tunnel Syndrome

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Abstract

Carpal tunnel syndrome is the result of many small lesions summating into a median nerve neuropathy. The cervical spine is involved at the root level requiring chiropractic adjustments of the spinal column. Muscles and fascia contribute to the pathology in the form of peripheral nerve entrapments caused by scar tissue and adhesions that can be reduced by soft tissue therapies such as Graston technique and Active Release Technique. At the distal point of the extremity the carpal tunnel itself must evaluated for subluxation of the carpals compromising the carpal arch and integrity of the supporting ligaments that maintain the arch. The subluxated carpals can be adjusted by the chiropractor and the ligaments can become functional with proper taping and support. Lastly the patient can nutritionally support the body with an anti-inflammatory diet.

Indexing terms;

Carpal tunnel syndrome, Median nerve neuropathy, Chiropractic, Peripheral nerve entrapments, Subluxation, Carpal arch, Repetitive Stress Injuries, Cumulative trauma disorders, Overuse injuries

[i]CONSERVATIVE TREATMENT AND MANAGEMENT OF CARPAL TUNNEL SYNDROME

Introduction

This paper will outline and discuss the prevalent issue of carpal tunnel syndrome and how it can be dealt with conservatively such as in a chiropractor's office. Several topics will be discussed in this paper including the prevalence of carpal tunnel syndrome, the effect of carpal tunnel on the activities of daily living for those afflicted with carpal tunnel syndrome, the role of a chiropractor in society, the anatomy of carpal tunnel syndrome and how a chiropractor treats carpal tunnel syndrome.

What is Carpal Tunnel Syndrome?

The carpal tunnel is a passageway that runs from the forearm through the wrist. Bones form three walls of the tunnel and a strong, broad ligament bridges over them. The median nerve, which supplies feeling to the thumb, index, and ring fingers, and the nine tendons that flex the fingers, passes through this tunnel. This nerve also provides function for the muscles at the base of the thumb (the thenar muscles). Usually, carpal tunnel syndrome (CTS) is considered an inflammatory disorder caused by repetitive stress, physical injury, or other conditions that cause the tissues around the median nerve to become swollen. It occurs either when the protective lining of the tendons within the carpal tunnel become inflamed and swell or when the ligament that forms the roof becomes thicker and broader. Compression on the median nerve fibers by the swollen tendons and thickened ligament slows down the transmission of nerve signals through the carpal tunnel. The result is pain, numbness, and tingling in the wrist, hand, and fingers (except the little finger, which is not affected by the median nerve).

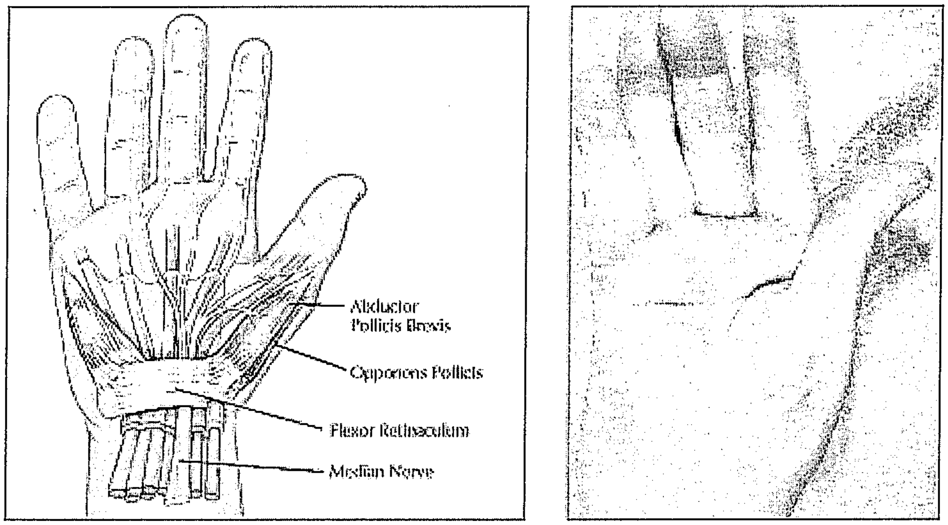


Figure 1. The carpal tunnel is a deep groove on the palmar surface of the carpal bones, underneath the flexor retinaculum. Through it pass the long flexor tendons and the median nerve; the latter supplies the muscles of the thenar eminence and the shaded area of cutaneous sensation shown on the left. The hand on the right has palmar erythema and atrophy of the abductor pollicis brevis and opponens pollicis caused by median nerve compression.

Prevalence

Carpal Tunnel Syndrome used to be reserved to waitresses and other occupations that required the worker to maintain an extended wrist position. Today Carpal tunnel syndrome is present with athletes such as tennis players, golfers, and lacrosse players. Hairdressers are prone to the repetitive stress nature of Carpal tunnel syndrome, as are machinists and assembly line workers. It is rampantly seen in the computer industry.

Santa Barbara, CA (PRWEB) January 18, 2005 -- As our reliance on computers increases, Repetitive Strain Injuries (RSI) such as Carpel Tunnel Syndrome (CTS) are hitting epidemic proportions. More than 28 million Americans use computers each day and, according to officials at the Occupational Safety and Health Administration, (OSHA) many risk coming down with carpal tunnel syndrome, the painful, debilitating condition that is the number one disability reported by insurance companies today

Worker's compensation states RSI such as carpal tunnel syndrome represents 62 percent of all North American WC claims and results in nearly $15-20 billion in lost work time and Workers Compensation claims each year, reports OSHA. The United States Department of Labor states that carpal tunnel syndrome was the "chief occupational hazard of the '90's - disabling workers in epidemic proportions."

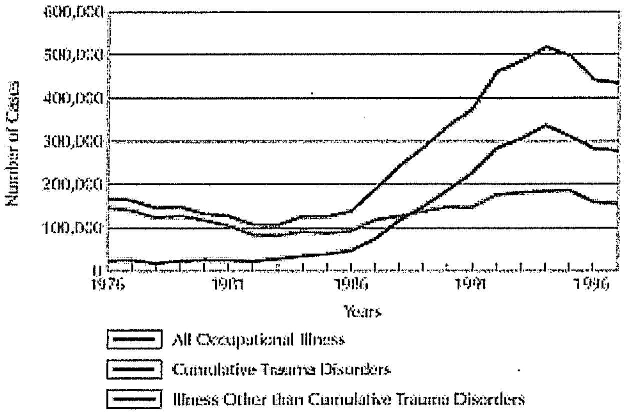


Figure 3. After the U.S. Occupational Safety and Health Administration required that repetitive motion disorders be reported, the recorded incidence of cumulative trauma dis- orders in private industry skyrocketed, from fewer than 50,000 cases in 1985 to 332,000 in 1994, followed by a decrease to 277,000 cases in 1997. This type of injury was largely responsible for the overall increase in occupational illness. (Source: U.S. Department of Labor)

Symptoms of Carpal Tunnel Syndrome

Symptoms usually start gradually, with frequent burning, tingling, or itching numbness in the palm of the hand and the fingers, especially the thumb and the index and middle fingers. Some carpal tunnel sufferers say their fingers feel useless and swollen, even though little or no swelling is apparent. The symptoms often first appear in one or both hands during the night, since many people sleep with flexed wrists. A person with carpal tunnel syndrome may wake up feeling the need to "shake out" the hand or wrist. As symptoms worsen, people might feel tingling during the day. Decreased grip strength may make it difficult to form a fist, grasp small objects, or perform other manual tasks. In chronic and/or untreated cases, the muscles at the base of the thumb may waste away. Some people are unable to tell between hot and cold by touch.

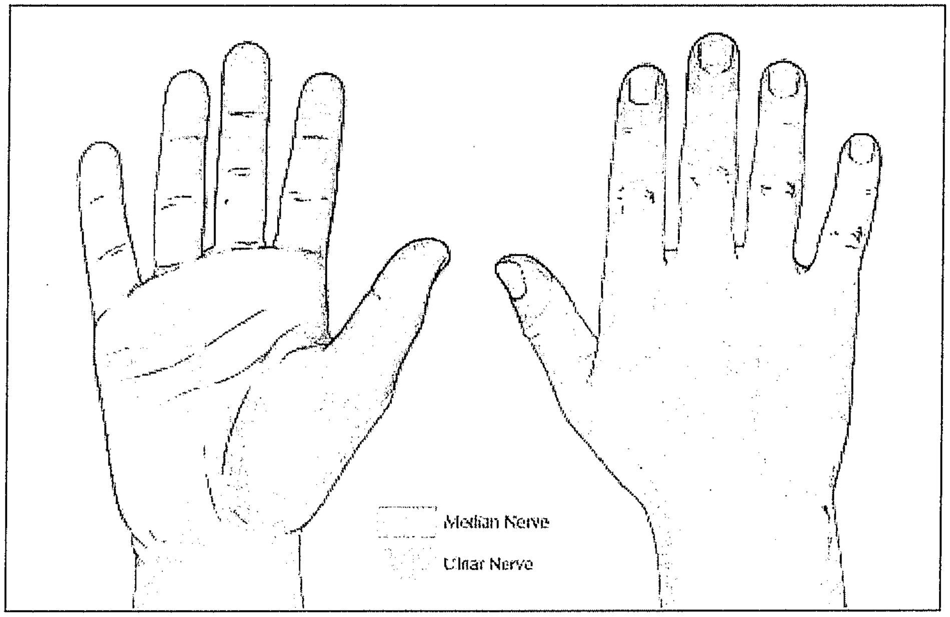
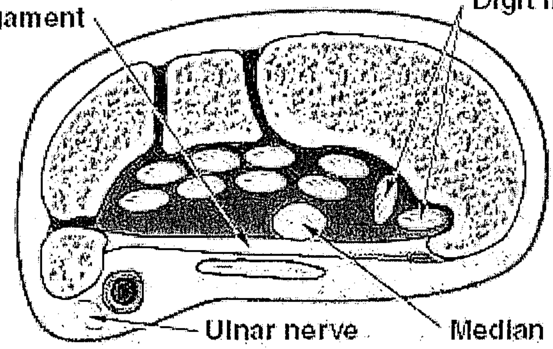


Figure 2. In most patients with carpal tunnel syndrome, pain and paresthesias are limited to the area supplied by the median nerve. Some patients also have signs of ulnar nerve compression, but widespread involvement of the hand suggests the presence of a metabolic derangement or inflammatory process (e.g., rheumatoid arthritis).

Chiropractors

Chiropractors are doctors that specialize in conditions affecting the nerves, joints, muscles, tendons and ligaments. A chiropractor will use an adjustment, soft tissue therapy, nutrition, and sometimes acupuncture (depending on credentials) to reduce inflammation and pain. The purpose of chiropractic is multifold. The chiropractor assesses biomechanical dysfunction, assesses neurological dysfunction, and educates the public on the health and maintenance of the human frame. The chiropractor solves patient problems and addresses an opportunity to guide the public in its own health management.

The chiropractor determines where biomechanical dysfunction is in the body, restores normal biomechanics, and teaches the patient to minimize the factors that contribute to their biomechanical problems.



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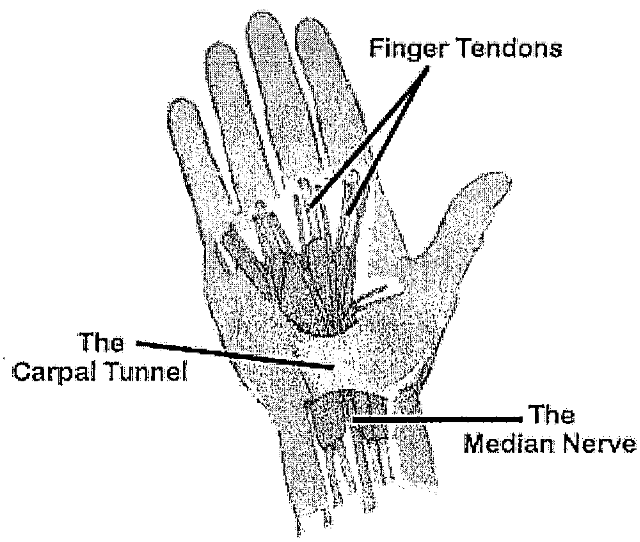
A chiropractor may also use the adjustment, the most powerful form of nerve stimulation, to create input into the nervous system and stimulate areas weak in the brain, much the same way a bodybuilder stimulates his muscles to grow with exercises. By addressing neurological disorders in this manner a chiropractor may correct deficient areas of the brain and thereby correct balance disorders and movement disorders experienced by many patients. Chiropractic neurologists have also helped many patients with carpal tunnel syndrome overcome their symptoms when they were brain-based lesions.

Chiropractors are unique in that they take a natural, comprehensive approach to addressing the biomechanical; biochemical, and neurological factors creating symptoms that cause patients to seek them out.

Who's at risk?

Women are three times more likely than men to develop carpal tunnel syndrome, perhaps because the carpal tunnel itself may be smaller in women than in men. The dominant hand is usually affected first and produces the most severe pain. Persons with diabetes or other metabolic disorders that directly affect the body's nerves and make them more susceptible to compression are also at high risk. Carpal tunnel syndrome usually occurs only in adults.



The risk of developing carpal tunnel syndrome is not confined to people in a single industry or job, but is especially common in those performing assembly line work - manufacturing, sewing, finishing, cleaning, and meat, poultry, or fish packing. In fact, carpal tunnel syndrome is three times more common among assemblers than among data-entry personnel. A 2001 study by the Mayo Clinic found heavy computer use (up to 7 hours a day) did not increase a person's risk of developing carpal tunnel syndrome.

During 1998, an estimated three of every 10,000 workers lost time from work because of carpal tunnel syndrome. Half of these workers missed more than 10 days of work. The average lifetime cost of carpal tunnel syndrome, including medical bills and lost time from work, is estimated to be about $30,000 for each injured worker.

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As discussed in the introduction there are several muscles that contribute to carpal tunnel syndrome. Due to the cumulative nature of carpal tunnel syndrome the muscles of the proximal arm must be examined as well.

Muscles of the forearm

For the purpose of functional anatomy this article will describe the extrinsic muscles of the forearm using a "functional" terminology proposed by Lame in 1951 that is more practical and meaningful. The palmer group consisting of flexor carpi radialis, flexor carpi ulnaris, flexor digitorum sublimis, flexor digitorum profundus, pronator teres and quadratus will be refered to as the "flexor pronator group". The dorsal group consisting of extensor carpi radialis longus, extensor carpi radialis brevis, extensor digitorum communis, indicis proprius, digiti quinti proprius, extensor pollicis brevis and extensor pollicis longus, abductor pollicis longus, and supinator will be referred to as "extensor assistant supinator".

Due to the widespread recognition and respect held by Gray's Anatomy it has been said that "Gray's Anatomy leads the field in anatomic description, both for medical professionals, who still refer to it, and for laymen who use it as art, information, and an aid to understanding their bodies." Therefore all anatomy references have been obtained from Gray's Anatomy 39th edition.

"Flexor pronator group"

The **Flexor carpi radialis** lies on the medial side of the Pronator Teres muscle. It arises from the medial epicondyle by the common tendon; from the fascia of the forearm; and from the intermuscular septa between it and the Pronator teres laterally, the Palmaris longus medially, and the Flexor digitorum sublimis beneath. Slender and aponeurotic in structure at its commencement, it increases in size, and ends in a tendon which forms rather more than the lower half of its length. This tendon passes through a canal in the lateral part of the transverse carpal ligament and runs through a groove on the greater multangular bone; the groove is converted into a canal by fibrous tissue, and lined by a mucous sheath. The Flexor carpi radialis is a flexor and abductor of the wrist; it also assists in pronating the hand, and in bending the elbow. The Flexor carpi radialis, and the palmaris longus derive their supply primarily from the sixth cervical nerve which supplies the median nerve.

The **Flexor carpi ulnaris** lies along the ulnar side of the forearm. It arises by two heads, humeral and ulnar, connected by a tendinous arch, beneath which the ulnar nerve and posterior ulnar recurrent artery pass. The humeral head arises from the medial epicondyle of the humerus by the common tendon; the ulnar head arises from the medial margin of the olecranon and from the upper two-thirds of the dorsal border of the ulna by an aponeurosis, common to it and the Extensor carpi ulnaris and Flexor digitorum profundus; and from the intermuscular septum between it and the Flexor digitorum sublimis. The fibers end in a tendon, which occupies the anterior part of the lower half of the muscle and is inserted into the pisiform bone, and is prolonged from this to the hamate and fifth metacarpal bones by the pisohamate and pisometacarpal ligaments; it is also attached by a few fibers to the transverse carpal ligament. The ulnar vessels and nerve lie on the lateral side of the tendon of this muscle, in the lower two-thirds of the forearm. The Flexor carpi ulnaris is a flexor of the wrist-joint: it also assists in flexing the elbow. The Flexor carpi ulnaris is supplied by the ulnar nerve.

The **Flexor digitorum sublimis** is placed beneath the Flexor carpi ulnaris muscle; it is the largest of the muscles of the superficial group, and arises by three heads—humeral, ulnar, and radial. The humeral head arises from the medial epicondyle of the humerus by the common tendon, from the ulnar collateral ligament of the elbow-joint, and from the intermuscular septa between it and the flexor carpi ulnaris, and palmaris longus muscles. The ulnar head arises from the medial side of the coronoid process, above the ulnar origin of the Pronator teres. The radial head arises from the oblique line of the radius, extending from the radial tuberosity to the insertion of the Pronator teres. As the four tendons pass beneath the transverse carpal ligament into the palm of the hand, they are arranged in pairs, the superficial pair going to the middle and ring fingers, the deep pair to the index and little fingers. The tendons diverge from one another in the palm and form dorsal relations to the superficial volar arch and digital branches of the median and ulnar nerves. Opposite the bases of the first phalanges each tendon divides into two slips to allow of the passage of the corresponding tendon of the Flexor digitorum profundus; the two slips then reunite and form a grooved channel for the reception of the accompanying tendon of the Flexor digitorum profundus. Finally the tendon divides and is inserted into the sides of the second phalanx about its middlethe Flexor digitorum profundus; the two slips then reunite and form a grooved channel for the reception of the accompanying tendon of the Flexor digitorum profundus. Finally the tendon divides and is inserted into the sides of the second phalanx about its middle.

The **Flexor digitorum profundus** is situated on the ulnar side of the forearm, immediately beneath the superficial Flexors. It arises from the upper three-fourths of the volar and medial surfaces of the body of the ulna, embracing the insertion of the Brachialis above, and extending below to within a short distance of the Pronator quadratus. It also arises from a depression on the medial side of the coronoid process; by an aponeurosis from the upper three-fourths of the dorsal border of the ulna, in common with the Flexor and Extensor carpi ulnaris; and from the ulnar half of the interosseous membrane. The muscle ends in four tendons which run under the transverse carpal ligament dorsal to the tendons of the Flexor digitorum sublimis. Opposite the first phalanges the tendons pass through the openings in the tendons of the Flexor digitorum sublimis, and are finally *inserted* into the bases of the last phalanges. The portion of the muscle for the index finger is usually distinct throughout, but the tendons for the middle, ring, and little fingers are connected together by areolar tissue and tendinous slips, as far as the palm of the hand.

The **Pronator teres** has two heads of origin—humeral and ulnar. The **humeral head,** the larger and more superficial, *arises* immediately above the medial epicondyle, and from the tendon common to the origin of the other muscles; also from the intermuscular septum between it and the Flexor carpi radialis and from the antibrachial fascia. The ulnar head is a thin fasciculus, which arises from the medial side of the coronoid process of the ulna, and joins the preceding at an acute angle. The median nerve enters the forearm between the two heads of the muscle, and is separated from the ulnar artery by the ulnar head. The muscle passes obliquely across the forearm, and ends in a flat tendon, which is inserted into a rough impression at the middle of the lateral surface of the body of the radius. The lateral border of the muscle forms the medial boundary of a triangular hollow situated in front of the elbow-joint and containing the brachial artery, median nerve, and tendon of the Biceps brachii.

The **Pronator quadratus** is a small, flat, quadrilateral muscle, extending across the front of the lower parts of the radius and ulna. It arises from the pronator ridge on the lower part of the volar surface of the body of the ulna; from the medial part of the volar surface of the lower fourth of the ulna; and from a strong aponeurosis which covers the medial third of the muscle. The fibers pass lateralward and slightly downward, to be inserted into the lower fourth of the lateral border and the volar surface of the body of the radius. The deeper fibers of the muscle are inserted into the triangular area above the ulnar notch of the radius—an attachment comparable with the origin of the Supinator from the triangular area below the radial notch of the ulna.

Extensor assistant supinator group

The **Extensor carpi radialis longus** (*Extensor carpi radialis longior*) is placed partly beneath the Brachioradialis. It arises from the lower third of the lateral supracondylar ridge of the humerus, from the lateral intermuscular septum, and by a few fibers from the common tendon of origin of the Extensor muscles of the forearm. The fibers end at the upper third of the forearm in a flat tendon, which runs along the lateral border of the radius, beneath the Abductor pollicis longus and Extensor pollicis brevis; it then passes beneath the dorsal carpal ligament, where it lies in a groove on the back of the radius common to it and the Extensor carpi radialis brevis, immediately behind the styloid process. It is inserted into the dorsal surface of the base of the second metacarpal bone, on its radial side.

The **Extensor carpi radialis brevis** (*Extensor carpi radialis brevior*) is shorter and thicker than the preceding muscle, beneath which it is placed. It *arises* from the lateral epicondyle of the humerus, by a tendon common to it and the three following muscles; from the radial collateral ligament of the elbow-joint; from a strong aponeurosis which covers its surface; and from the intermuscular septa between it and the adjacent muscles. The fibers end about the middle of the forearm in a flat tendon, which is closely connected with that of the preceding muscle, and accompanies it to the wrist; it passes beneath the Abductor pollicis longus and Extensor pollicis brevis, then beneath the dorsal carpal ligament, and is *inserted* into the dorsal surface of the base of the third metacarpal bone on its radial side. Under the dorsal carpal ligament the tendon lies on the back of the radius in a shallow groove, to the ulnar side of that which lodges the tendon of the Extensor carpi radialis, longus, and separated from it by a faint ridge

The **Extensor digitorum communis** arises from the lateral epicondyle of the humerus, by the common tendon; from the intermuscular septa between it and the adjacent muscles, and from the antibrachial fascia. It divides below into four tendons, which pass, together with that of the Extensor indicis proprius, through a separate compartment of the dorsal carpal ligament, within a mucous sheath. The tendons then diverge on the back of the hand, and are inserted into the second and third phalanges of the fingers in the following manner. Opposite the metacarpophalangeal articulation each tendon is bound by fasciculi to the collateral ligaments and serves as the dorsal ligament of this joint; after having crossed the joint, it spreads out into a broad aponeurosis, which covers the dorsal surface of the first phalanx and is reinforced, in this situation, by the tendons of the Interossei and Lumbricalis. Opposite the first interphalangeal joint this aponeurosis divides into three slips; an intermediate and two collateral: the former is inserted into the base of the second phalanx; and the two collateral, which are continued onward along the sides of the second phalanx, unite by their contiguous margins, and are inserted into the dorsal surface of the last phalanx. As the tendons cross the interphalangeal joints, they furnish them with dorsal ligaments. The tendon to the index finger is accompanied by the Extensor indicis proprius, which lies on its ulnar side. On the back of the hand, the tendons to the middle, ring, and little fingers are connected by two obliquely placed bands, one from the third tendon passing downward and lateralward to the second tendon, and the other passing from the same tendon downward and medialward to the fourth. Occasionally the first tendon is connected to the second by a thin transverse band.

The **Extensor indicis proprius** (*Extensor indicis*) is a narrow, elongated muscle, placed medial to, and parallel with, the preceding. It arises, from the dorsal surface of the body of the ulna below the origin of the Extensor pollicis longus, and from the interosseous membrane. Its tendon passes under the dorsal carpal ligament in the same compartment as that which transmits the tendons of the Extensor digitorum communis, and opposite the head of the second metacarpal bone, joins the ulnar side of the tendon of the Extensor digitorum communis which belongs to the index finger.

The **Extensor digiti quinti proprius** (*Extensor minimi digiti*) is a slender muscle placed on the medial side of the Extensor digitorum communis, with which it is generally connected. It arises from the common Extensor tendon by a thin tendinous slip, from the intermuscular septa between it and the adjacent muscles. Its tendon runs through a compartment of the dorsal carpal ligament behind the distal radio-ulnar joint, then divides into two as it crosses the hand, and finally joins the expansion of the Extensor digitorum communis tendon on the dorsum of the first phalanx of the little finger.

The **Extensor pollicis brevis** (*Extensor primi internodii pollicis*) lies on the medial side of, and is closely connected with, the Abductor pollicis longus. It arises from the dorsal surface of the body of the radius below that muscle, and from the interosseous membrane. Its direction is similar to that of the Abductor pollicis longus, its tendon passing the same groove on the lateral side of the lower end of the radius, to be inserted into the base of the first phalanx of the thumb.

The **Extensor pollicis longus** (*Extensor secundi internodii pollicis*) is much larger than the preceding muscle, the origin of which it partly covers. It arises from the lateral part of the middle third of the dorsal surface of the body of the ulna below the origin of the Abductor pollicis longus, and from the interosseous membrane. It ends in a tendon, which passes through a separate compartment in the dorsal carpal ligament, lying in a narrow, oblique groove on the back of the lower end of the radius. It then crosses obliquely the tendons of the Extensores carpi radialis longus and brevis, and is separated from the Extensor brevis pollicis by a triangular interval, in which the radial artery is found; and is finally inserted into the base of the last phalanx of the thumb. The radial artery is crossed by the tendons of the Abductor pollicis longus and of the Extensores pollicis longus and brevis.

The **Abductor pollicis longus** (*Extensor oss. metacarpi pollicis*) lies immediately below the Supinator and is sometimes united with it. It arises from the lateral part of the dorsal surface of the body of the ulna below the insertion of the Anconæus, from the interosseous membrane, and from the middle third of the dorsal surface of the body of the radius. Passing obliquely downward and lateralward, it ends in a tendon, which runs through a groove on the lateral side of the lower end of the radius, accompanied by the tendon of the Extensor pollicis brevis, and is inserted into the radial side of the base of the first metacarpal bone. It occasionally gives off two slips near its insertion: one to the greater multangular bone and the other to blend with the origin of the Abductor pollicis brevis.

The **Supinator** (*Supinator brevis*) is a broad muscle, curved around the upper third of the radius. It consists of two planes of fibers, between which the deep branch of the radial nerve lies. The two planes arise in common—the superficial one by tendinous and the deeper by muscular fibers—from the lateral epicondyle of the humerus; from the radial collateral ligament of the elbow-joint, and the annular ligament; from the ridge on the ulna, which runs obliquely downward from the dorsal end of the radial notch; from the triangular depression below the notch; and from a tendinous expansion which covers the surface of the muscle. The superficial fibers surround the upper part of the radius, and are inserted into the lateral edge of the radial tuberosity and the oblique line of the radius, as low down as the insertion of the Pronator teres. The upper fibers of the deeper plane form a sling-like fasciculus, which encircles the neck of the radius above the tuberosity and is attached to the back part of its medial surface; the greater part of this portion of the muscle is inserted into the dorsal and lateral surfaces of the body of the radius, midway between the oblique line and the head of the bone.

TREATMENT

ADJUSTING

Dr. Kevin Hearon of the council on extremity adjusting and founder of CCEP (Certified Chiropractic Extremities Practitioner) writes in his book Advanced Principles of Upper Extremity Adjusting that anterior displaced carpals and metacarpal heads are often indicated by carpal tunnel syndrome and should be checked for when evaluating carpal tunnel syndrome. But before adjusting the hand and wrist the managing chiropractor must observe the laws of extremity adjusting.

Laws of Extremity Adjusting

1) Segments misalign to the proximal segment
2) The proximal segment is the base from the distal segment's alignment
3) Segments are adjusted at their proximal end. (Exception – a/c (acromio clavicular) articulation.)
4) In the cases of multiple misalignments in the same extremity progressi ely adjust from the proximal misalignment to distal misalignment.

Theses laws were formulated to have a standard base from which you can approach extremity adjusting. They were designed to eliminate the confusion of the novice as to which segment to adjust when approaching a new spontaneous extremity problem that is not covered in this book.

Kevin Hearon, What you should know about extremity adjusting.

The issue is further complicated by the possibility of what doctors refer to as double crush syndrome. One study discovered that more than 2/3 of patients with specific upper extremity nerve entrapments also had cervical nerve problems. When addressing any exttemity issue, the chiropractor must first look to the spine. In the case of Carpal tunnel syndrome the chiropractor would examine the cervical spine due to its intimate relationship with the upper extremity with regard to nerve involvement. The median nerve is a branch of the brachial plexus that stems directly from the cervical spine. The cervical spine's motion and mechanics are a direct result of the upper thoracic spine. The spine is a kinetic chain meaning it is a series of joints whom are interdependent upone each other for motion. With that being said the cervical spine should be addressed after the thoracic spine has been corrected.

Many chiropractors including the author agree that the foundation principle states that the pelvis should be leveled and the spine given a stabile base from which to build upon. Therefore the entire spine should be addressed with any extremity lesion. Second many chiropractic techniques are based upon "above down, inside out". "Above down, inside out" is a point of view in which health is regarded as being expressed by the body from "above down, inside out". A double crush syndrome supports this theory and again this author endorses that theory and follows its guidelines when addressing all extremity issues.

Soft Tissues

There are four mechanisms by which a peripheral nerve may become mechanically disrupted resulting in irritation, inflammation, pain and loss of sensation.

1) The nerve may become compressed and irritated as it passes through very tight or spasmodic muscle tissue.
2) Along its path, the nerve canget caught or tethered as it enters or exits the many ligamentatous tunnels and facial openings.
3) The nerve can become irritated between bones and adjacent soft tissues.
4) Compression of the nerve due to adhesions. (scar tissue buildup).

Graston tecnique and Active Release Techniques are common tools used to address carpal tunnel syndrome. Both techniques focus on the soft tissues of the arma nd in particular the myofascial component. Graston technique uses stainless steel tools to detect and treat the "Gristle" found in the afflicted arm. The "Gristle" is fascia that is stuck in the inflamitory stage of healing and is suspected to be scar tissue formed on the fascia. The intent of treatment is to induce an inflammatory response in the affected tissues and trip strat the healing phase of the tissue.

Scraping the "Gristle" and breaking up the adhesions within the fascia induce the inflammatory response.

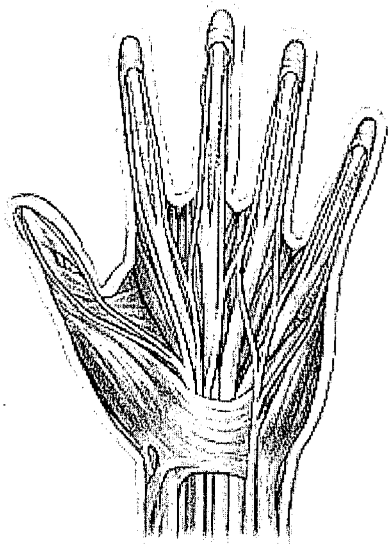
Active Release Technique developed by Dr. Mike Leahy addresses the muscular component of the myofascial lesion. By taking advantage of reciprocal inhibition and utilizing tension on the affected muscles the physician can again break up scar tissue formed on the muscles and fascia. The patient in this therapy takes an active role during the treatment. The patient is instructed to approximate the involved muscle or muscles and the treating doctor applies tension to the muscle at or near the adhesions upon which he palpated upon static palpation. The patient contracts the antagonistic muscle while the doctor provides tension to the agonist muscle. During the eccentric contraction the agonist muscle is exposed to tensile forces, which serve to break scar tissue and increase the range of motion of the treated muscle. Tension may be applied to the muscle tendon or belly and tension may be applied from origin to insertion or from insertion to origin depending on the nature of the lesion.

As soft tissue range of motion is improved, measures must be taken to maintain the range of motion and prevent new scar tissue from forming. Furthermore, what scar tissue that is formed must be controlled to lay down along the length of the tissue. Therefore the patient will be instructed to stretch the tissues often during the repair stage to provide tensile forces along the length of the tissue and maintain newly gained soft tissue range of motion.

The main sites of peripheral nerve entrapments are the brachial plexus at the scalenes, pectoralis minor, ligament of Struthers, the carpal tunnel, and anywhere it is in contact with the muscle and fascia of the upper extremity, and cervical spine. All areas must be addressed because carpal tunnel syndrome is a summation of many smaller lesions.

Supports

The ligaments and bones of the proximal row of carpal bones support the carpal tunnel. The Scaphoid, Lunate, Triquetrum, and Pisiform make up the arch of the carpal tunnel. When the arch is lost due to hyper mobility of the carpals and laxity of the supporting ligaments the carpal tunnel is compromised. The carpal bones act like bricks in an arch and the ligaments like mortars. The arch is held together by force closure of the supporting ligaments. The arch flattens or collapses when the ligaments become lax and the muscles, ligaments, tendons, blood vessels and nerves of the carpal tunnel become compressed.



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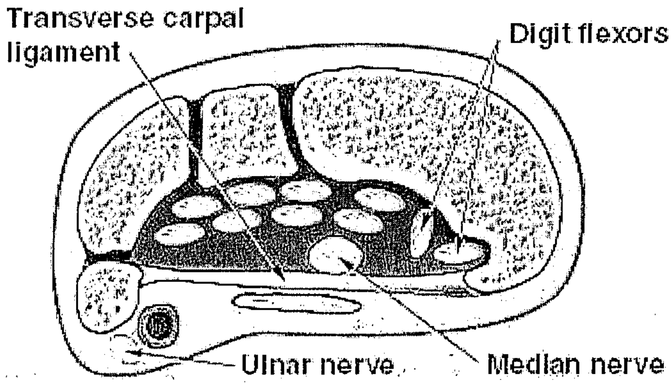
The carpal arch, made up of the proximal row of carpals, must therefore be stabilized to allow the ligaments and supporting structures to heal and return to their healthy state. A brace worn to support the wrist will reduce the effects of creep and hysteresis from occurring. It is agreed by many sources that a minimum of three months of support is required for tissue healing time. A brace may be taped as long as it provides force closure of the arch and maintains the carpal tunnel. A taping job can be evaluated by testing the strength of thumb and little finger opposition. Opposition will be strong with the carpal tunnel being intact.



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WRISTWAND

Currently there are stretching devices on the market which opens up the chronically tight muscles and connective tissues of the wrist and forearm by pronation of the wrist, forearm, and elbow coupled with internal rotation of glenohumeral join, anterolateral translation of the scapula and extension of the wrist, forearm, elbow and possibly reversing the usual way in which humans grasp.. Furthermore the stretch facilitates the fast twitch muscles of the forearm and hand extensors and flexors while actively stimulating these muscle groups to elongate. By simultaneously facilitating reciprocal inhibition of both the flexor muscle group and the extensor muscle group wristwand is able to eccentrically contract the hand and wrist muscles, ligaments and fascia and restore range of motion and function.

The WristWand stretching device is based on a centuries old stretching technique discovered in the champagne cellars of France. Part of the process of making champagne is to manually turn the bottles of fermenting wine ¼ of a turn each day. This is called "riddling". The people who do this are called "Riddlers". Each Riddler turns up to 30,000 bottles very day, yet they have no repetitive strain injuries. They are required as part of their job to do a very unique stretch. WristWand modified and improved on the stretch and created the WristWand to work in our modern day environment.

Stretching tools such as wristwand can effectively maintain range of motion and preserve range of motion gained by chiropractic adjustments and soft tissue therapies such as Nemo, Graston and ART. Corporations are starting to utilize tools such as wristwand and are effectively implementing the stretches by using software such as Ergomate.

Ergomate

A Harvard research team with the goal of reducing carpal tunnel syndrome and employee fatigue created Ergomate. The software is designed to interrupt computer work at regularly scheduled intervals. For example, if the software is set for 45minute intervals, every 45 minutes an alert will pop up on the monitor and request the user to begin doing his or her stretching routine. Should the user try to override the program and press escape, the computer will freeze up for an equal amount of time it would take to do the stretches. Thereby enforcing the stretching program.

MISCELLANEOUS CAUSES OF CARPAL TUNNEL SYNDROME

Some experts believe that incorrect posture may play a large role in the development of CTS, particularly in people who work at computer and other types of keyboards. The tendency to roll the shoulders forward, round the lower back, and thrust the chin forward can shorten the neck and shoulder muscles, compressing nerves in the neck. This, in turn, can affect the wrist, fingers, and hand. Bone dislocations and fractures can narrow the carpal tunnel, thereby exerting pressure on the median nerve. Certain other medical conditions, such as rheumatoid arthritis, diabetes, and hypothyroidism, can also cause the inflammation in the carpal tunnel that results in median nerve entrapment. Fluid retention during pregnancy or hormonal changes associated with menopause can cause swelling and symptoms of carpal tunnel syndrome.

About 25% of patients with work-related repetitive stress disorders also have evidence of other similar conditions that resemble but are not carpal tunnel syndrome. A definitive diagnosis is often difficult. Most require treatments similar to those used for CTS: rest, immobilization, steroid injections, and even surgery if conservative management is unsuccessful.

Table 1. Associated Diseases in 297 Patients with Work-Related Arm Pain or Carpal Tunnel Syndrome

Disease	Number of Patients (%)	
Metabolic	**41**	**(13.8)**
Hypothyroidism	18	(6.1)
Diabetes mellitus	17	(5.7)
Gout	3	(1.0)
Hypercalcemia	2	(0.7)
Hyperthyroidism	1	(0.3)
Inflammatory	**33**	**(11.1)**
Unclassified	12	(4.0)
Spondyloarthropathy	7	(2.4)
Rheumatoid arthritis	5	(1.7)
Seronegative arthritis	5	(1.7)
Raynaud's phenomenon/SLE	4	(1.3)

Osteoarthritis	**35**	**(11.7)**
Wrist	18	(6.1)
Finger	7	(2.4)
Cervical spine	4	(1.3)
Elbow	3	(1.0)
Other	3	(1.0)
Acute Trauma/RSD	**29**	**(9.8)**
Wrist	15	(5.1)
Hand/forearm/elbow	8	(2.7)
RSD (5 with acute trauma)	6	(2.0)

SLE = systemic lupus erythematosus
RSD = reflex sympathetic dystrophy

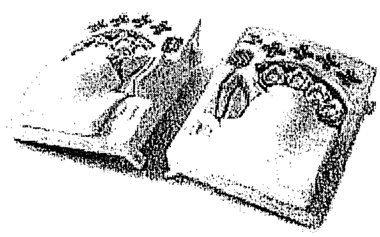
SURGICAL INTERVENTION

Open Release Surgery. Traditionally, surgery for CTS entails an open surgical procedure performed in an outpatient facility. A local anesthetic is injected either into the wrist and hand or higher up the arm. The surgeon makes a two-inch incision in the palm and cuts the carpal ligament free from the underlying median nerve. The ligament is literally released and therefore the pressure on the median nerve is relieved. Carpal tunnel release is the most commonly performed hand surgery, with more than 100,000 procedures each year.

A more recent variation known as a mini-open release technique uses an incision that is only about an inch and a half, and it can be performed in the doctor's office with only a local anesthetic. The operation takes only about 12 minutes. It is more expensive at this time than standard open release but is less costly than the other less invasive procedureendoscopy

For some patients, release surgery relieves CTS symptoms of numbness and tingling immediately. Other patients may not experience any benefit. Post-surgery complications may include nerve damage, infection, scarring, pain, and stiffness. The incision site may remain sore for months, and some patients experience some scar pain for years with open release. People who have the operation on both hands are completely incapacitated for about two weeks and must have someone to help them at home. Returning to strenuous work right after surgery may cause the symptoms to recur, and patients generally stay out of work for at least month and often much longer, depending upon the type of surgery and severity of the condition.

DATAHAND



In extreme cases of Carpal Tunnel Syndrome many workers whose careers are in jeopardy due to their inability to use their hand or hands for keyboard applications DataHand has been effective. DataHand is a new ergonomic keyboard that reduces hand pain. Janet S. Kaiser and James B. Koeneman, Ph.D., of the Harrington Arthritis Research Center, performed a study "DataHand Health, Comfort, Pain Relief, and Performance Study". The Harrington study documents an average 44% reduction of pain following initial use of the DataHand keyboard and an average 71% reduction in worker experience of pain after an average of 3.3 months of DataHand use.

There are several key reasons to DataHand's ability to reduce pain when compared to a standard keyboard.

The DataHand ergonomic keyboard:

Reduces the range of finger motion. The fingertips move about ½" compared to the conventional keyboards where the whole hand must move many inches. Wrist, arm, shoulder and neck must become involved when working on a flat keyboard: on the DataHand keyboard, only the fingers move.

Reduces key activation forces. The fingers of DataHand operators use 20 grams of force compared to 55 to 100 grams required on the flat keyboard. Research has shown forces below 48 grams reduce risks of musculoskeletal injury. Flat keyboard "bangers" often use forces 4 to 7 times more than necessary.

Provides optimal position and support for hands, wrists, and arms. The DataHand design ensures correct pronation and relaxation of the hands, wrists, and arms.

Nutritional Support

The carpal tunnel is as its name describes a tunnel. Since the tunnel has limited space and the tissues within that tunnel need room to function, inflammation must be considered and dealt with appropriately to alleviate the problem. Therefore from a conservative point of view the ideal way to remedy inflammation is an anti-inflammatory diet. An anti-inflammatory diet consists of eliminating refined sugars and replacing them with fruits and vegetables, as well as consuming the recommended daily amounts of essential fatty acids and maintaining an ideal balance of omega 3 fatty acids to omega 6 fatty acids. As chiropractors we can further fight inflammation with several key nutritional supplements which aggressively reduce inflammation.

The key nutritional supplements are Bromelain, Tumeric, Ginger, and Boswellia.

Bromelain

Bromelain is a digestive enzyme that is extracted from the stem and fruit of pineapple.

Several preliminary studies suggest that when taken by mouth, bromelain can reduce inflammation or pain caused by inflammation. Better quality studies are needed to confirm these results.

Tumeric

The rhizome (root) of turmeric (*Curcuma longa* Linn.) has long been used in traditional Asian medicine to treat gastrointestinal upset, arthritic pain, and "low energy." Laboratory and animal research has demonstrated anti-inflammatory, antioxidant, and anti-cancer properties of turmeric and its constituent curcumin. Preliminary human evidence, albeit poor quality, suggests possible efficacy in the management of dyspepsia (heartburn), hyperlipidemia (high cholesterol), and scabies (when used on the skin). However, due to methodological weaknesses in the available studies, an evidence-based recommendation cannot be made regarding the use of turmeric or curcumin for any specific indication.

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Ginger

The rhizomes (underground stem) and stems of ginger have assumed significant roles in Chinese, Japanese and Indian medicine since the 1500s. The oleoresin of ginger is often contained in digestive, antitussive, antiflatulent, laxative, and antacid compounds.

There is supportive evidence from one randomized controlled trial and an open-label study that ginger reduces the severity and duration of chemotherapy-induced nausea/emesis. Effects appear to be additive to prochlorperazine (Compazine®). The optimal dose remains unclear. Ginger's effects on other types of nausea/emesis, such as postoperative nausea or motion sickness remain indeterminate.

Ginger is used orally, topically, and intramuscularly for a wide array of other conditions, without scientific evidence of benefit.

Ginger may inhibit platelet aggregation/decrease platelet thromboxane production, thus theoretically increasing bleeding risk.

Boswellia

Conclusion

Carpal tunnel syndrome is the result of many small lesions summating into a median nerve neuropathy. The cervical spine is involved at the root level requiring chiropractic adjustments of the spinal column. Muscles and fascia contribute to the pathology in the form of peripheral entrapments caused by scar tissue and adhesions that can be reduced by soft tissue therapies such as Graston technique and Active Release Technique. At the distal point of the extremity the carpal tunnel itself must evaluated for subluxation of the carpals compromising the carpal arch and integrity of the supporting ligaments that maintain the arch. The subluxated carpals can be adjusted by the chiropractor and the ligaments can become functional with proper taping and support. Lastly the patient can nutritionally support the body with an anti-inflammatory diet.

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