Carpal tunnel syndrome: more than just a problem at the wrist

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Carpal tunnel syndrome is classically described as a symptom complex resulting from compression of the median nerve underneath the transverse carpal ligament at the wrist. It can result in significant patient discomfort and economic loss. In many cases, the condition does not adequately respond to the standard of care including rest, NSAIDs, wrist splints, steroid injections, physical therapy and surgery. Fortunately, this condition frequently responds favourably to OMT.

Symptoms

Patients typically present with pain involving the wrist and/or pain, numbness or tingling affecting the thumb, index, middle and radial side of the ring finger. These may wake the patient up at night. Pain may also be referred to the elbow and shoulder.

Diagnosis

Provocative tests can aid in the diagnosis of carpal tunnel syndrome. These include Phalen's maneuver, Tinel's test and the median nerve compression test. Thenar atrophy may be observed. EMGs remain the gold standard for the diagnosis of this condition.

Anatomy

The median nerve arises from the brachial plexus. The brachial plexus arises from spinal nerves C5-T1. The brachial plexus courses between the anterior and middle scalene muscles, between the first rib and clavicle and underneath the pectoralis minor muscle. The median nerve passes deep to the bicipital aponeurosis (fibrous band connecting the biceps tendon to the forearm fascia. It then passes between the two heads of the pronator teres muscle and through the fibrous arch formed by the flexor digitorum superficialis muscle. It then courses underneath the transverse carpal ligament at the wrist.

Research

Most treatments seem to focus on increasing the space underneath the transverse carpal ligament for the median nerve. One important question is not frequently addressed. Why isn't there enough room underneath the transverse carpal ligament?

Drs. Kappler, Chimata, Hohner, Mizera and myself have completed a research study addressing this issue. **MRI images were used to assess changes in fluid content (swelling) in both the carpal tunnel and median nerve after OMT treatment. These measurements were correlated with changes in nerve conduction velocities, pain ratings, wrist motion measurements and somatic dysfunction measurements.**

Six patients were diagnosed with carpal tunnel syndrome. OMT treatments were focused on the upper thoracic spine, lower cervical spine and tenderpoints in the forearm muscles. OMT was not applied to the wrist in an attempt to stretch the transverse carpal ligament. Five patients responded with improvement in symptoms and one did not. The responder group demonstrated decreased swelling in both the median nerve and carpal tunnel. The nonresponder demonstrated increased swelling in both the median nerve and carpal tunnel. Changes in the swelling of both the median nerve and carpal tunnel appeared to more closely parallel changes in hand symptoms than the nerve conduction studies. Statistically significant changes did not occur in the length of the transverse carpal ligament or the area of the carpal tunnel.

All six patients had a predominance of acute changes in the upper thoracic spine and upper ribs. Most patients had increased tension in the flexor muscles of the forearm.

Treatment

What is the role of the sympathetic nervous system in the development of carpal tunnel syndrome? In our study, all six patients had a predominance of acute changes in the upper thoracic spine and upper ribs. Cell bodies of preganglionic neurons concerned with the upper extremity are located in the upper thoracic spinal segments. The smooth musculature in the walls of lymphatic vessels contract when sympathetic nerves are stimulated. This reduces the size of the

lumen, thereby impairing lymphatic drainage. Increased sympathetic tone can therefore close down lymphatic channels and lead to congestion in regions of the body. **Upper thoracic dysfunction increases sympathetic tone to the upper extremity and decreases lymphatic drainage. This may lead to the increased swelling observed within the carpal tunnel (and possibly the entire upper extremity) and the subsequent production of symptoms.** This is why treating upper thoracic and upper rib dysfunction is of utmost importance in effectively treating this condition. The upper thoracic spine may be treated using any technique comfortable for you. The upper thoracic spine and upper ribs may respond best to counterstrain and indirect techniques when acute tissue texture changes are present.

What is the role of the "double crush" in the genesis of carpal tunnel syndrome? The double crush hypothesis proposed by Upton and McComas explains that compression of axons at one location may not impair axoplasmic transport enough to result in denervation changes in their target structures. If a similar amount of compression is simultaneously applied at a second location, the threshold for denervation effects is exceeded and symptoms occur. Basically, if the nerve becomes compressed proximally, it is more predisposed to injury distally. Remember, the median nerve arises from the brachial plexus. You need to appropriately address somatic dysfunction contributing to compression along the entire course of the brachial plexus and median nerve.

1. C5-T1 – origin of the brachial plexus. This area may be treated using any method comfortable to you. It may respond best to indirect or counterstrain techniques if acute tissue texture changes are present.

2. Anterior and middle scalene muscles – the anterior scalene muscle originates from C3-C6 and inserts on the first rib. The middle scalene muscle originates C2-C7 and inserts on the first rib. Both function to sidebend the neck toward the same side. Treat somatic dysfunction affecting the origin and insertion of these two muscles (C2-C7 and first rib).

Muscle energy technique – Example right anterior and middle scalene tight. Patient seated. Physician stabilizes the right shoulder with his/her right hand. The left hand is used to control the top of the patient's head and to sidebend the cervical spine to the left. Engage the barrier. Maintain this position while instructing the patient to gently (3-5 pounds of force) bend the neck to the right. The patient maintains the contraction for 3 seconds. Instruct the patient to relax. Wait 2 seconds and engage the new barrier. Repeat a total of 3-5 times. Reevaluate the scalenes. Has the motion improved?

3. Elevated first rib – typically, if the first rib is elevated on the right, T1 is rotated left and sidebent left. The vertebrae may need to be treated before the rib will respond. Or, problems in the upper thoracic spine on the left (T1-T4) may give the appearance of a "falsely elevated" first rib. Treating the upper thoracic dysfunction may normalize the motion of the first rib without having to directly treat the rib. This area may be treated with HVLA, muscle energy or any other technique you prefer.

4. Pectoralis minor muscle and biceps muscle – the patient is seated. The physician palpates for tenderness and tissue texture changes over the coracoid process (insertion of the pectoralis minor muscle). Palpation is also done to determine the presence of tension in the biceps tendon.

Example – right pectoralis minor and biceps tight. The patient is seated. The physician drapes the left hand over the patient's right shoulder so that the monitoring finger rests over coracoid process. The physician uses the right hand to hold the patient's right forearm. The patient's right arm is flexed to load the triceps muscle and unload biceps muscle. Force is applied through the left hand and body to protract the shoulder thus unloading the pectoralis minor muscle. Listen with your fingers. The tension in the pectoralis minor muscle will decrease. This method can be used as a counterstrain method and held for 90 seconds. Alternatively, an indirect release can result from holding the position until the release is completed and the tissues cease to soften. Reevaluate the area. Has the motion improved?

5. Pronator teres muscle and forearm flexors – assess pronation and supination in the involved forearm. Frequently, supination is restricted. Palpate for tenderness and tissue texture changes over the volar surface of the forearm. The muscles may feel tight. One finger serves as a monitor. Pronate (turn palm toward floor to unload pronator teres) and flex the patient's forearm (load extensors and unload flexors) until tension of the pronator and/or flexor muscles is decreased. Either hold for 90 seconds (counterstrain) or until the tissues finish softening (indirect release). Reevaluate the area. Has the motion improved?

6. Transverse carpal ligament – as a general rule, this ligament only needs to be stretched if the wrist is thickened (osteoarthritis). The transverse carpal ligament attaches medially to the pisiform and hook of the hamate. It attaches laterally

to the trapezium and scaphoid. Carpal tunnel surgery involves transecting this ligament to increase space within the carpal tunnel.

Example – right wrist. Forearm pronated (palm toward floor). The physician's left index finger contacts volar side of the patient's wrist, just medial to pisiform and hamate. The left thumb is positioned over the dorsal side of the patient's wrist. The remaining fingers of the left hand are spread over the hypothenar eminence. The physician's right index finger contacts volar side of the patient's wrist, just medial to scaphoid and trapezium. The right thumb is placed over the dorsal side of the patient's wrist. The remaining fingers of the right hand are spread over thenar eminence. Using the thumbs as a fulcrum, separate (bowstring) the two ends of the transverse carpal ligament. Hold until a release occurs.

Additional Management

Poor posture can contribute to somatic dysfunction in the upper thoracic spine. Many people work at a desk or computer and subsequently develop a kyphotic posture wherein the scapulae are protracted and the shoulders are rolled forward. The pectoralis minor muscle becomes tightens. Workstation problems need to be addressed. The computer screen may need to be raised to eye level to promote good posture. The chair height may need to be altered to promote good wrist mechanics (keep wrists straight while typing). Grips on tools may need to be altered to reduce stress on wrists and forearms. The patient may need duty modification or job rotation to reduce repetitive microtrauma (typing long hours without a break). The patient may benefit from performing daily postural exercises, scapular stabilization exercises and stretches for the pectoralis minor and scalene muscles.

1. Pectoralis minor stretches – example right pectoralis minor tight. The patient stands facing wall and places both hands at shoulder height. The back is kept straight and the shoulders are depressed. The patient turns the body to the left until a stretch is felt in the pectoral area. Leaning the body toward wall may enhance the stretch. Hold for 30 seconds and release. Perform 2-4 repetitions on each side. Stretch to symmetry on both sides (1).

2. Reverse angry cat exercise – this exercise is very effective for stretching (mobilizing) the upper thoracic spine and stretching the entire upper extremity. The patient is kneeling, palms down with thumbs turned outward. The patient inhales while pressing the upper thoracic spine up toward ceiling, tucks the chin to the chest and tucks the seat in (rounds the spine). This position is held for 2 seconds. Pause briefly. The patient exhales while lifting the head up toward the ceiling and allows the seat to fall posteriorly (flattens spine). Pause briefly. Repeat the exercise 5- 10 times daily. The patient may feel a tremendous stretch in upper extremity. Avoid producing pain. Progress slowly and carefully.

3. Core training - weak abdominal muscles can contribute to increased lumbar lordosis and a compensatory increase in thoracic kyphosis. The patient may benefit from gentle strengthening exercises for both the abdomen and low back.

4. Scalene stretches – example right scalenes tight. The patient is seated in a chair. The patient's right arm is straight and holds on to the bottom of the chair. The patient reaches up with the left arm, contacts the head and sidebends the neck to left until a stretch is felt. The right arm holds onto the chair and prevents the right shoulder from elevating. Hold for 30 seconds. Perform 2-4 repetitions on each side. Stretch both sides to equal symmetry.

Carpal tunnel stretches may help if there is decreased space within the carpal tunnel due to osteoarthritis. Thickening of the wrists may be seen and palpated on clinical exam. The patient stands facing toward wall. The palm is placed flat against wall. The wrist is gently extended. The other hand is used to gently extend the thumb. Hold for thirty seconds. Repeat 1-4 times daily as tolerated (2).

Other pearls – avoid producing pain. Pain produces spasm, inflammation and further swelling. Be patient. You can only progress as rapidly as the patient's body can respond. Nerves regrow at a rate of approximately 1 inch per month (1 mm per day). If the nerve is injured more proximally, it may take some time for complete regrowth and healing to occur. Failure to respond to conservative measures and/or progressive neurologic symptoms (significant and/or progressive thenar atrophy) are an indication for surgery.

References

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