



## **carpal tunnel syndrome**

The word carpal means wrist. Therefore, the carpal tunnel is a tunnel that is formed by the structural configuration of the wrist (carpal) bones. Carpal tunnel syndrome (CTS) is a pathologic condition in which the median nerve is compressed within the carpal tunnel. CTS can affect anyone, but is of special importance to manual therapists because of the heavy physical stresses that we place on our hands and wrists.

**STRUCTURE.** The carpal tunnel can be seen best by looking at a proximal-to-distal (down the forearm into the hand) view (Figure 1). The carpal bones project anteriorly on both the ulnar and radial sides: the pisiform and hamate on the ulnar side, and the trapezium and scaphoid on the radial side. This creates a central depression, or tunnel in which the carpal bones form the floor and walls of the tunnel. The ceiling is formed by a dense fibrous fascial structure known as the transverse carpal ligament (also known as the flexor retinaculum). The carpal tunnel is important because it creates an enclosed and protected space that affords safe passage for the median nerve from the forearm into the

hand. Also contained within the carpal tunnel are nine long finger flexor tendons: four tendons of the flexor digitorum superficialis, four tendons of flexor digitorum profundus, and the tendon of the flexor pollicis longus (Figure 2).

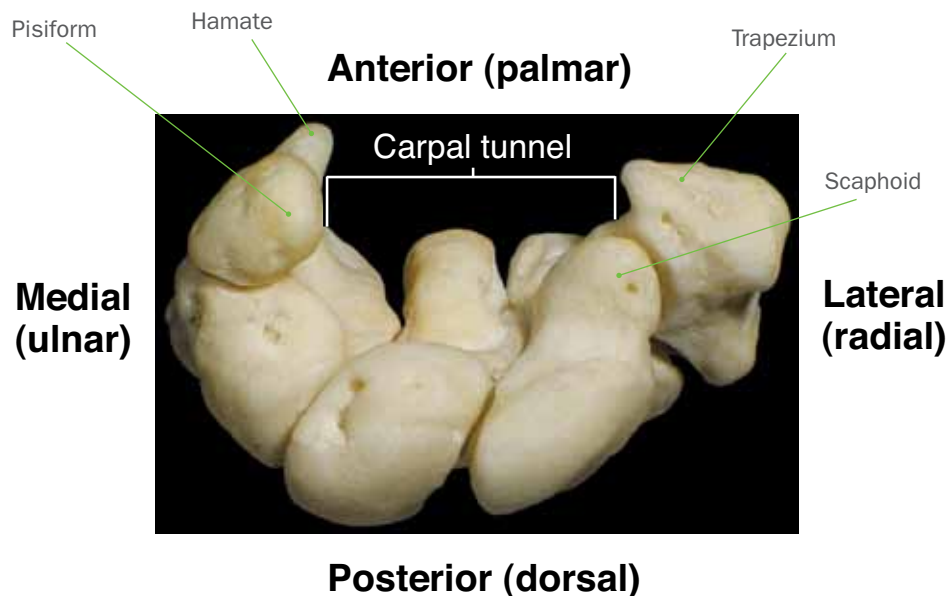
**NERVE COMPRESSION.** Ironically, the feature that makes the carpal tunnel valuable—creating an enclosed and protected space that protects the median nerve—is the same feature that can lead to CTS. When structures within an enclosed space are injured, the swelling that occurs has nowhere to escape. In the case of CTS, this swelling results in compression of the median nerve. If this condition becomes chronic, fibrous scar tissue adhesions may form, which can further compress the median nerve.

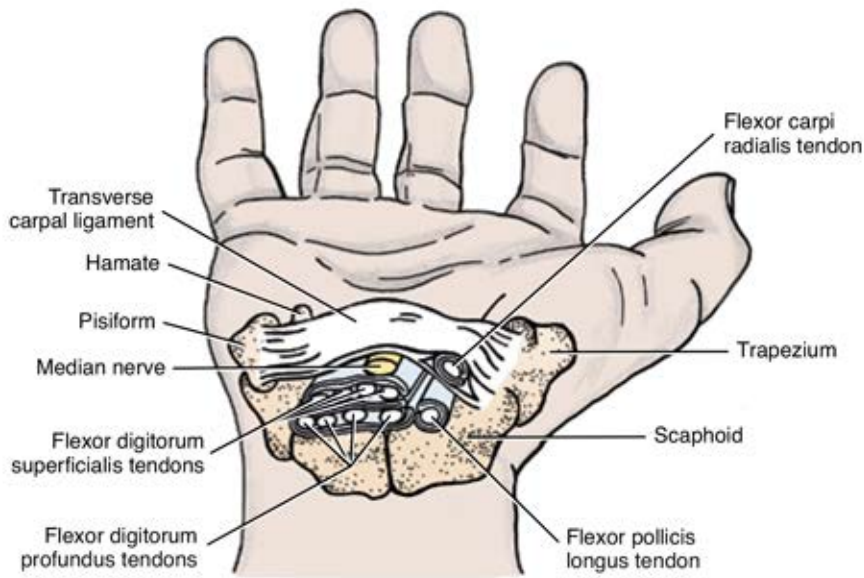
**CAUSES.** Injury to the carpal tunnel can occur through macrotrauma or repeated microtrauma. A typical macrotrauma is a fall on an outstretched hand. Repetitive microtrauma, which is more often the causative agent, may occur due to a number of poor postures and/or movement patterns.

For example, maximally flexing and/or extending the hand at the wrist joint can be problematic because these postures increase pressure within the carpal tunnel. Maximal extension is more often the culprit, especially

**FIGURE 1**

The carpal tunnel is formed by the carpal bones of the wrist.





**FIGURE 2** Structures located within the carpal tunnel. (Note: The flexor carpi radialis tendon travels in a separate fascial compartment; it is not located in the carpal tunnel.)

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if the hand is then pressed against a hard surface; examples include doing push-ups with hands flat on the floor, or opening a store door with the palms of the hands.

Another common postural micro-trauma is extending the hand at the wrist joint while flexing the fingers at the metacarpophalangeal and proximal interphalangeal joints. Examples of

board without using a wrist support; or perhaps playing piano and letting the wrists drop below the level of the keys.

Another common repeated microtrauma is placing pressure through the palms of the hands. This is especially prevalent for manual therapists, especially those who continually use their palms to generate deep pressure into their clients. One other fairly common cause of CTS is general systemic swelling. The most common example of this phenomenon is the swelling that often occurs with pregnancy.

Other risk factors for CTS include obesity, diabetes, and rheumatoid arthritis.

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