

# Evaluation of Tendon Injuries

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Tendon injuries may result from a variety of mechanisms including lacerations, crushing, avulsions and even repetitive trauma with degenerative changes. Injuries are often incurred at work or while performing routine activities at home in the working population. Another commonly injured age groups are unsupervised children getting their hands caught in heavy or sharp equipment.

Upon arrival at the treatment center, prioritize more devastating related injuries, if present.

Most tendon injuries will present with open wounds and will require immediate irrigation, initiation or updating of tetanus vaccine and depending on likelihood of developing an infection, antibiotic prophylaxis.

Once the wound is irrigated and bleeding is controlled, the patient is placed in a comfortable position (sitting or lying down) and evaluated in a setting where instructions and responses may be adequately heard and seen. It is ideal to be in a quiet and well-lit room.

## Inspection

On inspection, the location of the wounds and attitude of the fingers may provide important clues on the injuries. To be able to correlate this, it is assumed that the evaluator has a good knowledge of anatomy and basic biomechanics on of the hand.

## Flexor Tendon Anatomy

Except for the thumb, the four fingers each have 2 tendons from muscles originating from the elbow and forearm. They also have a proximal and distal interphalangeal joints while the thumb only has 1.

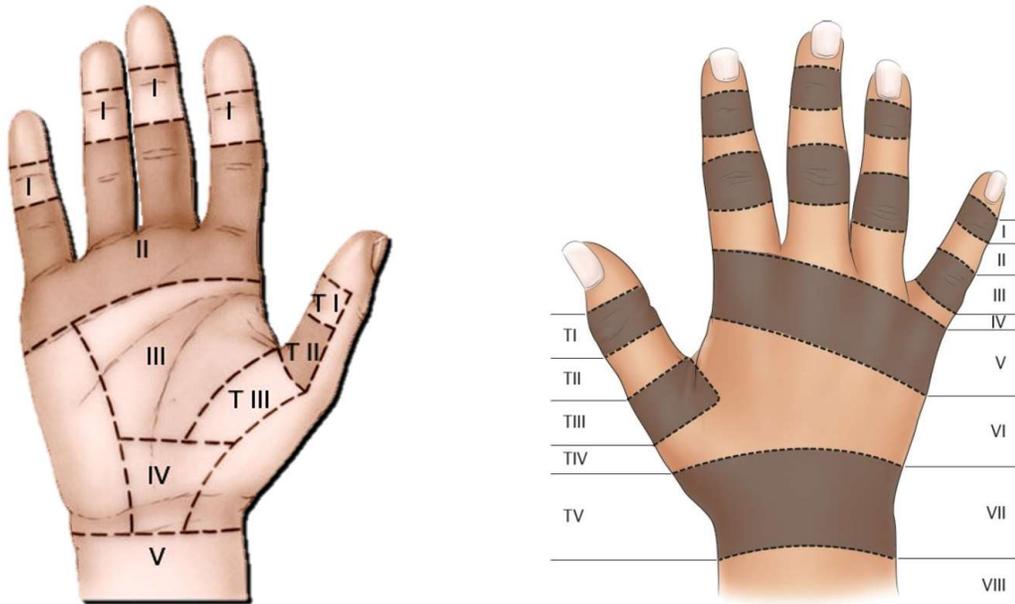
The flexor digitorum profundus is a composite muscle even if the innervation comes from the anterior interosseous nerve for the index and middle and ulnar nerve for the ring and small. Having a common FDP belly is an important consideration in the evaluation of the injury to isolate the FDS. At the palm, the FDP tendons also serve as the origin of the lumbricals which limits the retraction of the proximal stumps when injured.

At the fingers the 2 tendons are confined and movement made efficient by the fibro-osseous tunnels also referred to as pulleys. There are 5 annular (with A2 and A4 considered most important) and 3 cruciate pulleys alternating after A2. The thumb has an oblique pulley after A1 that biomechanically functions similar to A2.

## Extensor Tendon Anatomy

The extensor tendons at the wrist rest in 6 distinct compartments, separated by fibro-osseous tunnels. At the dorsum of the hand, the Extensor digitorum communis (EDC) splits into 4 with connections via several juncturae tendinae. There are also proper extensor tendons for the index and small fingers both resting on the ulnar sides of their EDC counterparts. These redundancies and interconnections may explain intact function even in the presence of complete tendon transections.

As a guide, review the zones of tendon injuries as shown in the illustrations:



Source: <https://www.plasticsurgerykey.com>

Remember some important basic points:

1. Zones are different between flexor and extensor tendons
2. Zones are used to label the tendon injuries, not the skin laceration.

For an initial examination, take note of some important points specific to the zones:

### **Flexor**

Zone 1 – isolated FDP transection and may be missed and dismissed as inability to move due to pain. A more proximal wound may still have a short stump if the finger was flexed and the tendon was under tension when transected.

Zone 2 – transection of both FDS and FDP under the pulleys and best treated early and by experts. This was previously referred to as “no man’s land” because results of repair in this area had poor results.

Zone 3 – nerves and arteries are more superficial, therefore, likely to be transected also

Zone 4 – injury within the carpal tunnel and may affect more tendons and motor branch of the median nerve

Zone 5 – consider injuries in the musculotendinous junction

### **Extensor (over joint – odd, over shaft of bone – even)**

Zone 1 – mallet finger, open DIP joint injury (later swan neck deformity)

Zone 3 – central slip, open PIP joint injury, (later Boutonniere deformity)

Zone 5 – sagittal band rupture (if closed), consider a human bite injury even if with a small wound

Zone 6 – most common and may not always be detected clinically because of juncturae tendinae and proper tendons.

Zone 9 - consider injuries in the muscles and the PIN branch of the radial nerve.

### **Palpation**

Palpation generally has not much role in tendon injuries but may be useful in screening for and assessing associated injuries like nerve transection and fractures.

For closed injuries with avulsion at insertion, tenderness may point to the level of retraction.

### **Range of Motion**

Active motion best demonstrates the integrity of the tendons. When patients can tolerate it, gentle composite motion may help screen for obvious deficiencies in movement. This may be done during wound irrigation as the irrigation may serve as a distraction. If there are gross deformities, testing for range of motion should not be done.

### **Flexor Tendons (Try these at home!)**

When a patient can tolerate it (e.g. closed injuries, chronic injuries, under anesthesia), the FDP is easily tested by asking the patient to flex the DIP while pressing on the middle phalanx.



An isolated FDS injury is not easily demonstrated with the similar maneuver since the FDP also flexes the PIP. Precise testing is done by isolating the FDS' pull on the PIP by immobilizing the FDPs of the other fingers, effectively immobilizing the FDP of the finger being tested.



This may also be achieved by just attempting to maintain PIP flexion while hyperextending the DIP joint. A finger with a transected FDS will not be able to hold this position.



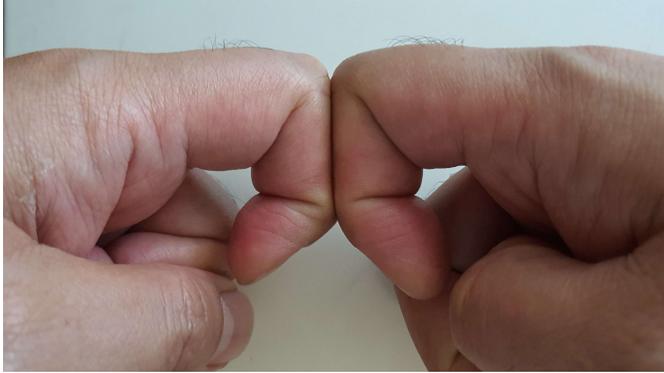
Another important consideration is when a patient is able to move but present with significant pain on resisted motion. Such findings should make one suspect of a possible partial tendon injury.

### **Extensor Tendons**

The inability to actively extend the DIP joint (mallet finger) demonstrates transection of the terminal slip equivalent to a Zone 1 extensor injury even in the absence of a wound.

Elson's test (Try this at home!)

In a patient with intact central slip, when the PIP is pressed against a table at 90deg flexion, attempt to extend against resistance will keep the DIP supple. If the central slip is disrupted, DIP will be rigid. A modification is to press the middle phalanges against each other at 90deg flexion of PIP flexion as shown below.



A snapping tendon with some limitation of MCP extension, associated with pain on the knuckles may point to a sagittal band injury.

Injuries over the metacarpal may result to varying degrees of extension lag, depending on other structures that may pull the joints to extension. Note that full extension of the interphalangeal joints are still possible even with transected proximal tendons and absence of MP extension since this motion comes from the pull of the intrinsic muscles.

### **Imaging**

Plain radiographs are routinely done to detect bony avulsion, other associated fractures/dislocations and retained foreign body (watch out for those glass, pebbles and teeth!).

Musculoskeletal sonography may also help detect the level of retraction of tendons to plan for surgery but rarely indicated in acute cases.

### **Differentials**

Like most lesions from injuries, there are not many conditions to consider as differentials. The challenge is more on identifying associated injuries for proper diagnosis prior to surgery.

### **Principles of Management**

Most complete transection of tendons that retract will not connect spontaneously and will need to be surgically approximated and repaired for function to return. This is especially true for flexor tendons. Some extensor tendon injuries do not retract and may be managed with splinting for around 6 weeks to facilitate healing.

At the emergency room, it is important to prevent complications associated with missed diagnosis and delayed treatment for closed injuries and inappropriate wound management that may result to infection or further tissue loss. It is also expected that immobilization will be applied to provide comfort and prevent further tissue damage.

The surgical management will vary with factors related to injury, to the patient and to the capabilities of the surgeon.