

High-Resolution 3-T MRI of the Fingers: Review of Anatomy and Common Tendon and Ligament Injuries

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OBJECTIVE. With high-resolution 3-T MRI, the complex anatomy of the fingers can be imaged in exquisite detail to provide an accurate diagnosis of clinically important ligament and tendon injuries.

CONCLUSION. We present our 3-T MRI protocol using a dedicated hand-and-wrist coil and review normal MRI anatomy of the fingers. We emphasize a systematic approach to the interpretation of finger MRI examinations and illustrate this approach with examples of tendon and ligament abnormalities.

MRI is used with increasing frequency by hand surgeons and other clinicians to help in the evaluation of patients presenting with suspected ligament and tendon injuries of the fingers. Modern 3-T MRI scanners with dedicated 16-channel surface hand-and-wrist coils allow high-resolution small-FOV imaging of the fingers. To ensure high-quality images, the scan protocol must be tailored for the finger and must use appropriate imaging planes. For accurate diagnosis, familiarity with finger anatomy and MRI features of common tendon and ligament injuries is essential. In this article, we present our scan protocol, review the MRI anatomy of the fingers, and discuss common tendon and ligament injuries.

3-T MRI Protocol

The study was performed on a 3-T scanner (Skyra, Siemens Healthcare) with a 16-channel hand-and-wrist receiver-only coil (Siemens Hand/Wrist 16 3T Tim coil, model (IT) 104999849). The imaging protocol is summarized in Table 1. The patient is positioned prone with the arm elevated above the head, which places the hand close to the isocenter of the gantry. The imaging planes for axial, coronal, and sagittal acquisitions must be prescribed with respect to the finger rather than the hand (Fig. 1). An adjacent finger should be included within the FOV to allow internal comparison.

Systematic Approach to MRI Interpretation

In our approach, the bones and joints are reviewed first. The bones are evaluated for the presence of fracture, osteomyelitis, osteonecrosis, or neoplasm. The joints are evaluated for the presence of effusion, synovial proliferation, erosions, osteophytes, and articular cartilage abnormalities. Next, the tendons and ligaments are analyzed with special emphasis on the flexor mechanism, extensor mechanism, collateral ligaments, volar plates, and sagittal bands. Finally, the surrounding soft tissues are evaluated for the presence of neoplasms, fluid collections, and neurovascular abnormalities. Because the MRI anatomy of tendons and ligaments is especially complex, we focus on these structures in this review.

Flexor Tendons

The flexor mechanism of the index, middle, ring, and small fingers consists of the flexor digitorum profundus (FDP) and the flexor digitorum superficialis (FDS) tendons. The FDP and FDS muscles flex all the joints that they cross, including the wrist, the metacarpophalangeal joints, and the proximal interphalangeal (PIP) joints. The FDP is the only flexor of the distal interphalangeal (DIP) joint [1, 2].

MRI Anatomy of Flexor Tendons

On MRI, normal flexor tendons have low T1 and low T2 signal. Within the wrist and

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TABLE 1: Scanning Protocol for 3-T MRI of the Fingers

Parameters	Coronal Proton Density Weighted	Axial T1 Weighted	Coronal T1 Weighted	Sagittal T1 Weighted	Axial T2 Weighted	Sagittal T2 Weighted
Type	TSE	SE	TSE	TSE	TSE	TSE
TR/TE	2800/46	400/15	440/15	429/12	3600/57	3800/61
Flip angle (°)	121	90	150	150	120	120
FOV (mm)	100 × 100	60 × 60	100 × 75	137 × 69	60 × 60	100 × 100
Matrix size	320 × 320	320 × 192	448 × 252	448 × 168	320 × 256	320 × 256
Phase oversampling (%)	100	30	100	30	60	100
Phase-encoding direction	Right to left	Anterior to posterior	Right to left	Right to left	Anterior to posterior	Right to left
In-plane resolution (mm)	0.313 × 0.313	0.167 × 0.313	0.223 × 0.298	0.306 × 0.411	0.188 × 0.234	0.313 × 0.391
Thickness/spacing (mm)	2/0.5	3/0.5	2/0.5	2/0.5	3/0.5	2/0.5
No. of slices	21	31	21	19	31	19
Bandwidth (Hertz/pixel)	256	155	228	228	230	230
Turbo factor	9	1	2	2	13	13
Parallel imaging factor ^a	2	Not applicable	2	1	2	2
Averages	1	1	1	2	2	3
Scan time (min:s)	1:51	3:25	1:59	1:37	4:06	3:57

Note—TSE = turbo spin-echo, SE = spin-echo.

^aRefers to generalized autocalibrating partially parallel acquisition factor.

hand, the FDS tendons are located superficially (volar) to the FDP tendons. Within the fingers, the FDS tendons split at the level of the mid diaphysis of the proximal phalanges to allow the FDP tendons to pass superficially. At the level of the PIP joint, the two slips of each FDS tendon reunite deep to the FDP tendon to form the Camper chiasm (Fig. 2 and Video S1, which can be seen in the *AJR* electronic supplement to this article, available at www.ajronline.org). The FDS tendons insert on the middle phalanx (P2), whereas the FDP tendons insert on the distal phalanx (P3) [1, 2]. Each FDS tendon inserts on the volar surface of the mid diaphysis of P2 as two separate slips. Similarly, each FDP tendon inserts on the volar aspect of the proximal diaphysis of P3. The distal portion of the FDP tendon has a median longitudinal groove or furrow on its volar aspect that, in our experience, can appear as two separate slips at its insertion on MRI [3]. The relationship of the FDS and FDP tendons is best revealed by following the tendons on contiguous axial T2-weighted fat-suppressed images or proton density-weighted fat-suppressed images. The insertion of the flexor tendons is best seen on sagittal T2-weighted fat-suppressed or proton density-weighted fat-suppressed images [4, 5].

MRI Anatomy of Pulley System

The flexor tendons of second through fifth fingers are contained within fibroosse-

ous digital sheaths that extend from the distal palm to the distal phalanges. The digital sheaths are lined by parietal synovium, which is reflected on the surface of the tendon as visceral synovium. The pulleys consist of localized thickenings of the digital sheath. The index, middle, ring, and small fingers usually contain five annular (Fig. 3) and three cruciate pulleys [6–8]. The first annular pulley (A1) attaches to the volar plate of the metacarpophalangeal joint and the volar aspect of the base of the proximal phalanx. The second annular pulley (A2) attaches to the volar aspect of the proximal and mid diaphysis of the proximal phalanx. The fourth annular pulley (A4) attaches to the mid diaphysis of the middle phalanx. The third (A3) and fifth (A5) annular pulleys attach to the volar plate of the PIP joint and DIP joint, respectively. The first cruciate pulley (C1) is located between A2 and A3 pulleys immediately proximal to the PIP joint and attach to the volar aspect of the proximal phalanx. The second cruciate pulley (C2) is located between A3 and A4 pulleys immediately distal to the PIP joint. The third cruciate pulley (C3) is located between A4 and A5 pulleys immediately proximal to the DIP joint. The C2 and C3 pulleys attach to the volar aspect of the middle phalanx. The pulleys function to maintain close apposition of the flexor tendons and subjacent bones as well as to help with the flexor tendon tracking during

flexion and extension of the metacarpophalangeal, PIP, and DIP joints. The flexor tendons derive nutrition via synovial diffusion and direct vascular perfusion via vincula tendinum (vincula longa and vincula brevia).

On 3-T MRI, the five annular pulleys are best seen in axial and sagittal planes as small areas of soft-tissue thickening along the volar aspect of the flexor tendons (Fig. 3): A1 is seen along the volar aspect of the metacarpophalangeal joint and base of the proximal phalanx, A2 is seen along the volar aspect of the mid diaphysis of the proximal phalanx, A3 is seen along the volar aspect of the PIP joint, A4 is seen along the volar aspect of the mid diaphysis of the middle phalanx, and A5 is seen along the volar aspect of the DIP joint. The thinner more flexible cruciate pulleys are difficult to visualize on MRI.

Flexor Tendon Injuries

The most common flexor tendon injuries are avulsion injuries and lacerations. The avulsion injuries are usually closed injuries. The FDP tendon is avulsed more commonly than the FDS tendon. FDP tendon avulsions are especially common among rugby or football players who grab the jersey of an opponent (also called jersey finger). The injury results from forced hyperextension at the DIP joint during active finger flexion [9].

The FDP avulsion injuries were originally classified by Leddy and Packer [10] into three

types. The type 1 injury with tendon retraction into the palm (Figs. 4A and 4B) is associated with tear of the vincula blood supply and requires urgent surgical repair. The type 2 injury with tendon retraction to the level of the PIP joint is usually associated with some preserved direct vascular perfusion. Type 3 injuries are avulsion fractures, which prevent tendon retraction proximal to the A4 pulley.

Three additional avulsion types have been described since the original work of Leddy and Packer [10]. Type 4 injuries are the avulsion fractures of the FDP in which the avulsed fracture fragment does not remain attached to the torn FDP tendon. Type 5 injuries are avulsion fractures of the FDP with an extraarticular (type 5a) or intraarticular (type 5b) fracture of the proximal phalanx. Type 6 injuries are open avulsion fractures of the FDP with a lost fracture fragment [11–14].

Flexor Tendon Lacerations

Flexor tendon lacerations are open injuries usually resulting from lacerations of the volar aspect of the hand. Flexor tendon lacerations are classified into five zones [2, 15, 16].

A zone 1 injury involves an FDP tendon laceration distal to the FDS insertion (Fig. 4). The FDP laceration is usually treated with FDP tendon advancement if the distal stump length is less than 1 cm or with tenorrhaphy if the distal stump length is greater than 1 cm [2, 17].

Zone 2 extends from the distal palmar fold (proximal part of the A1 pulley) to the insertion of the FDS tendon. Zone 2 injuries involve FDS and FDP tendons and carry the worst prognosis [14]. Zone 3 extends from the distal margin of the flexor retinaculum to the distal palmar fold. The carpal tunnel corresponds to zone 4. Zone 5 extends from the forearm to the flexor retinaculum [2, 15, 16].

Zone 2 through zone 5 injuries could involve both flexor tendons and the neurovascular bundle. Historically, zone 2 injuries were considered surgically irreparable. In current practice, primary surgical repair (within 24 hours) is preferred for injury in any of the five zones. Emergency repair is indicated when there are associated neurovascular bundle injuries [2, 17–20].

MRI of Flexor Tendon Injuries

On T2-weighted fat-suppressed and proton density-weighted fat-suppressed sequences, flexor tendon tears are seen as fluid signal at the site of the tear (Fig. 4). On T1-weighted sequences, flexor tendon tears are

seen as intermediate or low signal, although associated hemorrhage may show increased signal. Avulsion fractures are seen as focal areas of cortical discontinuity at the site of the tendon insertion and associated edema in the underlying bone marrow. Large avulsion fragments are relatively easy to identify because of the increased T1 signal from fatty marrow. Small cortical avulsions, with decreased T1 and T2 signal, are more difficult to identify and may be better seen on conventional radiographs or CT.

Flexor tendon tears may have associated tenosynovitis. When it is chronic, flexor tenosynovitis may lead to thickening of the digital sheath and pulleys and present with clinical findings of trigger finger [21] (Fig. 5).

MRI allows diagnosis of complete or partial tendon tears, helps determine the location of the tears and the degree of tendon retraction (Fig. 4), and helps exclude any associated avulsion fractures or other injuries. For these reasons, MRI is often used to classify and optimally manage these injuries.

Pulley Injuries

Pulley injuries are most commonly seen in rock climbers. Rock climbing commonly involves flexion of the metacarpophalangeal and PIP joints and extension of the DIP joints, which places high stress on the pulleys and can result in complete or partial tears. The A2 pulley of the ring finger is the most commonly injured pulley [22–26].

Pulley Injuries on MRI

On 3-T MR images, complete tears of the annular pulleys may be visualized directly as a focal discontinuity of the pulley fibers. In the absence of direct visualization, pulley tears may be suspected when bowstringing of the flexor tendon is present. Bowstringing is seen as an increased gap between the flexor tendon and the volar surface of the phalanx. The longitudinal extent and degree of the bowstringing is related to the number of pulleys torn and the finger position during imaging. The bowstringing increases with forced flexion. In a cadaveric study, Hauger et al. [8] reported a gap of 2–5 mm with complete tears of a single pulley, increasing to a gap of 5–8 mm with tears of multiple contiguous pulleys in forced flexion. It is important to recognize that partial pulley tears may not result in bowstringing [8]. Additional indirect findings of pulley injuries include edema superficial and deep to the pulley and fluid within the tendon sheath [27].

Extensor Mechanism

The extensor mechanism of the index, middle, ring, and small fingers consists of extrinsic extensor tendons, which receive contributions from intrinsic extensor tendons [1, 28]. The extrinsic tendons originate within the forearm and include tendons of the extensor digitorum communis (EDC), extensor indexes proprius (EIP), and extensor digiti quinti minimi. The EDC tendon runs through the fourth extensor compartment and provides tendon slips to the index through small fingers. The EIP tendon runs through the fourth extensor compartment along with the EDC tendon and inserts on the index finger. The extensor digiti quinti minimi tendon runs through the fifth extensor compartment and inserts on the small finger. There is considerable anatomic variation in the extensor tendons [29–33]. In the most common pattern, there is one EIP tendon to the index finger inserting on the ulnar aspect of the EDC tendon, one EDC tendon to the middle finger, two EDC tendons to the ring finger, no EDC tendon to the small finger, and two extensor digiti quinti minimi tendons to the small finger [32]. The primary function of the extrinsic extensor tendons is extension of the metacarpophalangeal, PIP, and DIP joints [1, 28].

The intrinsic extensor tendons arise from the interosseous and lumbrical muscles. There are four lumbrical muscles, three palmar interosseous muscles, and four dorsal interosseous muscles. The lumbrical tendons cross the metacarpophalangeal joint on the volar aspect of the deep transverse metacarpal ligament along the radial aspect of the finger. The interosseous tendons cross the metacarpophalangeal joints on the dorsal aspect of the deep transverse metacarpal ligament (Video S1). The intrinsic tendons insert on the radial or ulnar side of the proximal phalanx via the medial band and on the dorsal digital expansion as the lateral band. The primary function of the intrinsic extensor tendons is flexion of the metacarpophalangeal joints and extension of the PIP and DIP joints [34].

MRI Anatomy of Extensor Mechanism

Immediately distal to the metacarpophalangeal joint, the EDC tendon to each digit trifurcates into the central slip and two lateral slips. On sagittal MR images, the central slip is seen to insert on the dorsal aspect of the base of the middle phalanx (P2) (Fig. 6A). The lateral slips merge with the lateral bands (Fig. 6B) of the intrinsic tendons to form the

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conjoint lateral bands. The conjoint lateral bands are visualized on T1- and T2-weighted images as hypointense structures along the dorsolateral aspect of the middle phalanx. The conjoint tendons converge over the dorsum of P2 to form the terminal tendon. The terminal tendon inserts on the dorsal aspect of the base of the distal phalanx (P3) (Fig. 6A).

The triangular ligament connects the conjoint tendons over the dorsum of P2 to prevent palmar subluxation during PIP joint flexion. Thin retinacular ligaments attach the conjoint lateral tendon to the flexor tendon sheath and prevent dorsal subluxation during PIP joint extension. The triangular and retinacular ligaments are not well visualized on MRI. The complex anatomic arrangement of the aponeurotic extensor tendon over the dorsum of the proximal phalanx is referred to as digital extensor expansion or extensor hood.

The sagittal bands are a part of the extensor retinacular system, which forms a closed cylindric tube around the metacarpal head and the metacarpophalangeal joints. The sagittal bands are the primary lateral stabilizer of the extensor digitorum tendon at the metacarpophalangeal joint.

On MR images, the sagittal bands extend from the radial and ulnar margins of the extensor tendon to the volar plate (Fig. 7A). On T1- and T2-weighted axial images, sagittal bands are seen as hypointense tissue extending circumferentially around the metacarpophalangeal joints, from the extensor tendon to the volar plate.

The complex anatomy of the extensor mechanism is summarized on a schematic diagram (Fig. 6C) and can be seen in Videos S1 and S2.

Extensor Mechanism Injuries

Extensor tendon injuries are relatively common and are classified into nine zones [28, 35–37]. Zone 1 injuries, which occur at the DIP joint, are most common. Forced flexion at the DIP joint, while the PIP joint is extended, produces an avulsion injury of the terminal extensor tendon, with or without a small avulsion fracture, also known as *mallet finger*.

Zone 2 injuries, which occur at the level of the middle phalanx, result in injuries to the triangular ligament and/or the lateral bands. If only one lateral band is injured, treatment is usually conservative, because DIP extension can still be achieved; however, if the triangular ligament and both lateral bands are torn, surgical repair is often required [28].

Zone 3 injuries, which occur at the level of the PIP joint, result in tears of the central slip

and may be associated with an avulsion fracture or an injury to the lateral bands. Patients commonly present with a *boutonniere* deformity (Fig. 8), with flexion at the PIP joint and hyperextension at the DIP joint. Most of the injuries are treated with splinting. Open injuries, displaced avulsion fractures of the middle phalanx, and PIP joint instability may require surgical treatment [36, 37].

Zone 4 injuries, which occur at the level of the proximal phalanx, can result in injuries to the central slip, the lateral slips, the medial bands, and the extensor hood. Most commonly, these are caused by dorsal lacerations and are usually associated with partial tendon tears. In general, extensor tears involving greater than 50% tendon thickness are usually repaired surgically [36, 37].

Zone 5 injuries, which occur at the level of the metacarpophalangeal joint, involve the sagittal band and extrinsic extensor tendon. Most commonly, these are caused by human bite wounds and usually involve the dominant second metacarpophalangeal joint from striking the teeth with a clenched fist. These injuries are often open injuries and can result in partial or complete tendon tears [34]. These are usually associated with tear of the metacarpophalangeal joint capsule and may eventually lead to a septic arthritis at the metacarpophalangeal joint [36, 37].

Sagittal band injuries are usually closed injuries resulting from resisting finger extension or direct trauma. Sagittal band injuries most commonly involve the radial sagittal band of the middle or the ring finger. Sagittal band injuries are classified into three types [38]. Type 1 injuries are contusions without tear or instability. Type 2 injuries are tears associated with extensor tendon snapping, without complete tendon dislocation (Fig. 7B). Type 3 injuries are associated with tendon dislocation into the intermetacarpal groove.

A discussion of zone 6 through zone 9 injuries is beyond the scope of this article.

MRI of Extensor Injuries

MRI evaluation of the extensor mechanism should focus on the terminal tendon, lateral bands, and central slip. Description of the extent of the tear ($\leq 50\%$ or $> 50\%$) should be included. If present, avulsion fractures should be noted, including fracture size and amount of articular surface involvement.

Finger Ligaments

The most important ligamentous structures of the index, middle, ring, and small

fingers are the collateral ligaments, the volar plates, and the sagittal bands [39–42]. The collateral ligaments are the main stabilizers of the metacarpophalangeal, PIP, and DIP joints. There are two proper collateral ligaments (radial and ulnar collateral ligaments) and two accessory collateral ligaments per joint. The volar plates are quadrangular-shaped fibrocartilaginous structures present at the metacarpophalangeal, PIP, and DIP joints. The volar plates are firmly attached to the volar aspect of the proximal, middle, and distal phalanges. The volar plates are also attached to the collateral and the accessory collateral ligaments [43]. At the metacarpophalangeal joint, the volar plates attach to the deep transverse metacarpal ligaments and the sagittal bands.

MRI Anatomy of Collateral Ligaments

On 3-T MR images, the collateral ligaments of the metacarpophalangeal, PIP, and DIP joints are seen along the radial and ulnar margins of the joints (Fig. 9). The proper collateral ligaments of the metacarpophalangeal joints attach proximally to the posterior tubercle and adjacent depression on the side of the metacarpal head [44, 45]. Similarly, the proper collateral ligaments of the PIP and DIP joints attach proximally to the concave area on lateral aspect of the proximal and middle phalanx head, respectively. The proper collateral ligaments of the metacarpophalangeal, PIP, and DIP joints course distally in a slightly oblique course to attach to the volar one third of the base of the proximal, middle, and distal phalanx, respectively. The distal attachment is slightly broader than the proximal attachment.

The proximal attachment of accessory collateral ligaments of the metacarpophalangeal, PIP, and DIP joints is volar to the respective proper collateral ligament. The accessory collateral ligaments fan out distally and volarly and attach to the volar plate. The proper collateral ligaments are taut in flexion, and accessory collateral ligaments are taut in extension.

MRI Anatomy of Volar Plates

On MRI, the volar plates consist of a relatively thick fibrocartilaginous portion distally and a thinner membranous portion more proximally. The thinner proximal margin of the volar plate merges with the volar periosteum (Fig. 10). At the PIP joints, there are thin proximal expansions on either side of the volar plate called *checkrein* or *check lig-*

aments. These attach to the volar surface of the proximal phalanx. The checkrein ligaments are not well seen on MRI.

Finger Ligament Injuries

The most common ligament injuries of the finger occur at the PIP joint, ranging in severity from a sprain to a fracture-dislocation [39]. The PIP joint can dislocate in dorsal, volar, or lateral directions. Dorsal dislocations are often associated with volar plate tears and may be associated with avulsion fractures (44% in one series) [46]. If a fracture fragment is large, involving greater than 40% of the volar articular surface, it can result in an unstable fracture-dislocation. In these injuries, the collateral ligaments remain attached to the volar fracture fragment as the middle phalanx dislocates dorsally [39]. Less often, dorsal dislocations become irreducible because of tears of the proximal attachment of the volar plate and intraarticular entrapment of the volar plate fibers [47]. Lateral dislocations are often associated with collateral ligament tears and at least partial tears of the volar plate. Rarely, entrapment of the collateral ligament results in an irreducible dislocation. Volar PIP joint dislocations can produce a tear of the central slip or entrapment of the condyle between the central slip and the lateral band [39]. Dislocations of the DIP joints are relatively uncommon because of greater stability.

Dislocations and associated ligament injuries of the metacarpophalangeal joints are also less common; however, they do occasionally occur in the dorsal direction. Dorsal dislocations result from a hyperextension injury and most commonly involve the index finger. In this injury, the volar plate usually tears at the proximal attachment and may get trapped in the joint preventing reduction. With dorsal subluxations, the metacarpophalangeal joint may be locked in hyperextension, without entrapment of the torn volar plate [39].

MRI of Finger Ligament Injuries

On MRI, collateral ligament tears are typically seen at their proximal attachment (Figs. 9B and 9C). In contrast, volar plate tears typically involve their distal attachment (Fig. 10C). Forced ulnar deviation at the metacarpophalangeal joint may result in isolated tears of the radial collateral ligament (Fig. 9B). Isolated tears of the ulnar collateral ligaments at the metacarpophalangeal joint are relatively rare [48, 49]. Sagittal band tears may be associated with extensor tendon dislocation.

Conclusion

Ligament and tendon finger injuries are extremely common. Anatomic detail provided by 3-T MRI can determine the extent of these injuries. A fundamental knowledge of finger anatomy and abnormalities, in concert with high-resolution MRI, can lead to an appropriate diagnosis and optimal patient management.

Acknowledgments

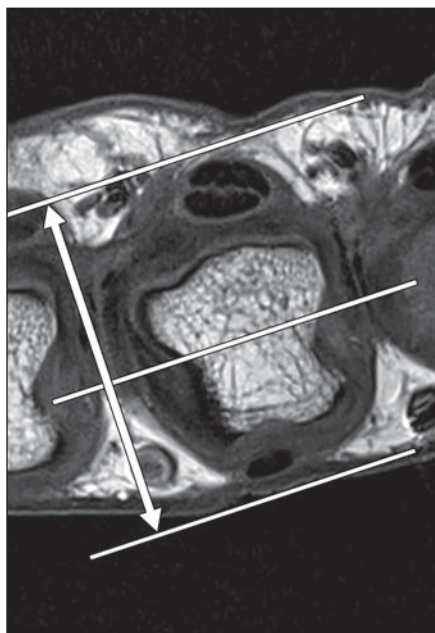
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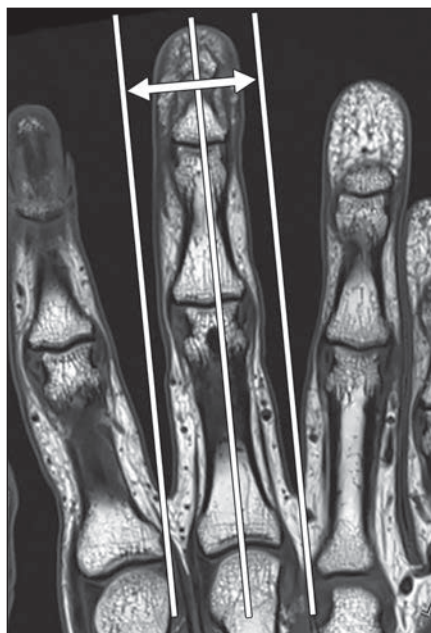
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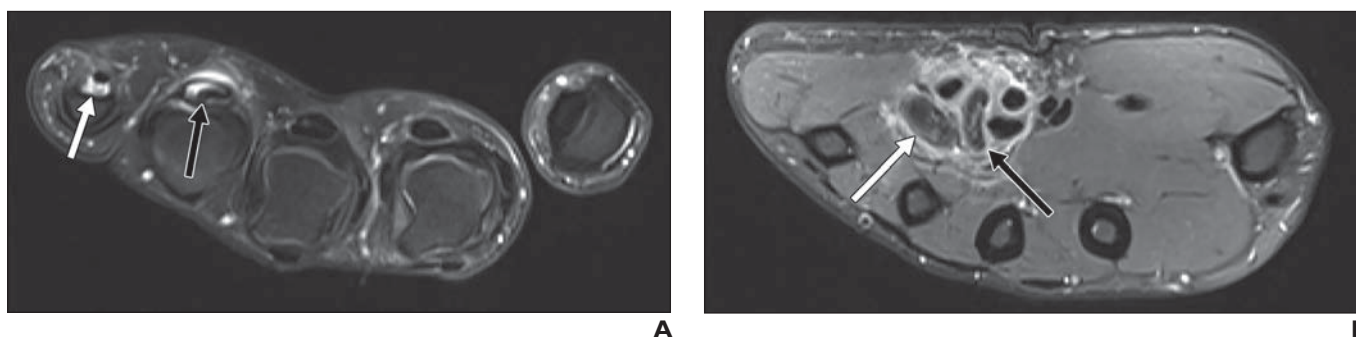
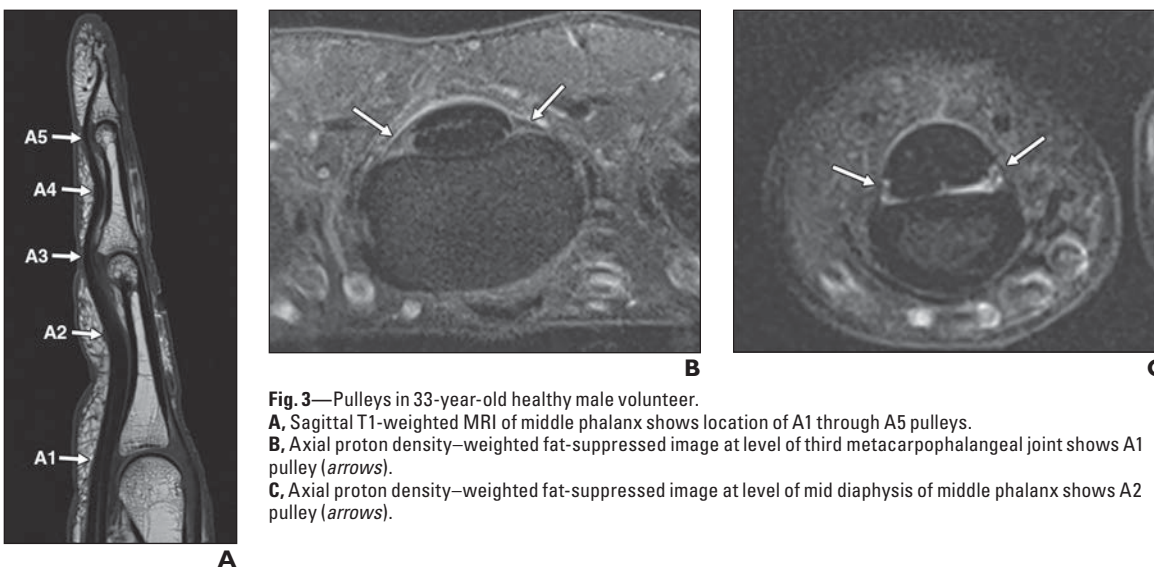
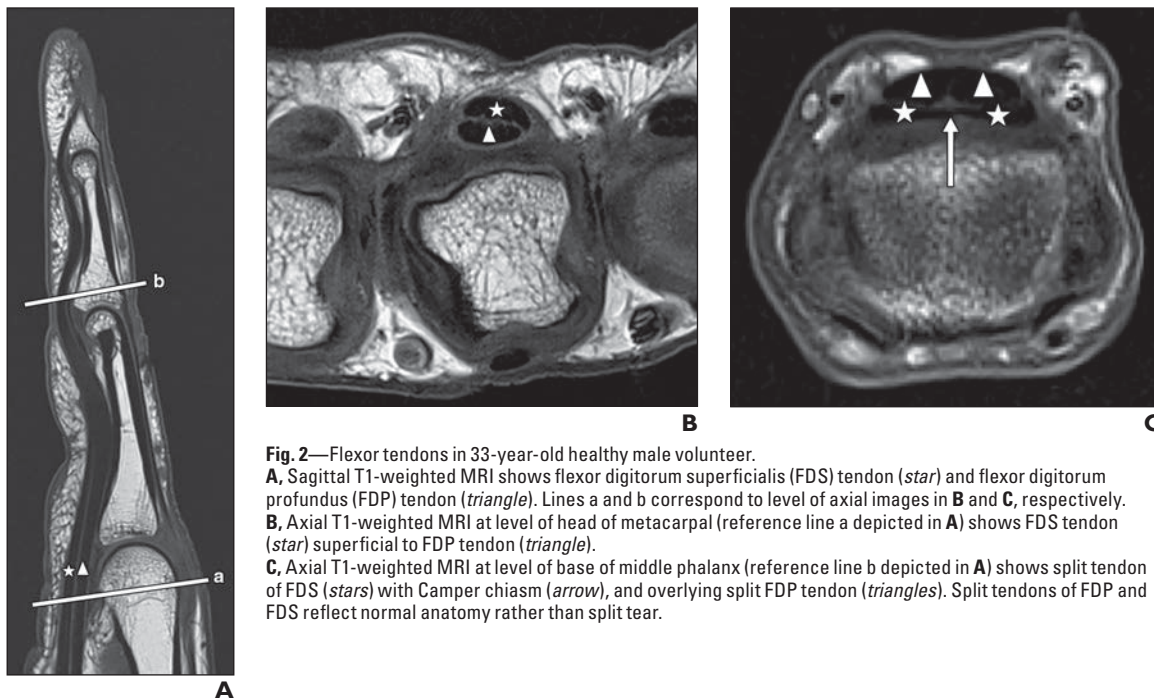
A



B

Fig. 1—MRI scanning planes for 33-year-old healthy male volunteer.

A, Axial T1-weighted MRI shows scan lines for coronal imaging plane (double-ended arrow).
B, Coronal T1-weighted MRI shows scan lines for sagittal imaging plane (double-ended arrow).



(Fig. 4 continues on next page)



Fig. 4 (continued)—Two patients with zone 1 injuries.
C, 20-year-old man with right ring finger injury (zone 1 injury) sustained while playing flag football. Coronal proton density-weighted fat-suppressed image shows torn and retracted tendon of flexor digitorum profundus to level of mid diaphysis of proximal phalanx (arrow).



Fig. 5—63-year-old man with right middle trigger finger. Sagittal T2-weighted fat-suppressed image shows flexor tenosynovitis with thickening of A1 (arrow) and A2 (arrowheads) pulleys.

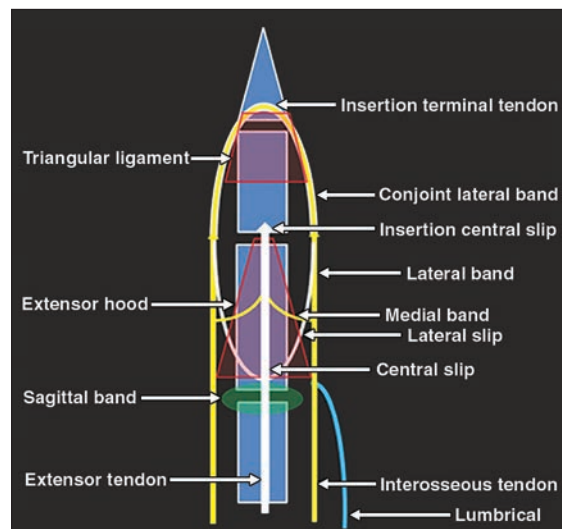
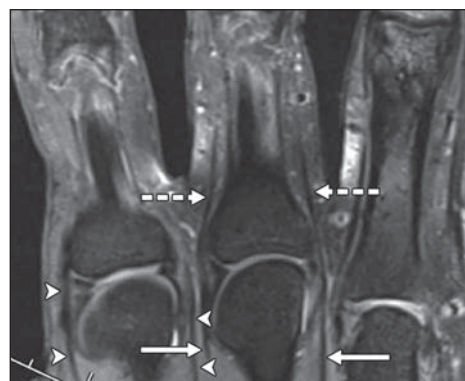
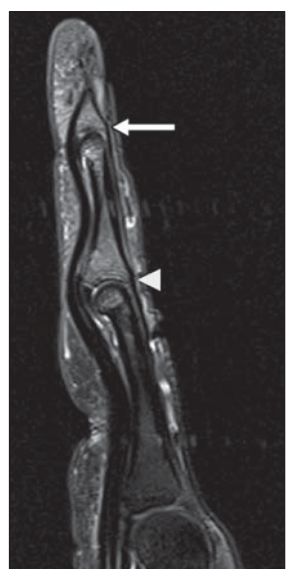


Fig. 6—Extensor mechanism in 33-year-old healthy male volunteer.

A, Sagittal T2-weighted fat-suppressed image shows normal central slip insertion (arrowhead) to dorsal aspect of base of middle phalanx and terminal tendon insertion (arrow) to dorsal aspect of base of distal phalanx.

B, Coronal proton density-weighted fat-suppressed image shows interosseous tendons for index (arrowheads) and middle (solid arrows) fingers, and lateral bands (dashed arrows) for middle finger.

C, Schematic diagram of extensor mechanism of finger. (Illustration by Gupta P)

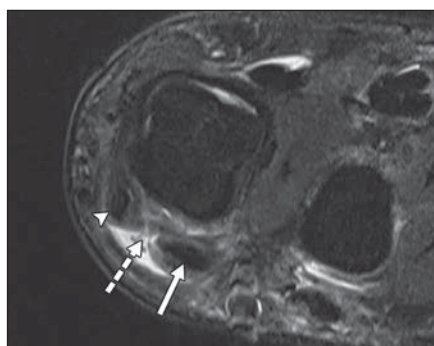
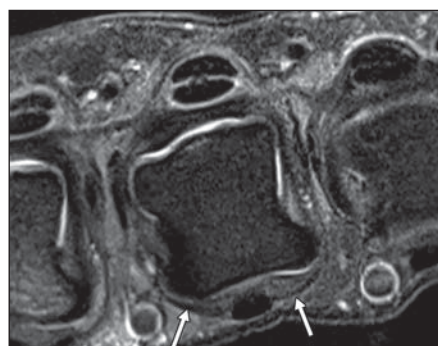


Fig. 7—Sagittal bands.

A, 33-year-old healthy male volunteer. Axial proton density-weighted fat-suppressed image at level of third metacarpal head shows normal sagittal bands (arrows).

B, 21-year-old male football player with right fifth finger injury (jammed right hand between helmet and pad). Axial T2-weighted fat-suppressed image at level of fifth metacarpophalangeal joint shows tear of sagittal band (dashed arrow) between extensor digitorum (solid arrow) and extensor digiti minimi (arrowhead) tendons.



Fig. 8—20-year-old woman with left fifth finger injury sustained while playing basketball. Sagittal T1-weighted image shows tear of extensor tendon central slip (arrow) with boutonniere deformity and volar subluxation of middle phalanx at proximal interphalangeal joint.

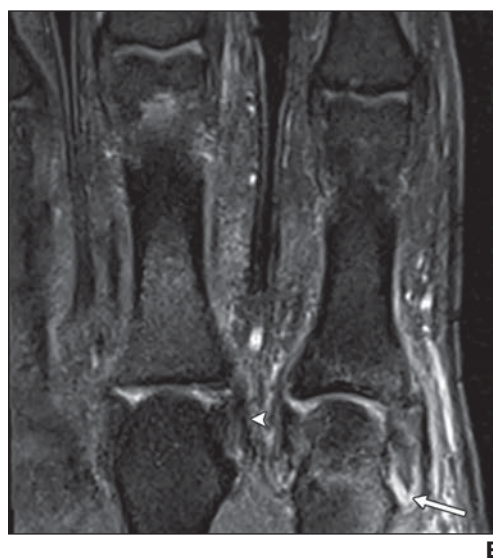
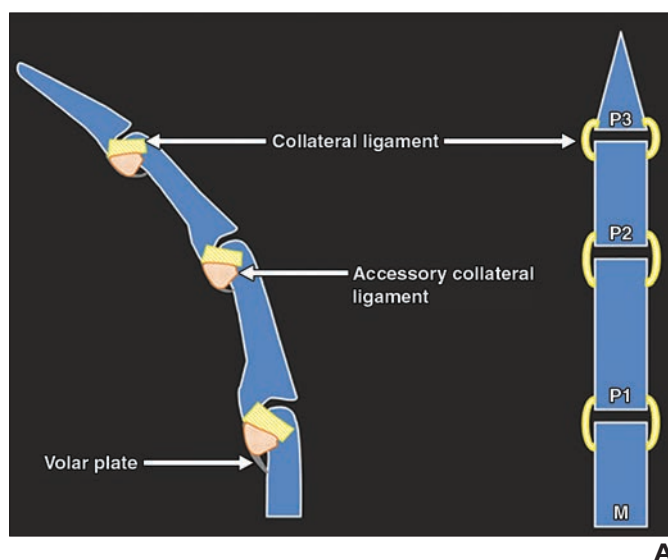


Fig. 9—Collateral ligaments.

A, Schematic diagram shows collateral ligaments (proper) and accessory collateral ligaments of metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints. M = metacarpal, P1 = proximal phalanx, P2 = middle phalanx, P3 = distal phalanx. (Illustration by Gupta P)

B, 43-year-old man with right index finger injury sustained while starting chain saw. Cord recoiled, causing index finger to snap back. Coronal proton density-weighted fat-suppressed image shows tear of radial collateral ligament at attachment to metacarpal head (arrow). Normal radial collateral ligament of third metacarpophalangeal joint is shown by arrowhead.

C, 37-year-old woman with chronic left ring finger pain and no known trauma. Coronal T2-weighted fat-suppressed image shows partial tear of radial collateral ligament of ring finger proximal interphalangeal joint at proximal attachment (arrow). Arrowhead shows normal radial collateral ligament of middle finger.

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Fig. 10—Volar plate.

A, 33-year-old healthy male volunteer. Sagittal T2-weighted fat-suppressed image shows normal volar plate (*arrow*) of third metacarpophalangeal joint with distal attachment to volar base of middle phalanx and proximal attachment to metacarpal neck with small volar recess.

B, 33-year-old healthy male volunteer. Axial proton density-weighted fat-suppressed image at level of third metacarpal head shows attachment of sagittal band (*black arrows*), accessory collateral ligament (*arrowhead*), and deep transverse metacarpal ligament (*white arrow*) to volar plate (*star*).

C, 22-year-old man with left ring finger pain secondary to injury sustained while playing football. Sagittal T2-weighted fat-suppressed image shows tear of proximal interphalangeal joint volar plate at distal attachment to base of middle phalanx. Torn volar plate is retracted to level of metacarpal neck (*arrow*).

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