An Introduction to wrist and hand MSK ultrasound

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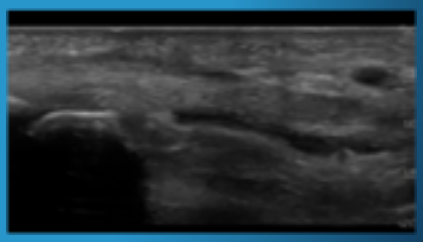
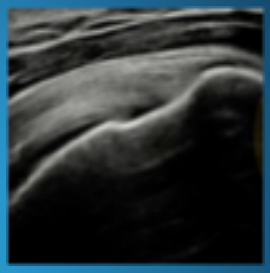
What is musculoskeletal ultrasound?

- Use of high-frequency sound waves to visualise musculoskeletal soft tissue structures.
- Broad spectrum of use – multiple joints and structures can be visualised.
- Two core views of structures – longitudinal and transverse.
- Technically challenging skill – complex anatomy and probe manipulation.
- Excellent resolution of superficial musculoskeletal structures.
- Can dynamically evaluate structures - link to the clinical picture!



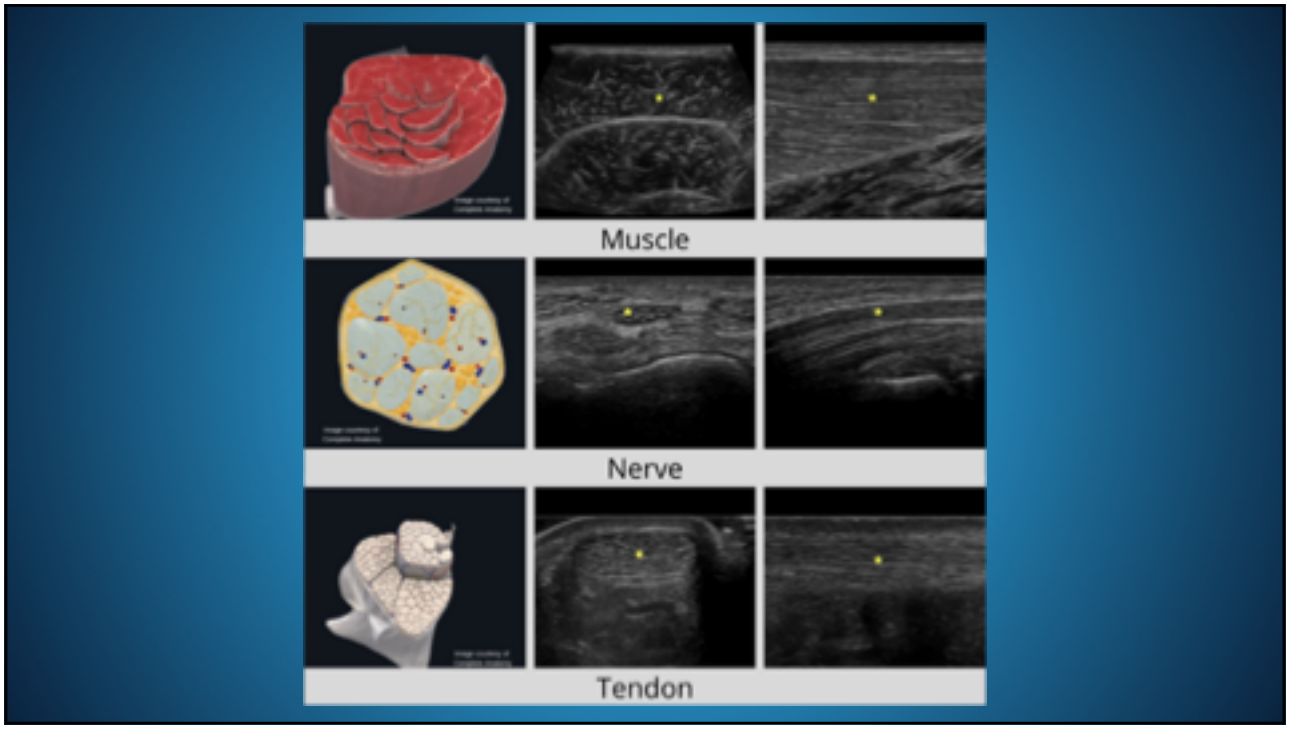
Clinical roles + MSK ultrasound imaging

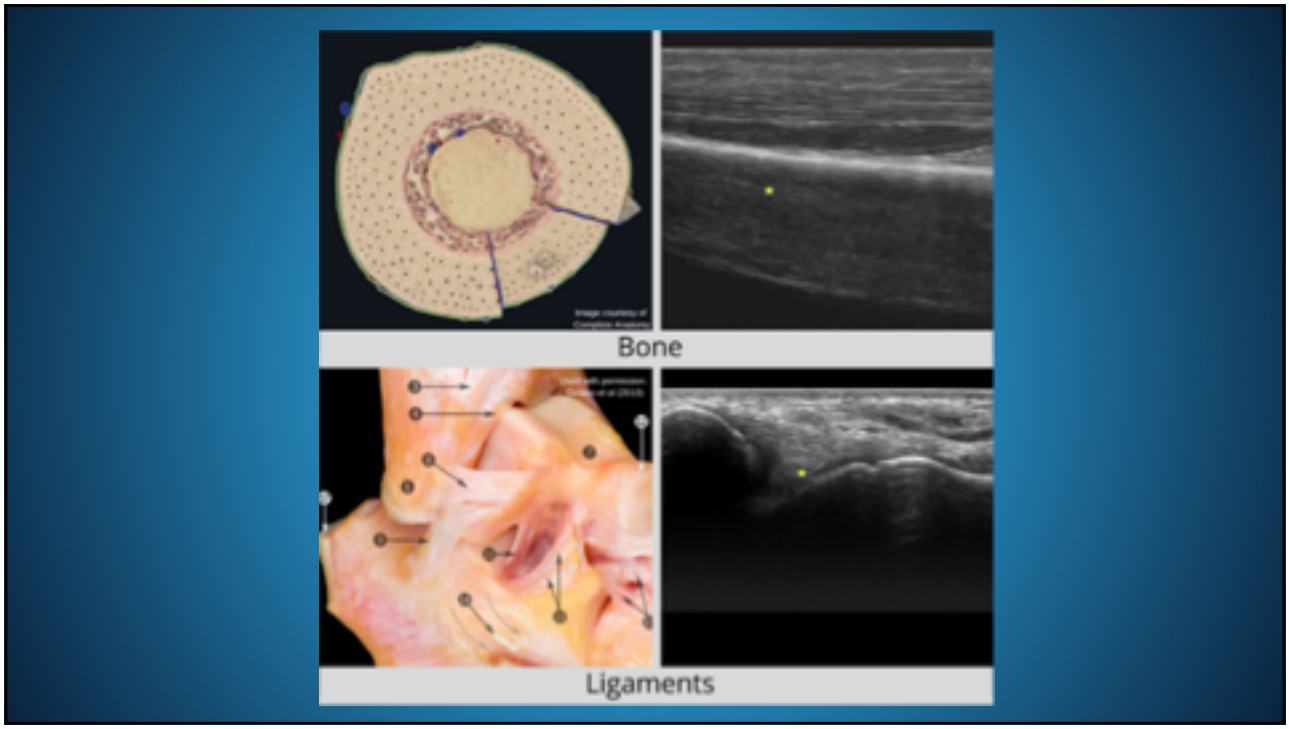
- Integrated **within** the clinical assessment.
- **NOT** a standalone diagnostic investigation.
- Can be used to support the clinical reasoning process.
- Opportunity to enhance patient pathways.



#keepitrelevant

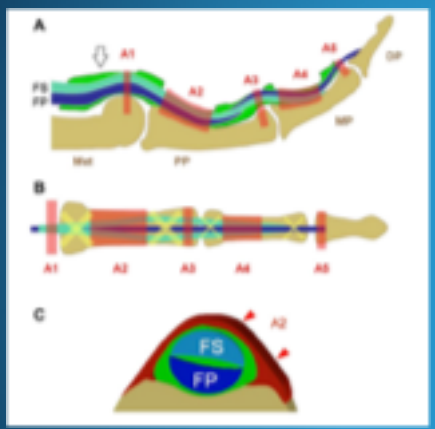
Probe skills…Anisotropy…


Muscle
Nerve
Tendon


Bone
Ligaments

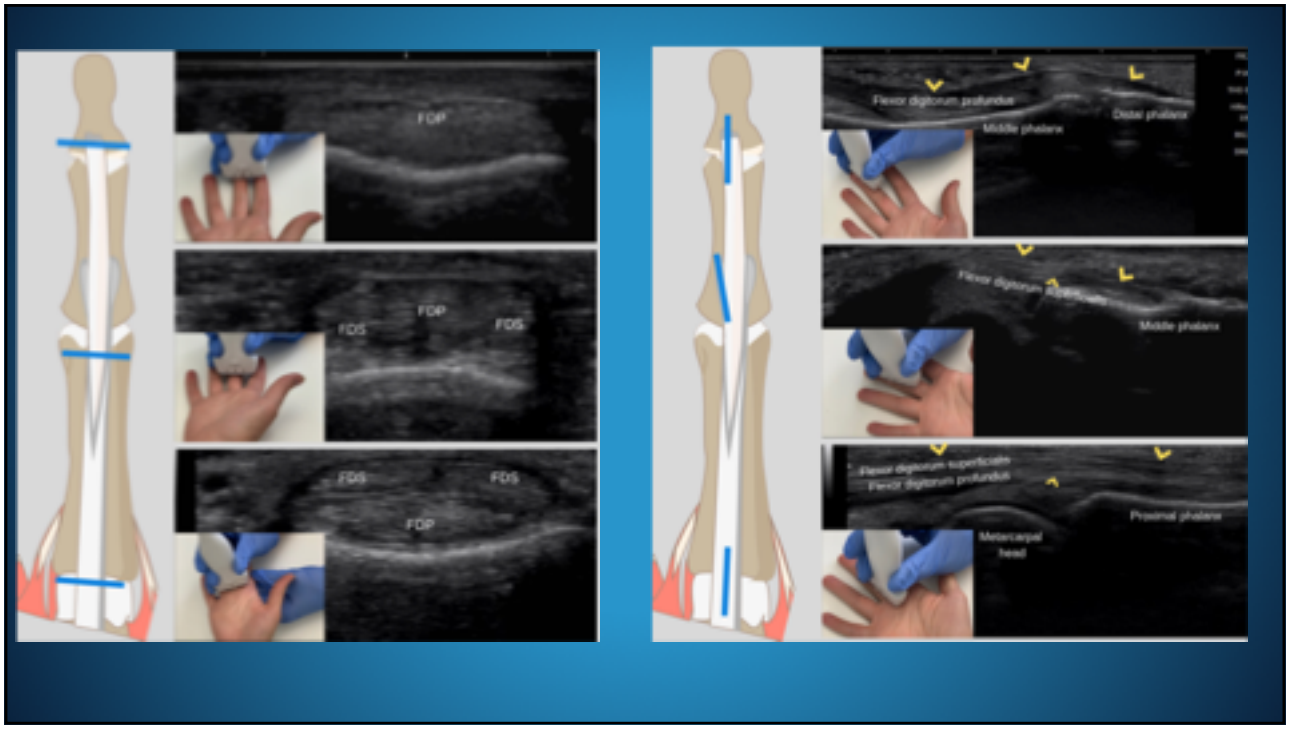
The hand

Flexor tendon anatomy



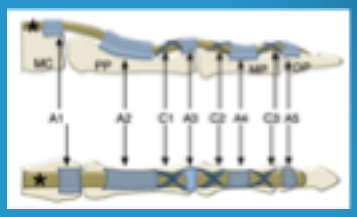
Each of the four digits has two flexor tendons, the flexor digitorum superficialis (FDS) and profundus (FDP).

At the base of the proximal phalanx, the tendon of the FDS divides into two slips that pass on either side of the FDP tendon to reach its deep face and insert into the middle phalanx. After crossing the superficialis, the FDP continues its straight course and inserts into the base of the distal phalanx.

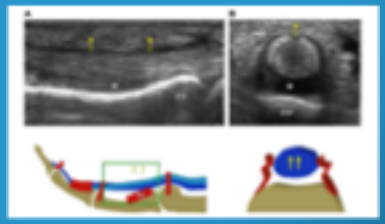


Flexor pulley system

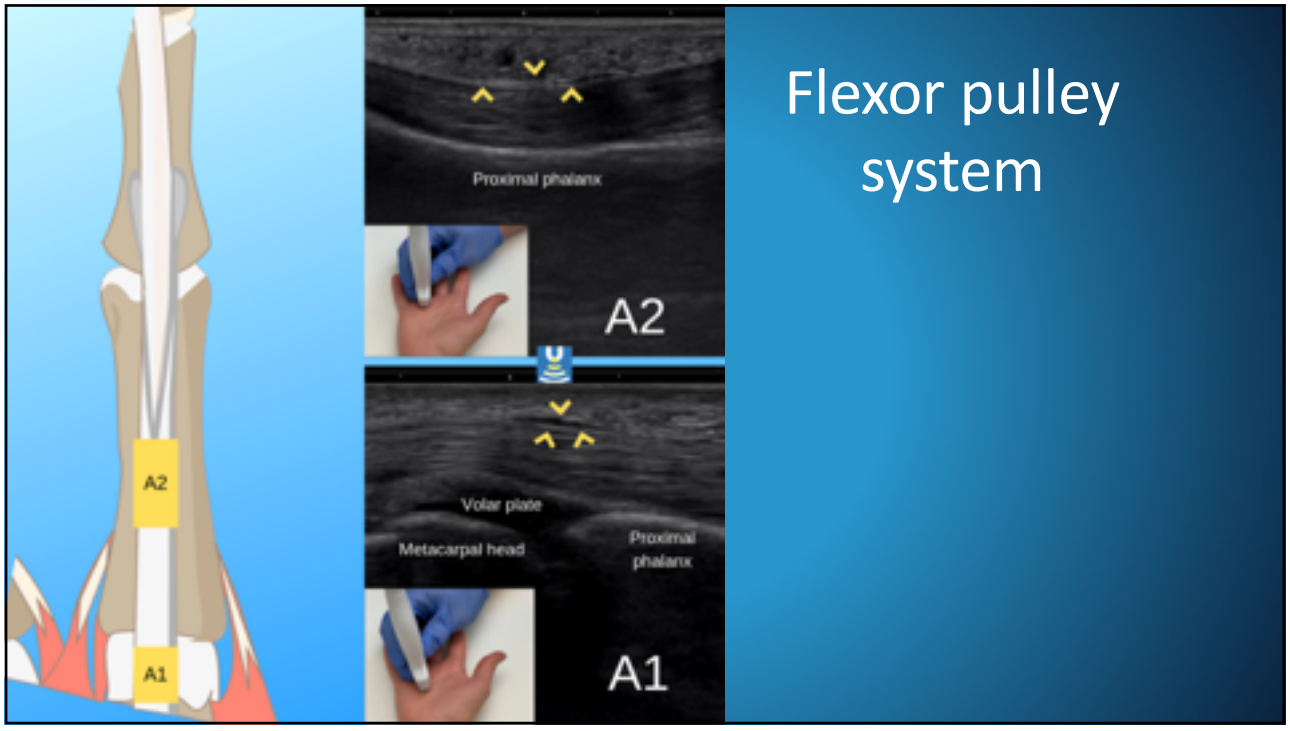
A series of retinacular structures in which the sheath is thickened at five specific points, form the annular pulley system (pulleys A1-A5), while another three form the cruciate pulley system (pulleys C1-C3).



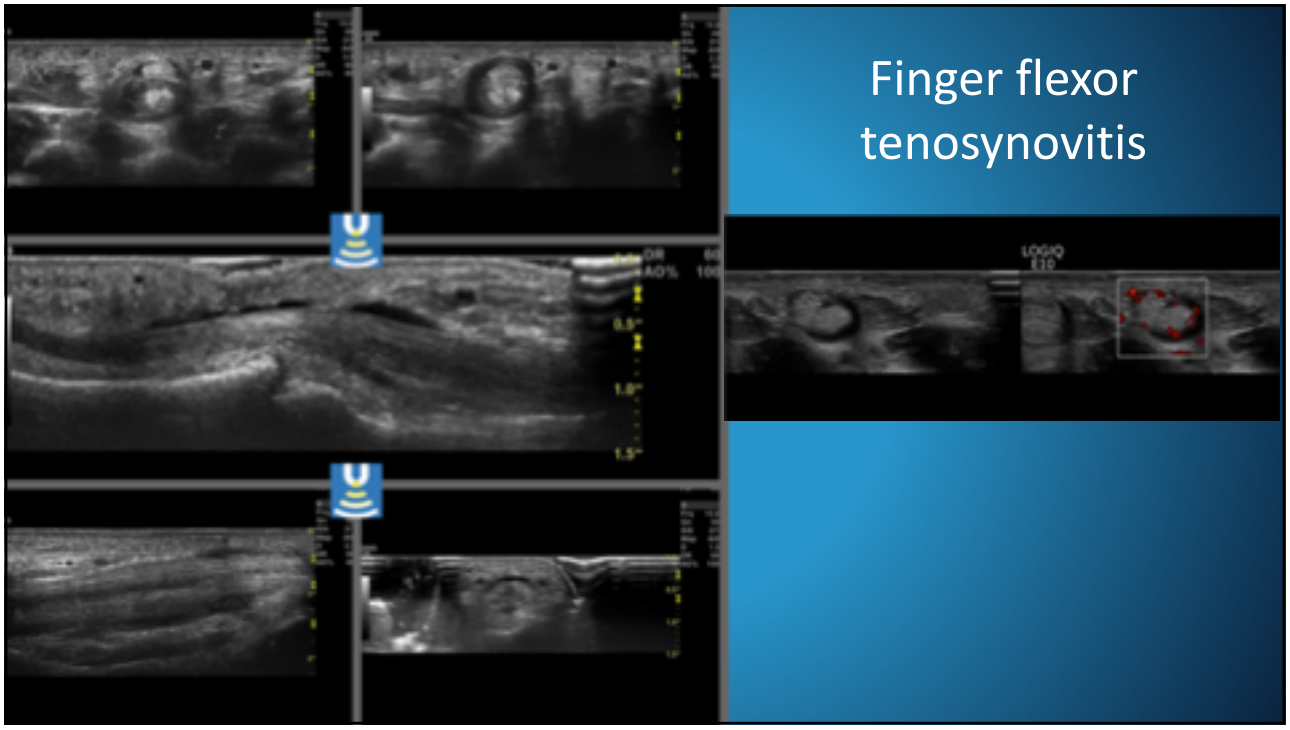
These pulleys prevent excursion of the flexor tendons from the MCP and IP joints during finger flexion.



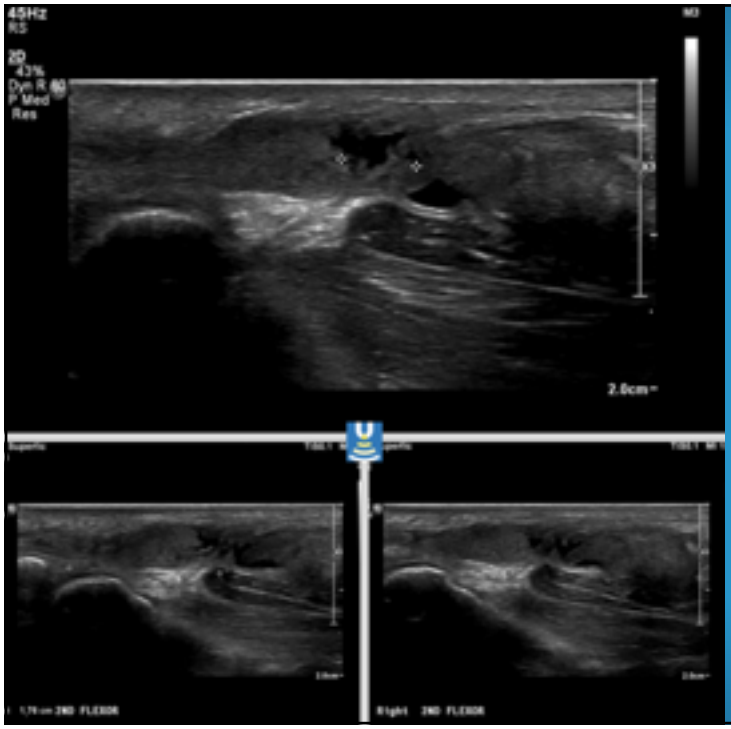
Injuries - They most commonly involve the ring and middle fingers, commonly climbers.



Flexor pulley system



Finger flexor tenosynovitis



Ruptured flexor tendon

Extensor mechanism of the hand

Covering:

Saggital band evaluation

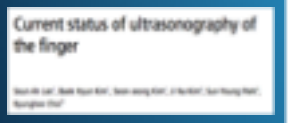
Extensor tendon anatomy and evaluation under ultrasound

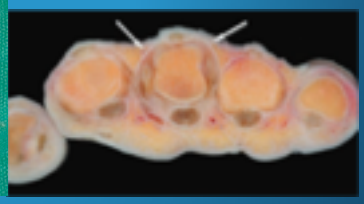
Zones I, II, III, IV and V

The dorsal hood and saggital bands

The dorsal hood or extensor hood is a retinacular system that stabilises the extensor tendon at the dorsal aspect of the metacarpophalangeal joint (MCP) aiding to keep the extensor tendon in place during flexion and extension.

The sagittal bands run circumferentially around the MCP joint and insert ventrally on the palmar plate and the deep transverse metacarpal ligament.



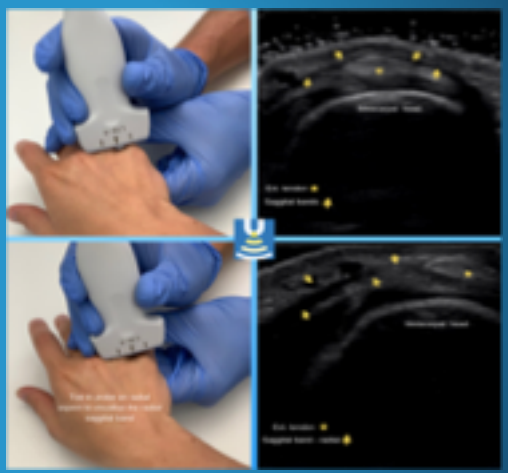


Ultrasound evaluation

The sagittal bands are easily visualised in the transverse plane at ultrasound imaging. They present as hypoechoic bands on both sides of the extensor tendon at the level of the metacarpophalangeal joint.

The superficial layer of the SB runs over the extensor tendons. Together with a layer running under the tendons, the superficial layer forms a tunnel in which the extensor digitorum tendons are located.

Dynamic evaluation of the position of the extensor tendon during MCPJ flexion.



Saggital band injury – what to look for?

US demonstrates irregular thickening of the abnormal sagittal band with hypoechoogenicity.

Ruptures of the sagittal bands are reported to occur spontaneously or in association with metacarpophalangeal joint trauma such as boxer knuckle. They have also been reported with synovial disorders such as rheumatoid arthritis and psoriasis

Frequent site of disruption is the radial sagittal band, such that the extensor tendon dislocates in an ulnar direction

Lee et al (2016) Current status of ultrasonography of the finger, Ultrasonography ,35:110-123.

Extensor tendon anatomy

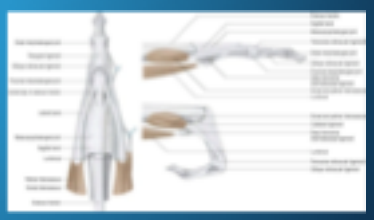
More complex than the flexor system

Thin superficial structures not contained within a synovial sheath.

$4^{th}/5^{th}$ divide, sending slips to adjacent fingers.
Intra-tendinous bands between the 2^{nd} and 3^{rd} fingers

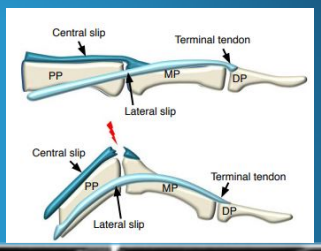
Divide into 3 slips:

- Central tendon slip – inserts onto base of the middle phalanx.
- Lateral tendons x2 , pass on each side of the central slip to insert onto the base of the distal phalanx.



Extensor tendon injuries – Part I

- Boutonniere deformity
  - The mechanisms underlying Boutonnière deformity include acute violent flexion of the PIP joint, a blow to the dorsum of the middle phalanx, or volar dislocation of the PIP joint.
  - Central slip of the injured extensor tendon demonstrates a lack of tendon echoes that would indicate insertion into the middle phalangeal base



Lee et al (2016) Current status of ultrasonography of the finger, Ultrasonography ,35:110-123.

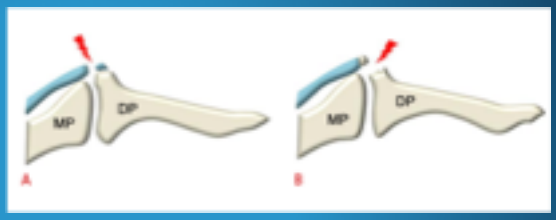
Extensor tendon injuries – Part II

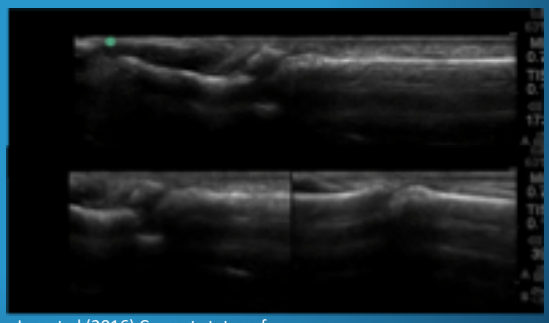
Mallet finger

Distal interphalangeal (DIP) joint is abruptly forced into extreme flexion, at which time the tendon may pull off a piece of bone.

The clinical symptoms of mallet finger include pain, swelling, and inability to extend the DIP.

Irregular hypoechoic soft tissue lesion is usually present over the distal shaft of the middle phalanx representing the retracted tendon. Also, note avulsion.



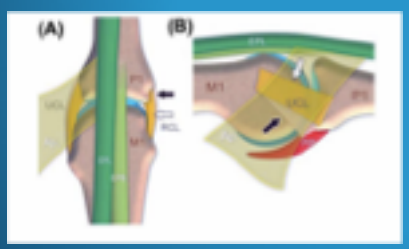


Lee et al (2016) Current status of ultrasonography of the finger, Ultrasonography ,35:110-123.

Ultrasound evaluation

Ulnar collateral ligament (UCL)

- The UCL arises from the distal first metacarpal lateral tubercle and attaches on the medial tubercle of the proximal phalanx, typically measuring 4–8 mm in width and 12–14 mm in length. The ulnar collateral ligament may be subdivided into 'Proper' and 'Accessory' UCL with additional UCL fibers inserting on the volar plate, a fibrous supporting structure, and other fibers contributing to dorsal support of the extensor pollicis longus tendon. (Melville et al, 2013)



Draghi et al (2018) Injuries to the collateral ligaments of the Metacarpophalangeal and Interphalangeal Joints: Sonographic Appearance, Journal of Ultrasound in medicine.

Clinical examination of the UCL

Injuries to the UCL occur when a forced abduction accompanied by varying degrees of hyperextension is applied to the thumb MCP joint.

End feel?
Key is block radial side.

More than 35 degrees during valgus stress with the MCP in extension, more than 20◦ in extension and/or more than a 15◦ difference compared to the contralateral side is commonly agreed upon.

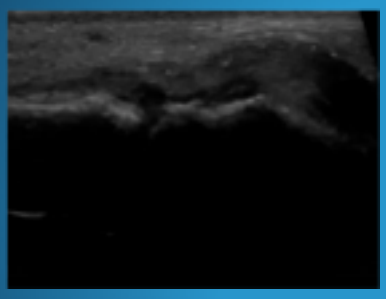
Ultrasound appearances

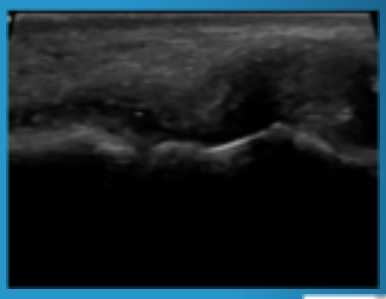
- Normal UCL is a linear echogenic structure spanning the MCP joint.
- Overlying subcutaneous tissues are very echogenic, the normal UCL may appear relatively hypoechoic compared to these superficial soft tissues; however, compact linear ligament fibers should still be identified.
- Segments of the UCL can appear hypoechoic when not imaged perpendicular to the sound beam from anisotropy similar to other ligaments.
- The UCL is covered by the adductor pollicis aponeurosis, which is composed of transverse and oblique fibers from the tendon of the adductor pollicis muscle and extensor hood of the thumb .

- Sonographically, the adductor aponeurosis appears as a thin and uniform echogenic band overlying the UCL, which may also appear slightly hypoechoic relative to the overlying echogenic connective tissue

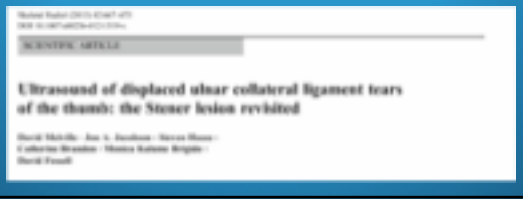
UCL technique

Sonographic appearances



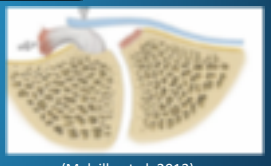


'..demonstrated an absence of UCL fibers and presence of a well-defined, heterogeneous mass-like abnormality proximal to the MCP joint'



SCIENTIFIC ARTICLE

Ultrasound of displaced ulnar collateral ligament tears of the thumb: the Stener lesion revisited

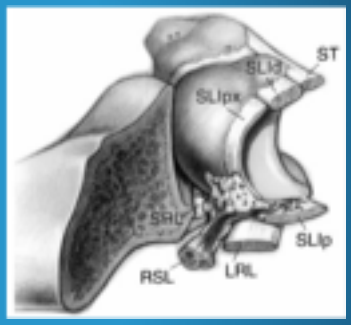


(Melville et al, 2013)

The wrist

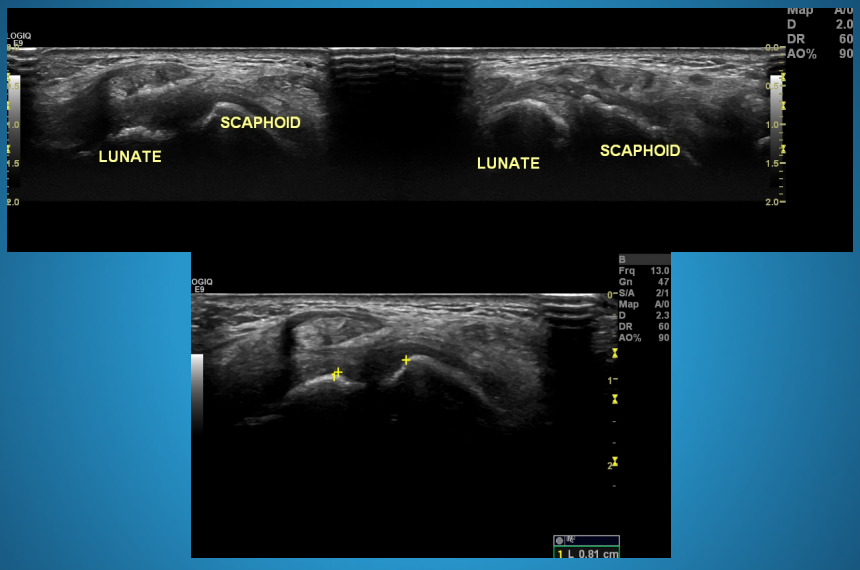
Scapholunate ligament

- Scapholunate important stabiliser of the proximal row, scaphoid rather than lunate motion is most affected.
- 'The dorsal part of the SLL is the strongest and the primary stabiliser of the SL joint and can resist forces of up to 260 N.3' (Anderson, 2017)
- Radiographs, greater than 2mm is considered a sign of dissociation
- **Dorsal component**:
  - strongest, most important in resisting volar-dorsal translation
  - 3 mm in thickness and composed of short, transversely-orientated collagen fibres
- **Intermediate component**:
  - primarily composed of fibrocartilage, homologous to the meniscus of the knee
- **Volar component**:
  - 1 mm in thickness



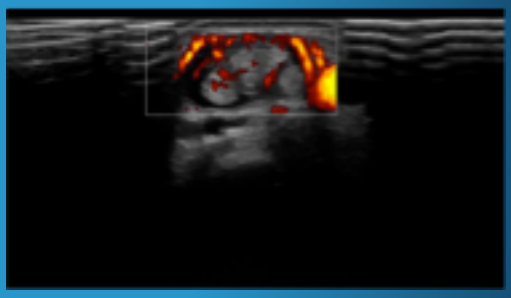
(Linkous et al, 2000)

- Start visualising Listers tubercle.
- Move the probe distally
- The transducer is advanced distally and the proximal pole of the scaphoid bone is seen distal to the radiocarpal joint space. The transducer is then moved toward the ulnar aspect to visualise the adjacent hyperechoic cortex of the lunate bone. The dorsal scapholunate articulation is characterised by a triangular space.



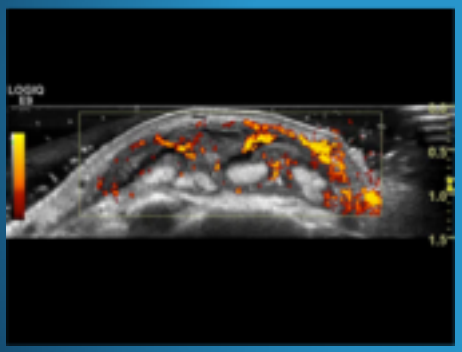
Tenosynovitis

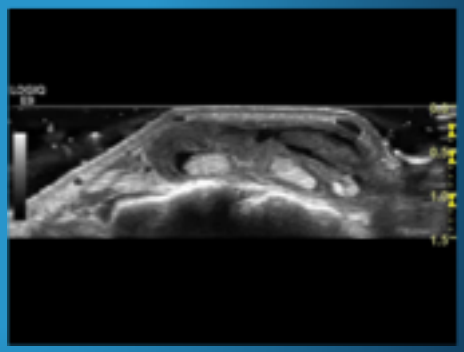
1st extensor tenosynovitis



Tenosynovitis

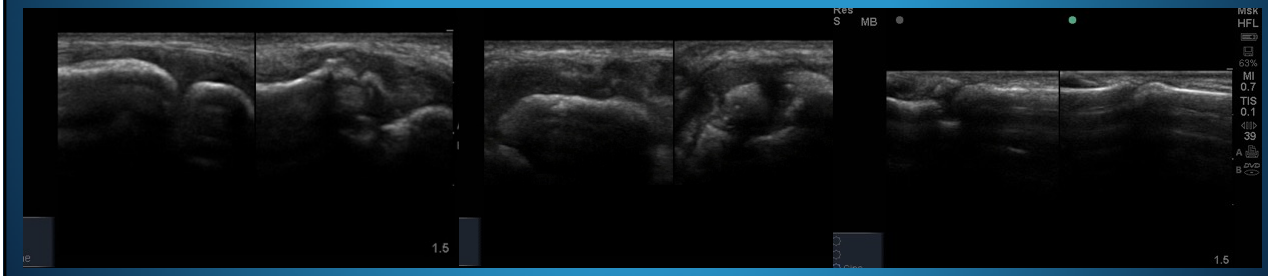
4th extensor compartment tenosynovitis





Hand fractures

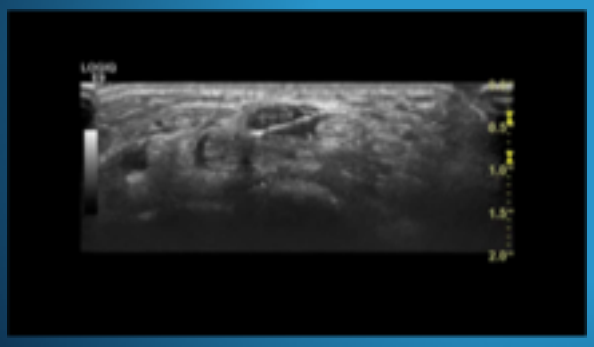
Ultrasound imaging performed by emergency sonographers showed excellent sensitivity and specificity in the diagnosis of hand fractures (Tayal et al, 2007).

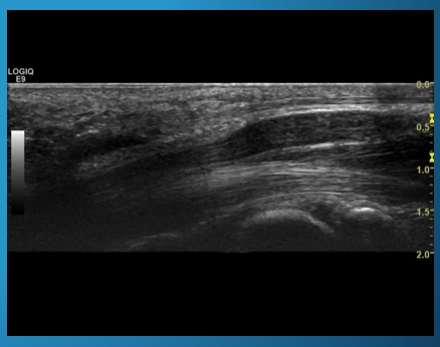


Nerve entrapment

Change in the size of the median nerve in the carpal tunnel is secondary to the combination of proximal swelling and distal compression of the nerve (Wessel et al, 2019)

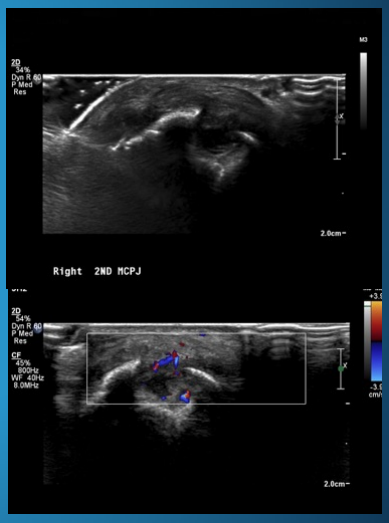
Ultrasound, nerve conduction studies, and CTS-6 have similar sensitivity and specificity for the diagnosis of carpal tunnel syndrome (Fowler et al, 2015).

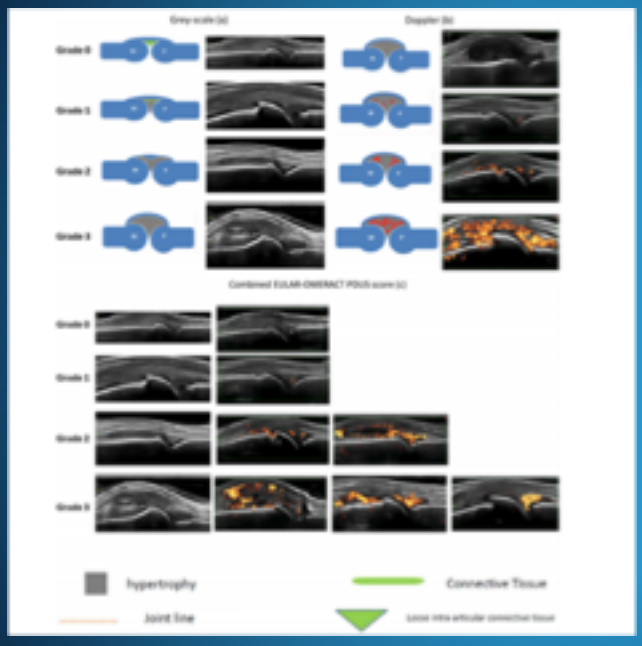




Inflammatory joint changes: Erosions

- Defined as an intrarticular discontinuity of the bone surface that is visible in two perpendicular planes (Wakefield et al, 2005)
- Can also be seen at tendon insertions eg PsA and enthesitis.
- US is more effective for erosion detection than CR and has a comparable efficacy to MRI with good reproducibility.



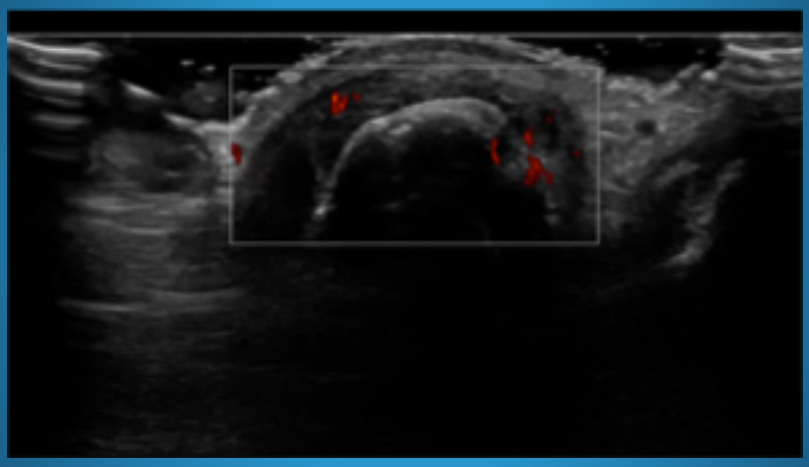


Grading synovitis

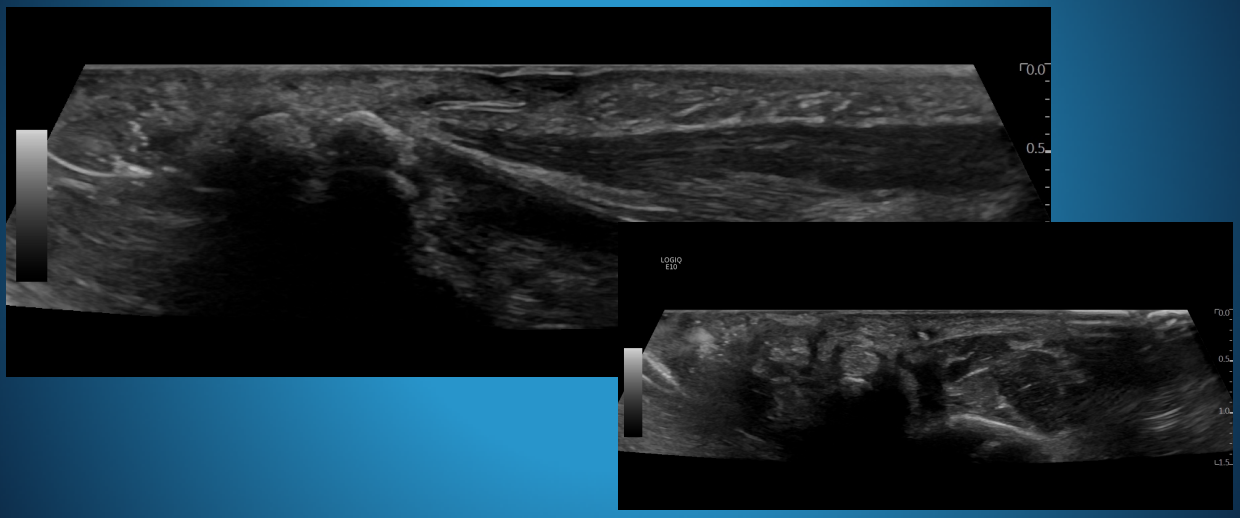
Ultrasound found to be more sensitive for detecting joint inflammation than clinical examination (Rees et al, 2007).

Table 4 EULAR-OMERACT combined scoring system for grading synovitis in rheumatoid arthritis	
Grade 0: Normal joint	No GS-detected SH and no PD signal (within the synovium)
Grade 1: Minimal synovitis	Grade 1 SH and cGrade 1 PD signal
Grade 2: Moderate synovitis	Grade 2 SH and cGrade 2 PD signal or Grade 1 SH and a Grade 2 PD signal
Grade 3: Severe synovitis	Grade 3 SH and cGrade 3 PD signal or Grade 1 or 2 SH and a Grade 3 PD signal

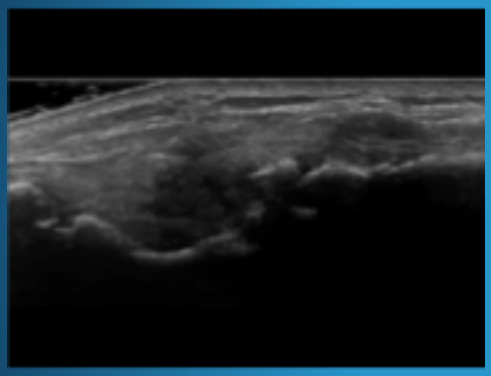
Inflammatory joint changes – MCPJ synovitis

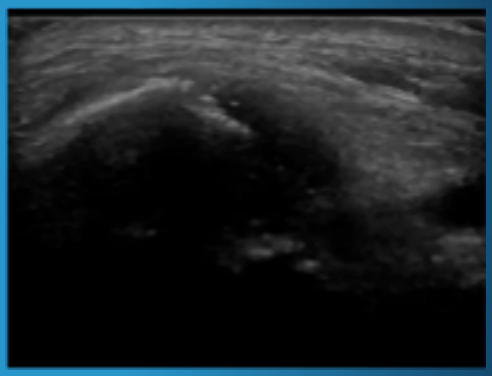


Something different..



Ultrasound to guide injections





Thankyou!

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