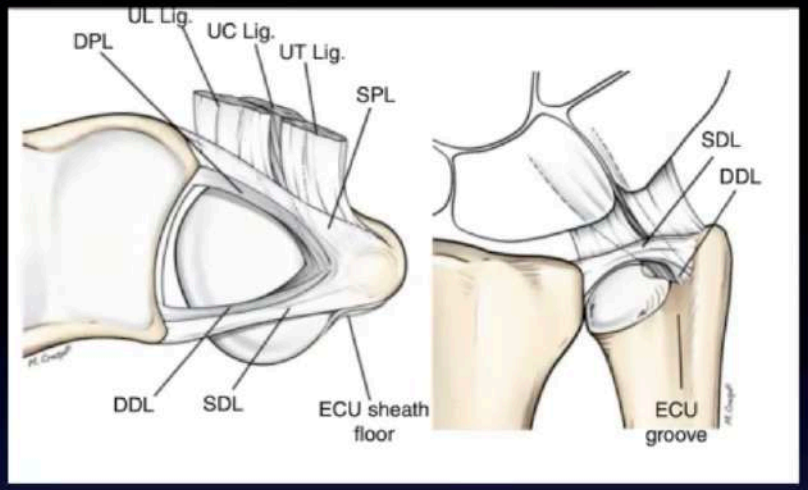

Concept - Ulnar wrist pain TFCC

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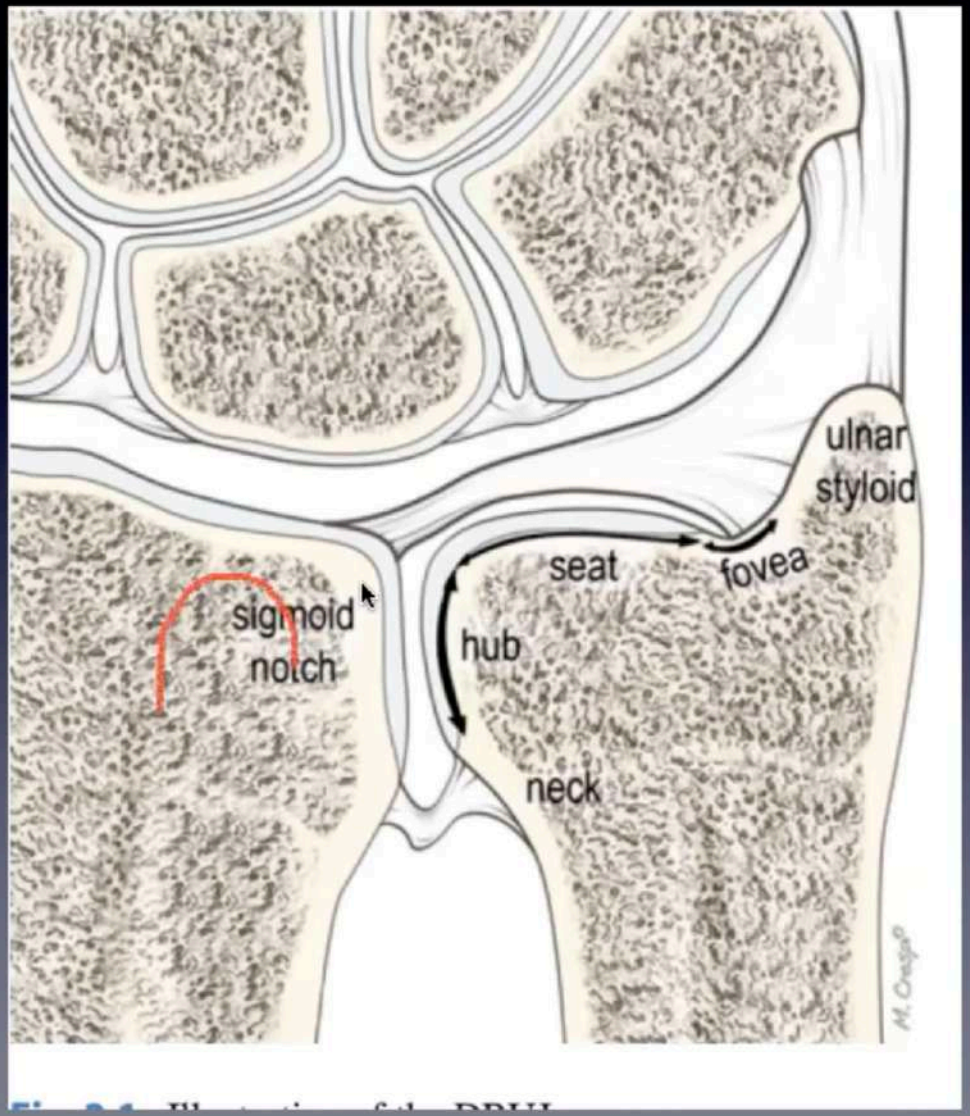
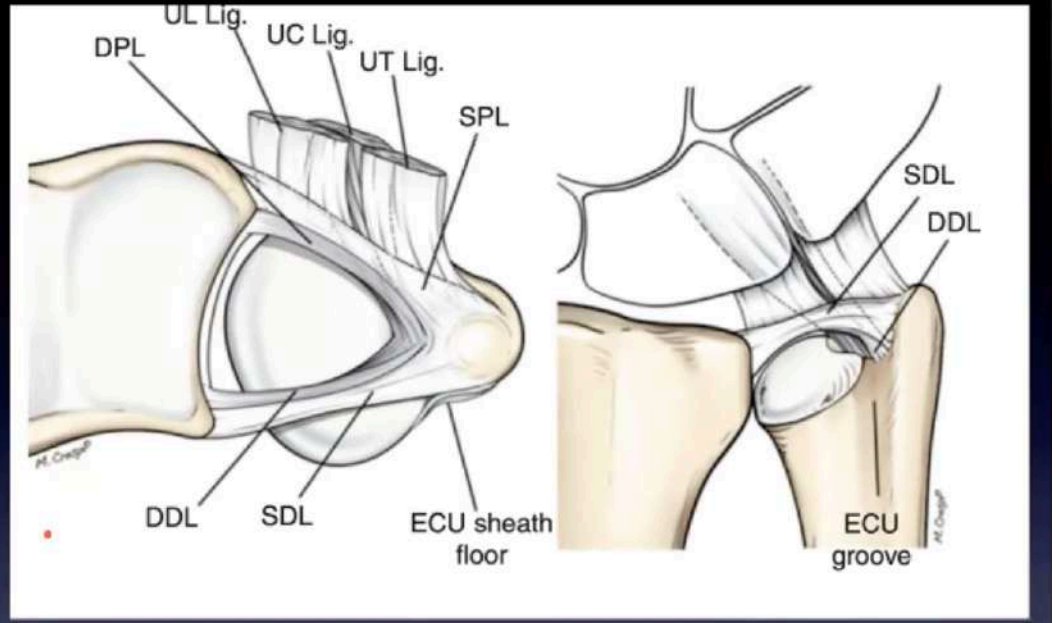
Director [Mittal Hand Microsurgery centre, Jaipur]
Senior consultant - SDMH ,jaipur
DNB [St Stephen Hospital New Delhi]
FNB[Ganga Hospital Coimbatore]

Nomenclature



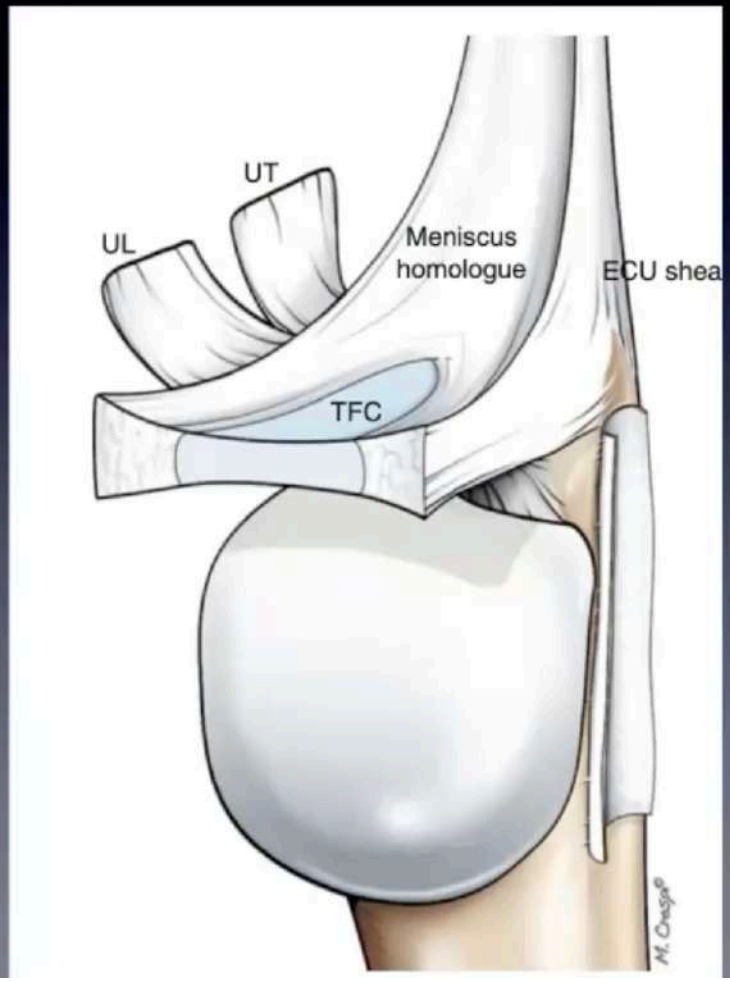
TFCC - Function



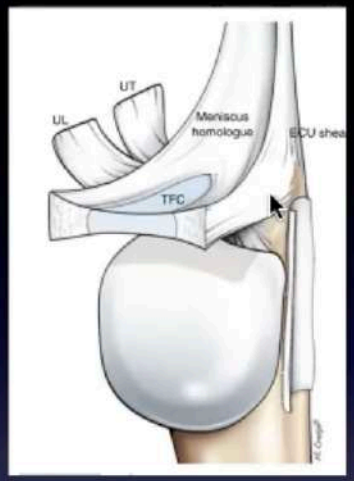
- Distribute load between ulna and ulna carpus
- Stabilize **DRUJ** and **ulnocarpal** joint

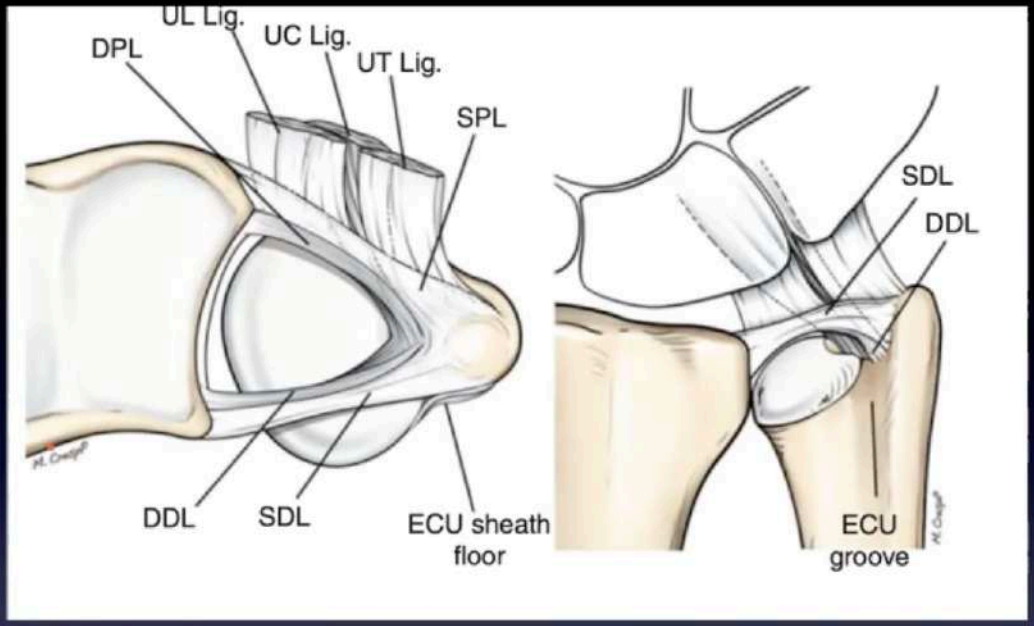
TFCC
[Triangular fibrocartilage complex]

- **TFC [articular disc]**
- **Meniscus homologue**
- **Radioulnar ligament**
- **UL, UT**
- **Sheath of ECU**
- **Ulnar joint capsule**



TFCC - 3 components



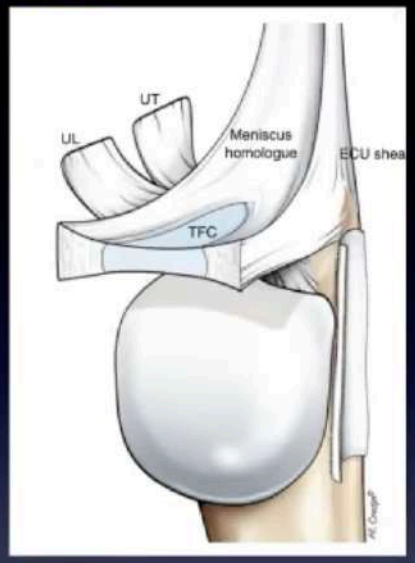


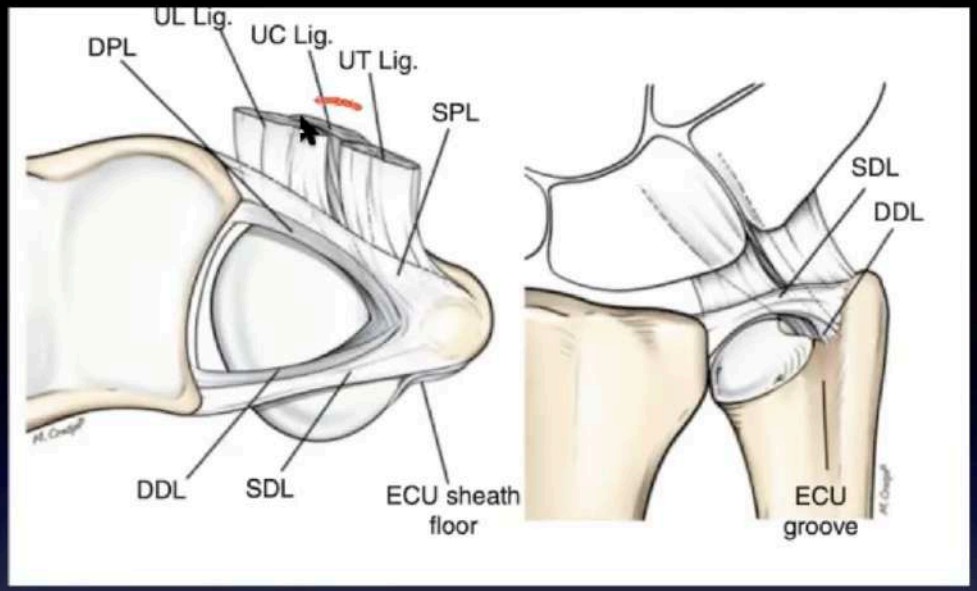
- **Distal** - - support and surround the ulna carpus - Disc, MH, UL ligament ,UT ligament
- **Proximal** - stabilize the radius to ulna directly - RUL [Radioulnar ligament]
- **Functional ulna collateral ligament** - sheath of ECU and thickened ulnar capsule

Anatomy - ulnocarpal compartment

- Ligaments - UT, UL , UC ligaments
- Meniscus homologue
- **Prestyloid recess**
- ECU sheath floor
- Joint Capsule of UC and DRU

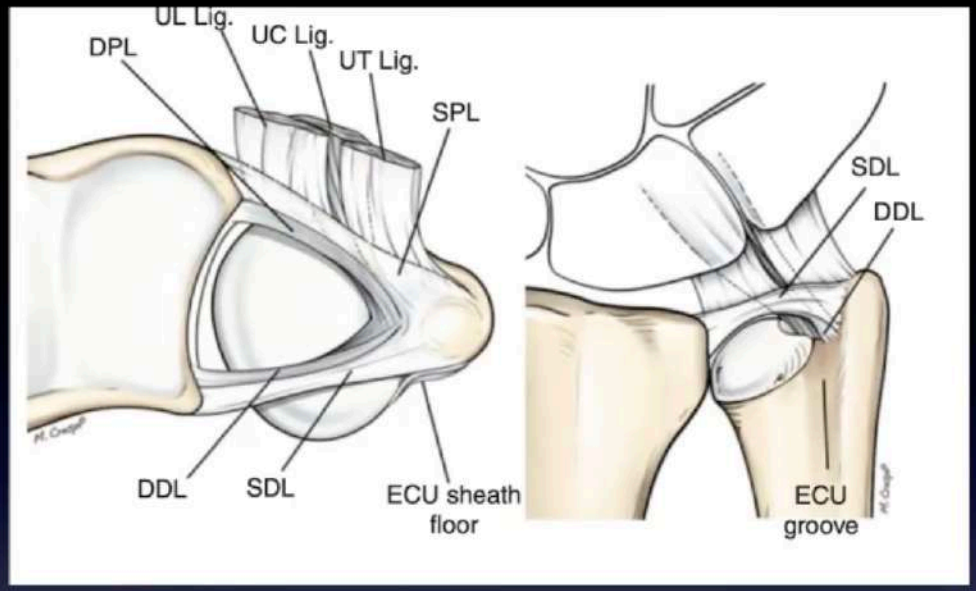
Ulnocapitate ligament [superficial]





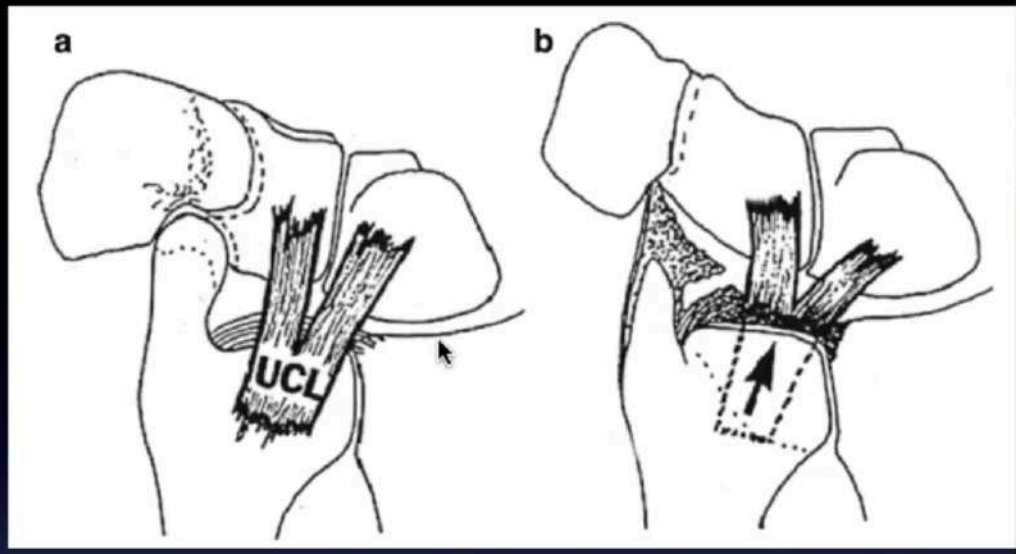
- Most superficial of UL , UT
- Originate **not** directly to **TFC**[disc] but **palmar foveal** region of ulna head
- Insert on palmar ulnar aspect of capitate

Ulnotriquetral ligament [Deep]



- Originate from **palmar Radioulnar ligament** and **some** from palmar radial aspect of ulna styloid
- Insert on palmar ulnar aspect of triquetrum
- **More oblique orientation** than UL ligament

Ulno lunate ligament [Deep]

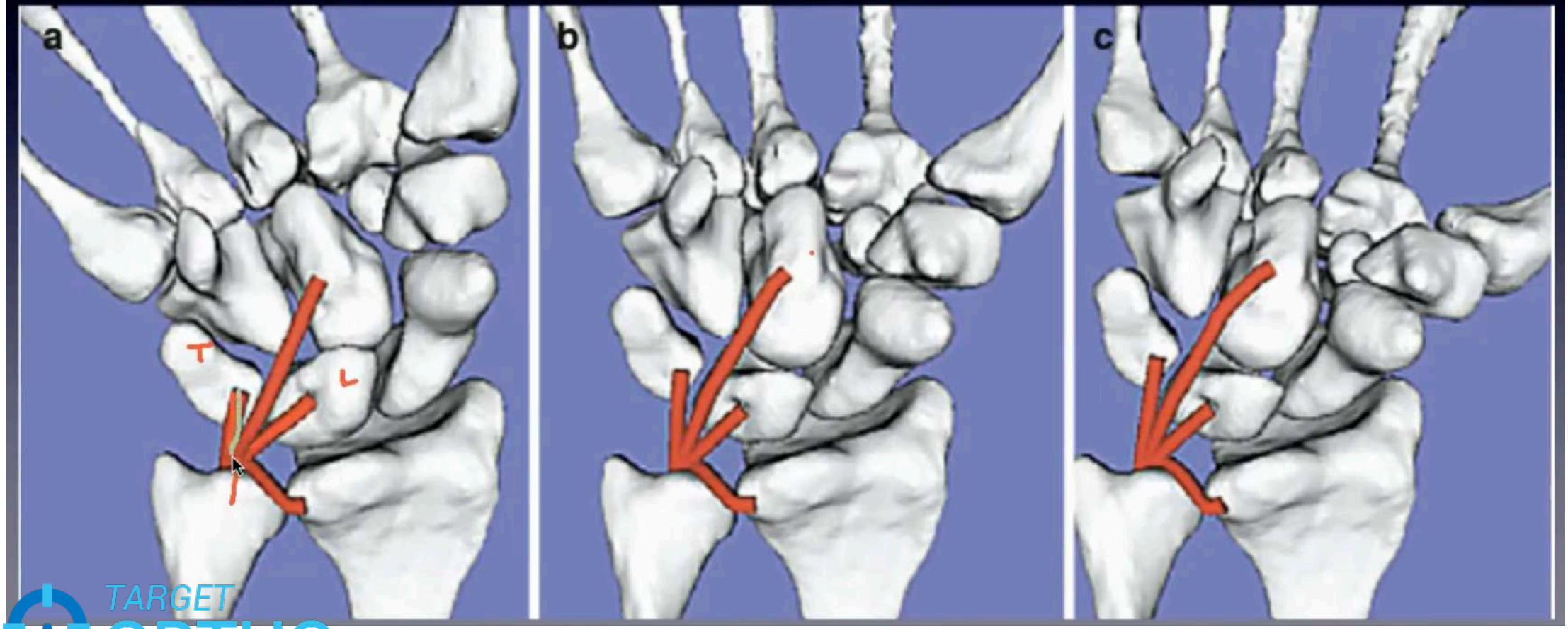


- No clear demarcation between UL & UT
- Distinction can be made by distal attachment
- Originate from **TFC** [disc] and insert with Short radiolunate ligament to palmar cortex of lunate
- **Unlike monkeys UL & UT originate from TFC and not from ulna .thus allow good ROM of promotion and supination without imparting ulnocarpal joint stability**

Kinematics

- **During radio ulnar deviation**
- UT and UL ligament shows **reciprocal** behaviour with respect to each other

UL,UT reciprocal
Ulnar ,Neutral, Radial deviation



Summary

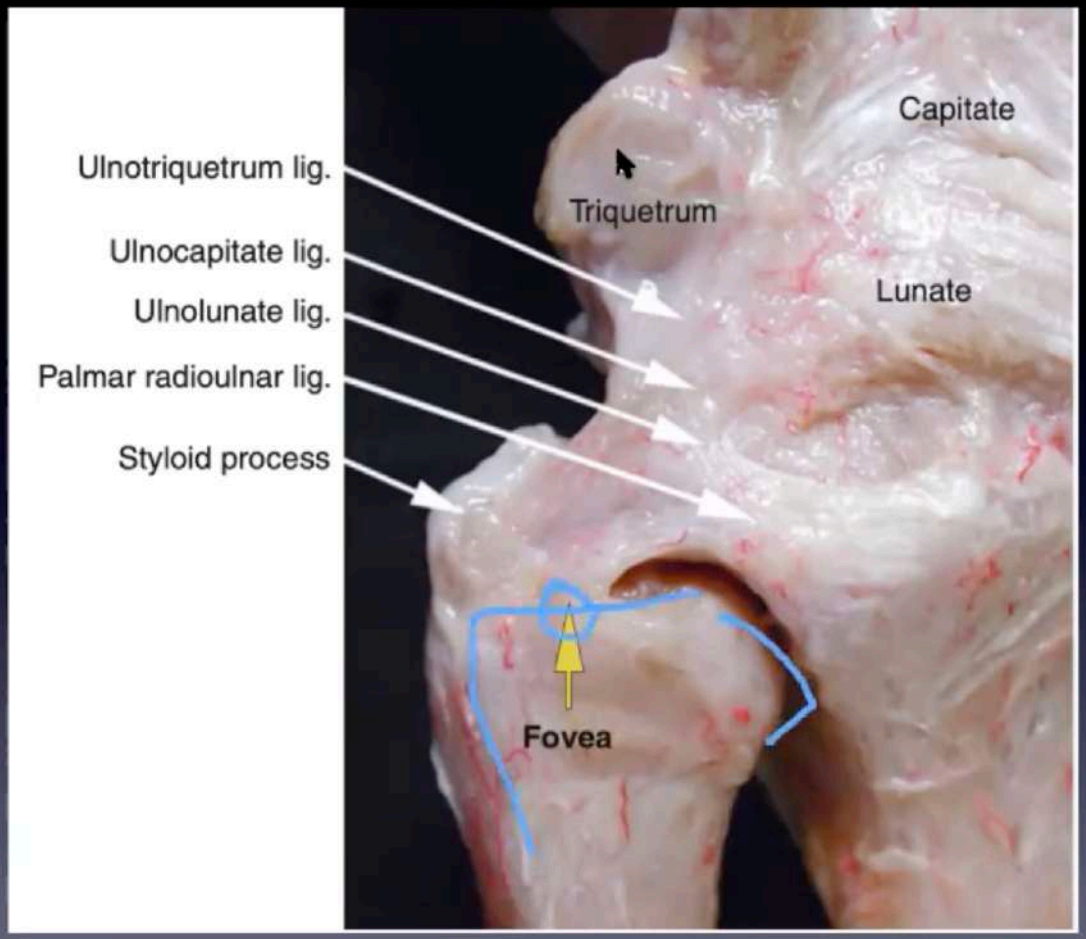


Fig. 1.2 Dissection of a human right wrist demonstrating the ulnocarpal ligament complex viewed from the palmar side. The ulnotriquetral, ulnocapitate, and ulnolunate ligaments originate together at the fovea of the ulnar head and the base of the ulnar styloid. These ligaments, along with the palmar radioulnar ligament, extend distally like a fan in the coronal plane and insert at the palmar aspects of the triquetrum, capitate, and lunate. In this case, the pisiform, ulnocarpal capsule, and flexor tendons have been excised (Courtesy of Dr. Marc Garcia-Elias)

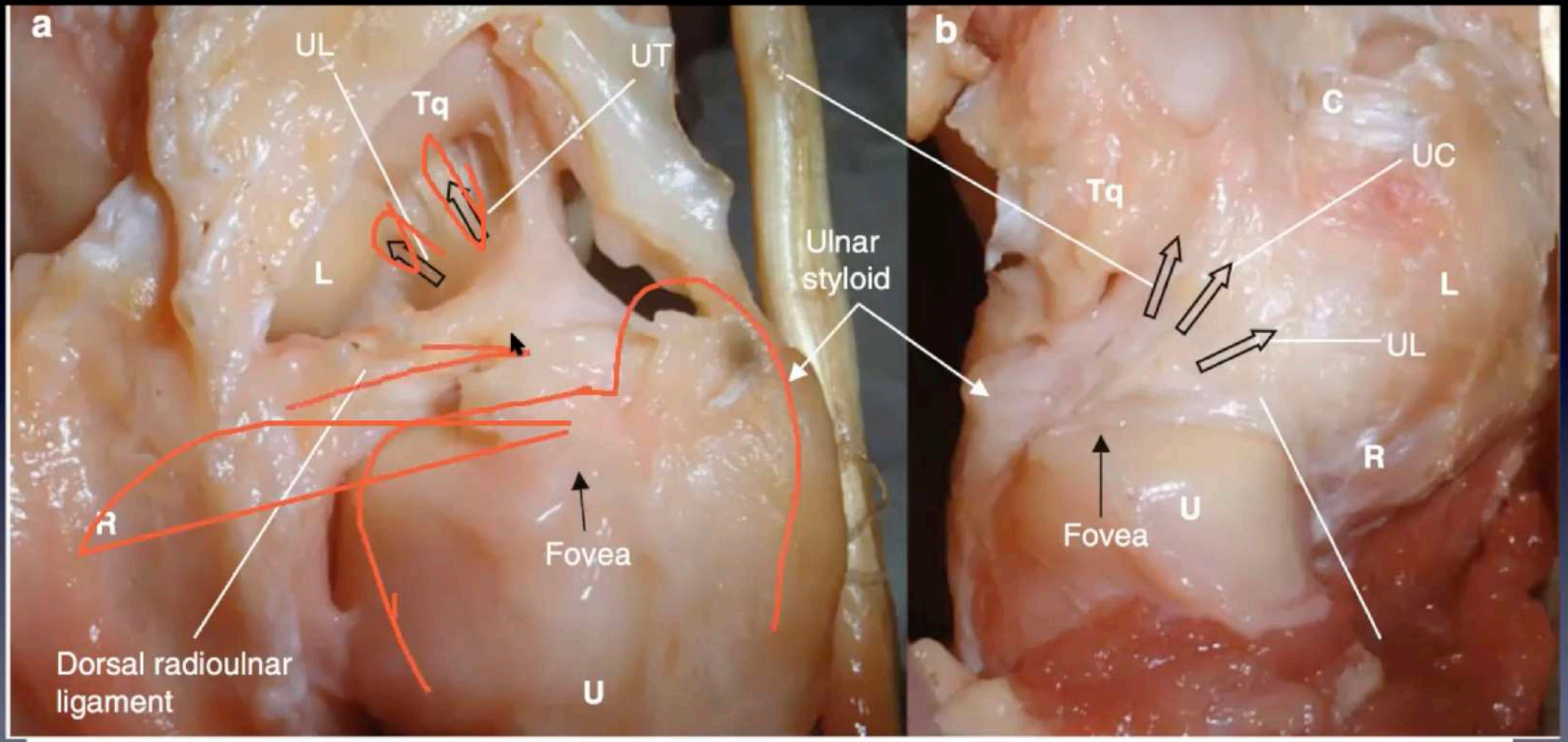
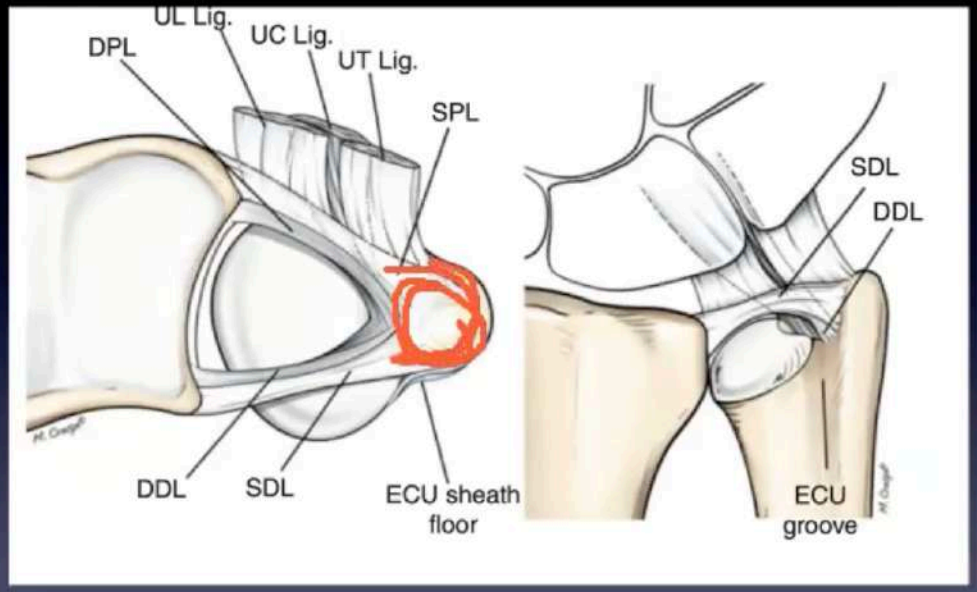


Fig. 1.3 Anatomy of the ulnocarpal ligaments in a right cadaver wrist. The ulnotriquetral ligament originates mainly from the palmar radioulnar ligament, and some fibers originate from the ulnar styloid process. Dorsal view (**a**) and palmar views (**b**). The joint capsule and the ECU sheath floor are removed. The ulnocapitate ligament is not visible from the dorsal view. *R* radius, *U* ulna, *L* lunate, *C* capitate, *Tq* triquetrum, *UT* ulnotriquetrum ligament, *UL* ulnolunate ligament, *UC* ulnocapitate ligament

Meniscus homologue

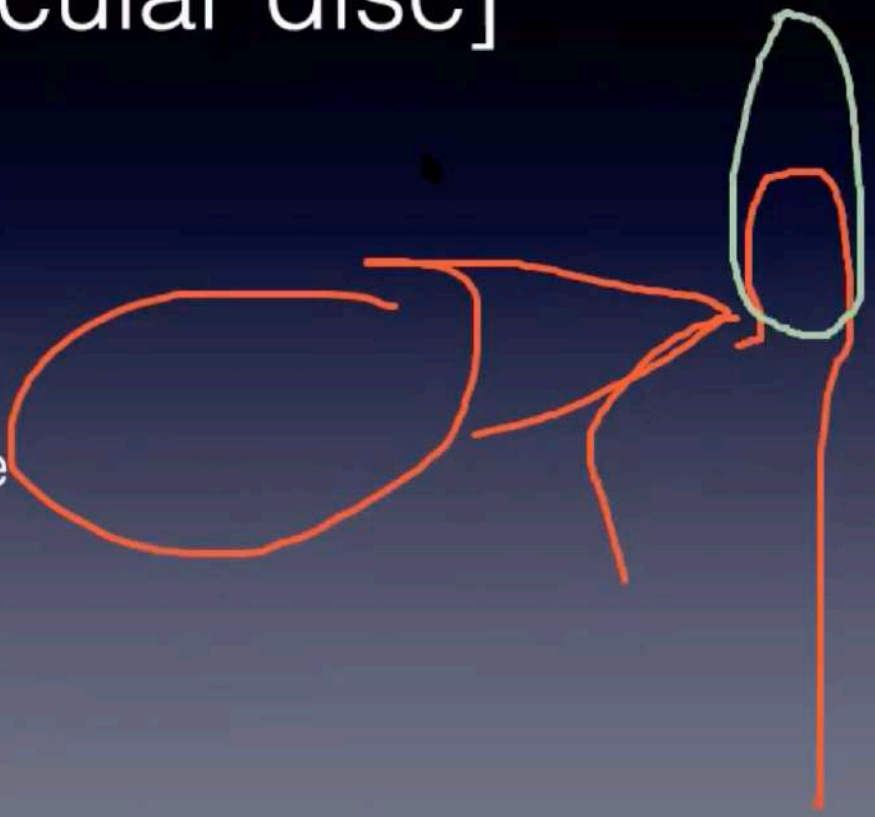


- Soft tissue **C** shaped configuration from distal view **englobing the ulna styloid tip**
- **Interposed between** TFC , TQ, ulnar capsule

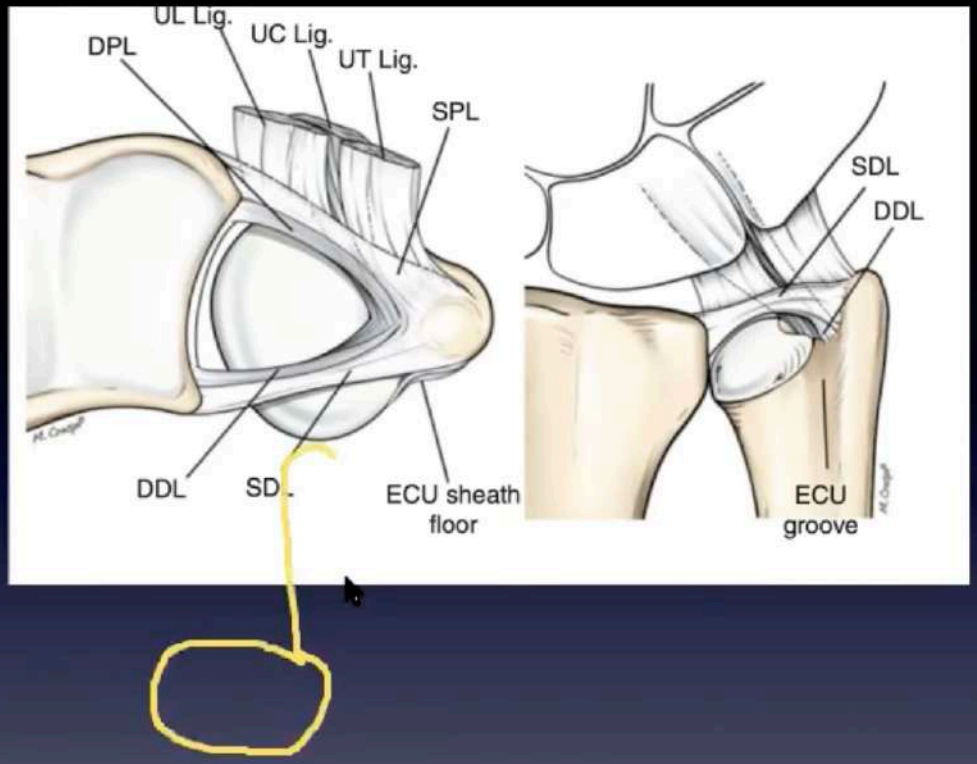
Meniscus Homologue

Unlike TFC [articular disc]

- Not avascular [means very vascular]
- Does not contain dense collagen fibre
- Higher elasticity



Prestyloid recess

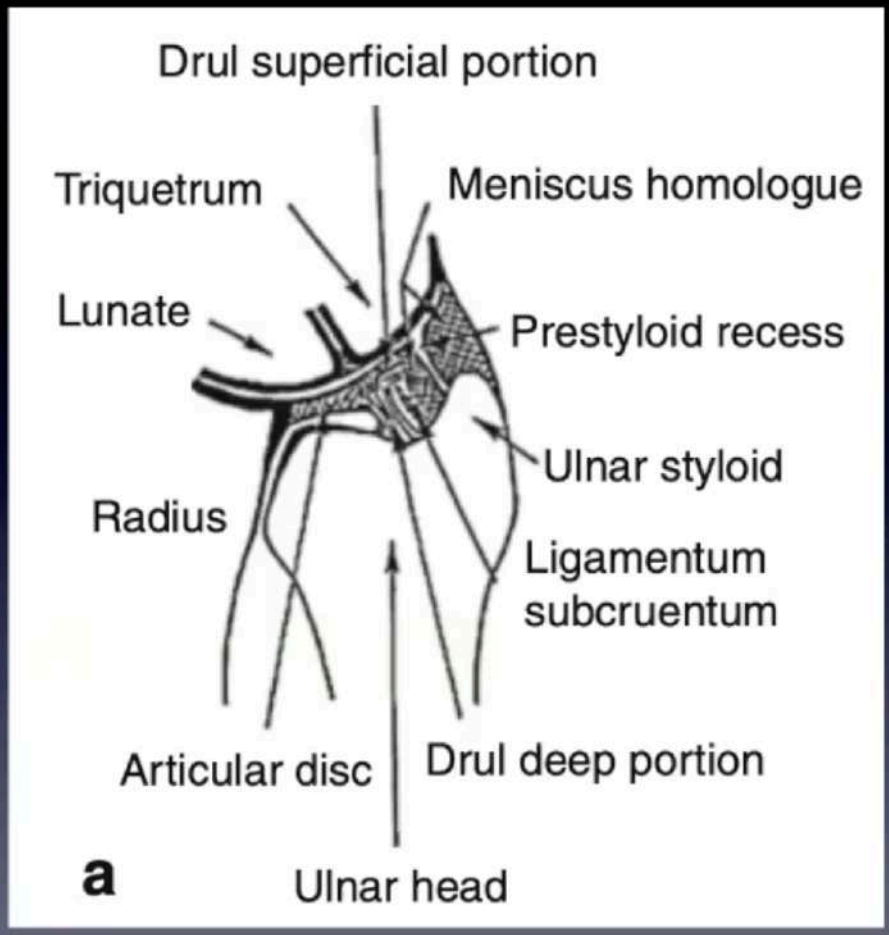


- Between MH and TFC[disc]
- **Anterior to ulna styloid process** MH does not cover ulna styloid process ,thereby creating a pouch variable in size a d shape

Prestyloid recess
Three type configuration

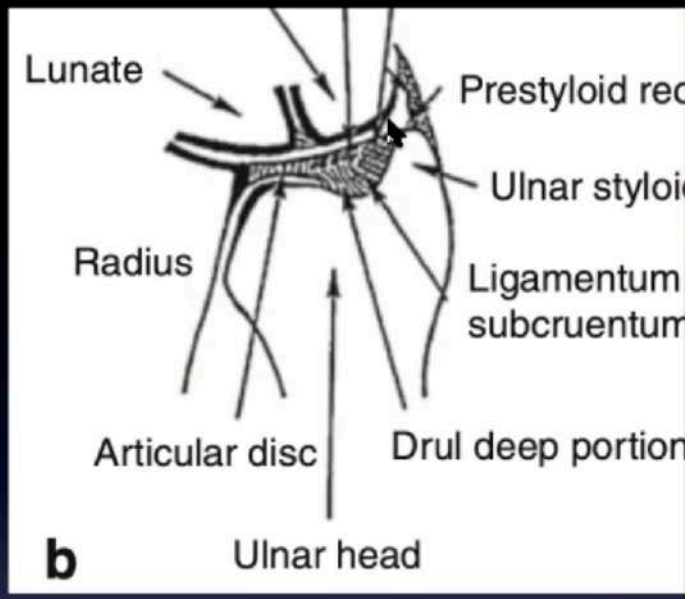
- **Depending MH attachment**
- **Narrow and long opening** connecting to ulnocarpal space - mc
- **Wide and short opening** connecting to ulna carpal space
- **No opening** to ulnocarpal space but it is connected to Druj

Prestyloid recess- Narrow long



- MH attached to
- **Proximally** to ulna styloid process - **radial** , dorsal ,palmar
- **Distally** to ulna styloid tip - **circumferentially**

Prestyloid recess- wide short

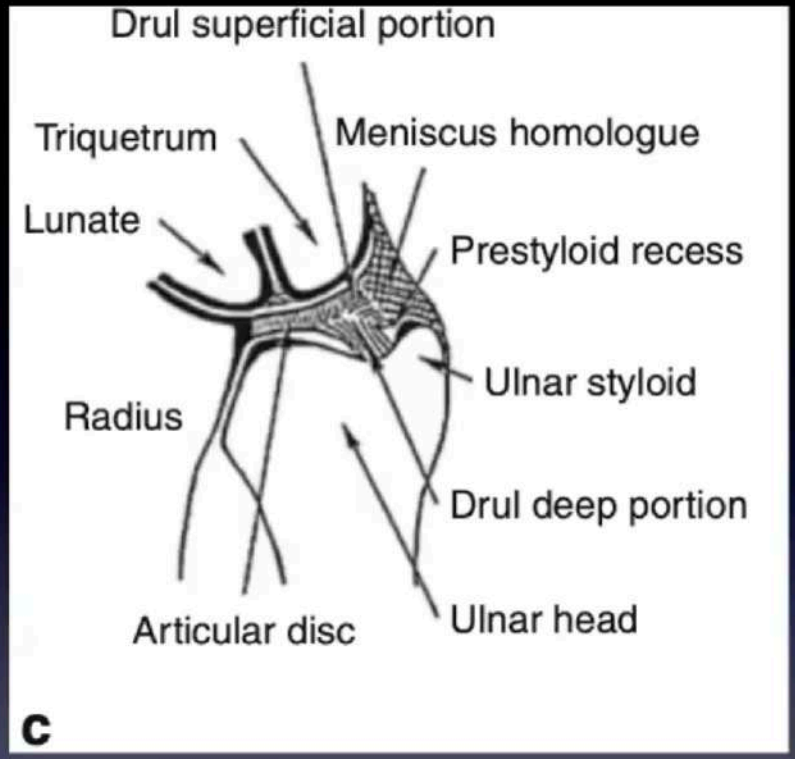


- MH attached to
- **Proximally** to ulna styloid process - radial , dorsal ,palmar
- **But Distally** without attachment to ulna styloid tip

Sheath of ECU

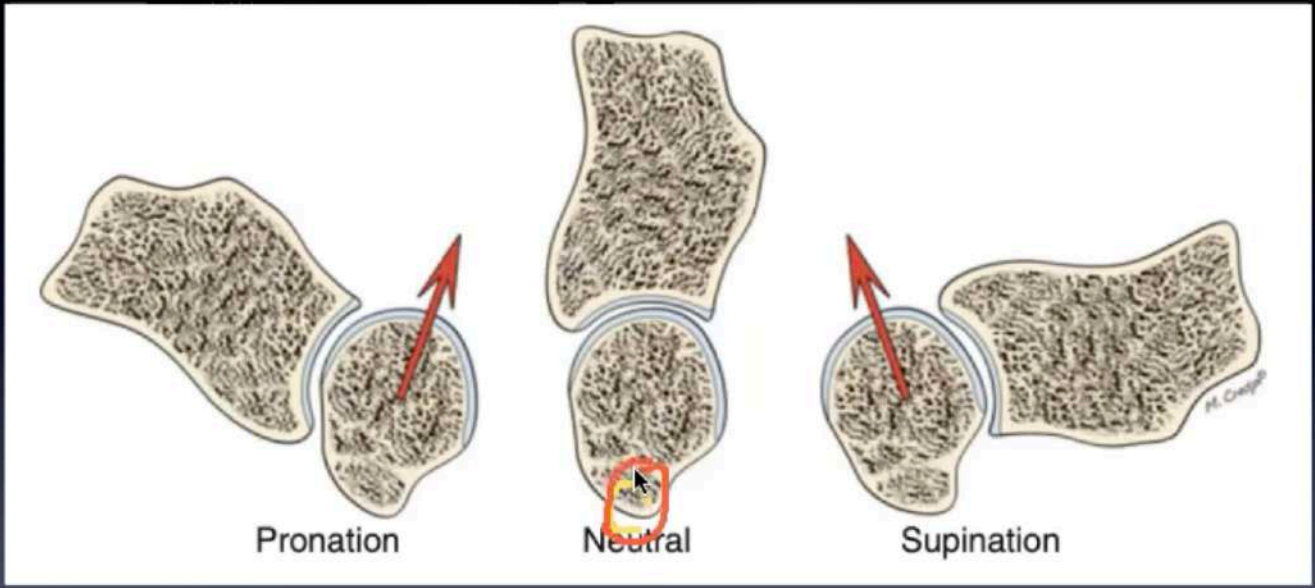
- **Originate** from dorsal aspect of **TQ**
- **Insert** to dorsal and **ulnar aspect of ulna styloid**

Prestyloid recess- No opening type to ulnocarpal space



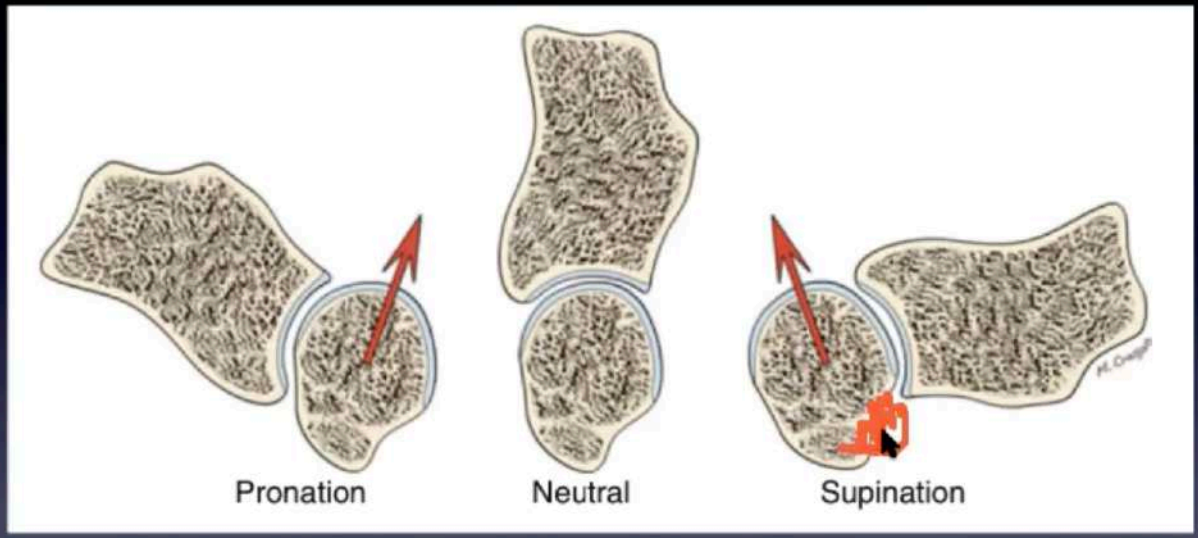
- MH attached to
- **Proximally** to ulna styloid process - ulnar, dorsal ,palmar and nothing on radial aspect of ulna styloid
- **Distally** without attachment to ulno styloid tip
- **Instead PSR communicated with DRUJ coming from radial aspect of ulna styloid**

Sheath of ECU -Full pronation



- **Ulna styloid tip in volar surface** -
- so sheath is **full stretch** and
- **prevent dorsal dislocation of ulna head**

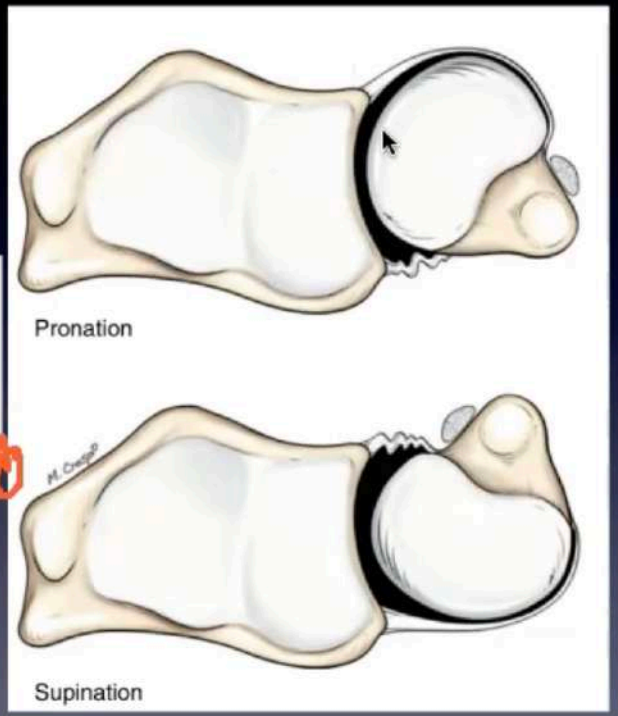
Sheath of ECU -Full supination



- **Ulnar styloid tip is dorsal** - sheath is **relax**
- Sheath may **impinge** between styloid and TQ in supination lead to **ulna styloid impaction syndrome.**

DRUJ and ulnar joint capsule

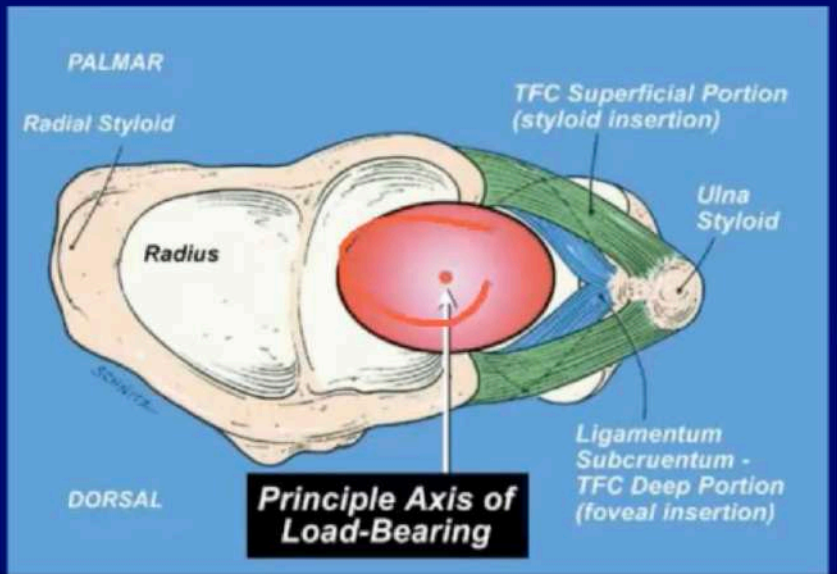
Fig. 2.3 Illustration of the dorsal and palmar joint capsule of the DRUJ. Dorsal capsule is extended in pronation, while palmar capsule is extended in supination



- Soft spot between UT ligament and ECU sheath floor - 6U portal

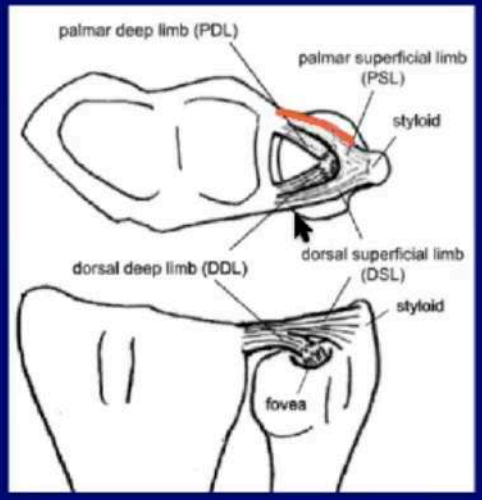
Radio ulnar ligaments

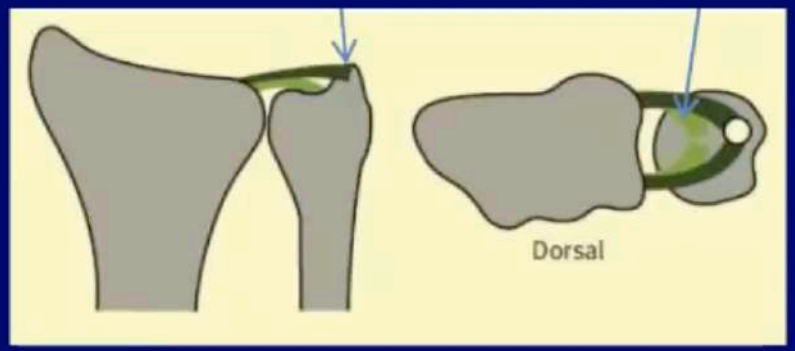
- Extend from dorsal and palmar margin of sigmoid notch
- As it extends it divides into superficial limb and deep limbs
- And attach to ulna in triangular fashion



Radio - ulnar ligaments

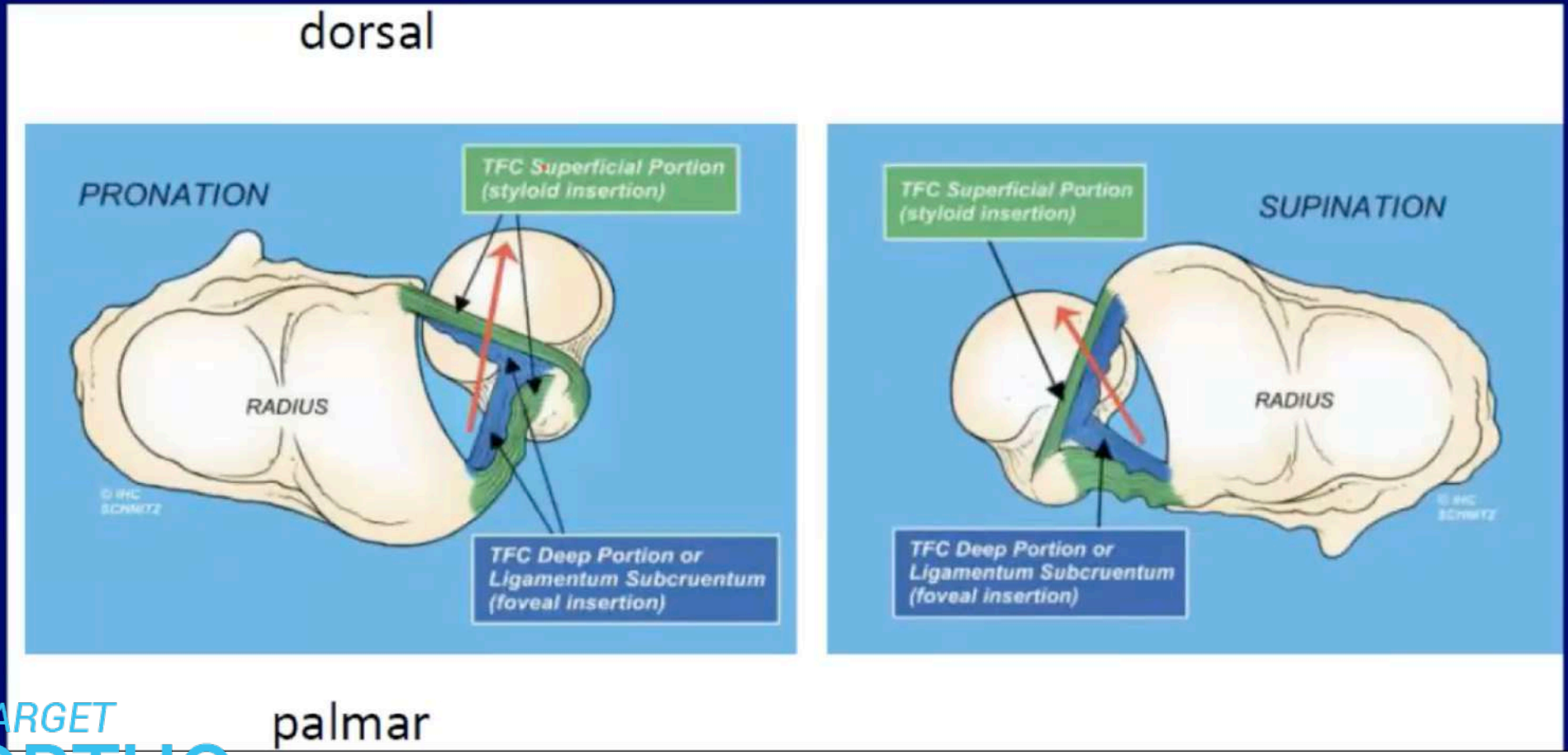
- Superficial limb attach to base and midportion of ulna styloid
- Deep limb attach to fovea
- The space between the limbs near the ulna styloid contains richly vascularized loose connective tissue called ligament subcrutetum





TFC biomcehanics

- In forearm supination – palmar superficial and dorsal deep radioulnar ligament are tight



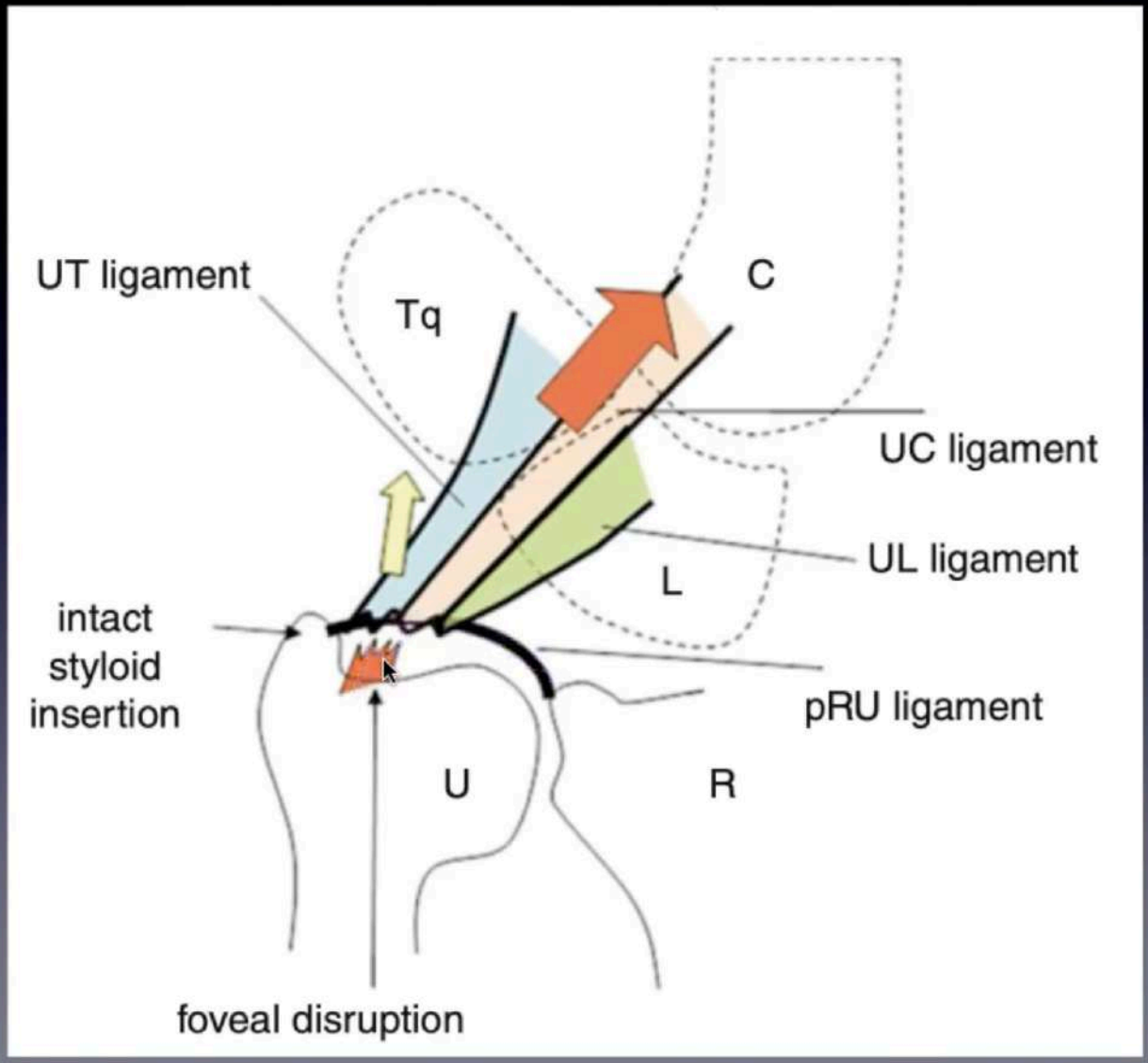


Fig. 1.16 Ulnar fovea sign test

Ulna foveal sign

- Foveal Tenderness is **sensitive and specific test to differentiate** between
- **UT** [Druj stable] and
- **foveal avulsion** TFCC [DRUJ unstable]

Clinical examination
Ulnar side wrist pain

- Extra capsular cause
- Intracapsular cause

Differential diagnosis
Ulnar side wrist pain

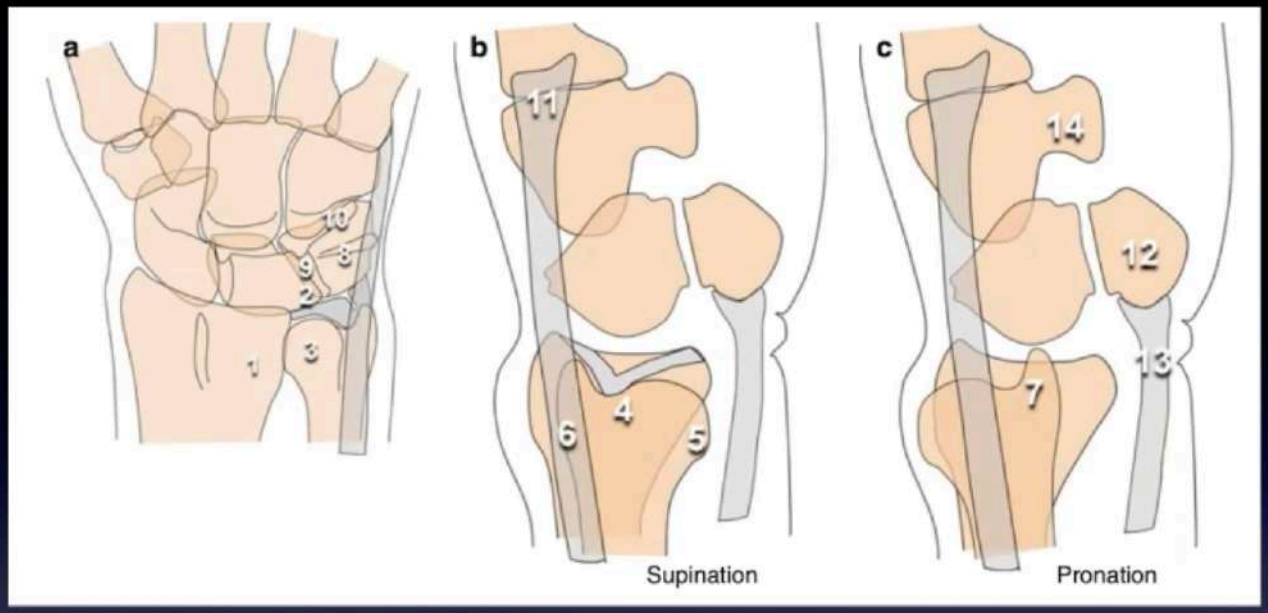
Carpometacarpal joint instability*
Enthesopathy of the extensor carpi ulnaris (ECU)*
Hook of the hamate fracture or nonunion*
Chondromalacia of the proximal pole of the hamate
Ununited dorsal chip fracture of the triquetrum
Palmar midcarpal instability
Dorsomedial midcarpal instability [45]
Capitolunate instability (CLIP syndrome)
Lunotriquetral (LTq) instability
Fracture of a partial LTq coalition (synchondrosis)
Ulnocarpal ligaments rupture or avulsion
Pisotriquetral dysfunction*
Enthesopathy of the flexor carpi ulnaris*
Ulnar styloid triquetrum impaction syndrome
TILT syndrome [42]
Synovitis in the prestyloid recess in early rheumatoid arthritis
Triangular fibrocartilage complex (TFCC) injury
Ulnocarpal impaction syndrome
Kienbock's disease
Injury to the dorsal sensory branch of the ulnar nerve*
Guyon's canal nerve entrapment*
Hypothenar hammer syndrome*
ECU tenosynovitis*
Instability secondary to injury of the ECU subsheath*
Distal radioulnar joint (DRUJ) osteoarthritis

Inspection

- **Dimple sign** - multidirectional instability DRUJ
- Patient hand flat on table and ask to press it down - prominent dorsal ulna head shift palmarly creating dimple dorsally .

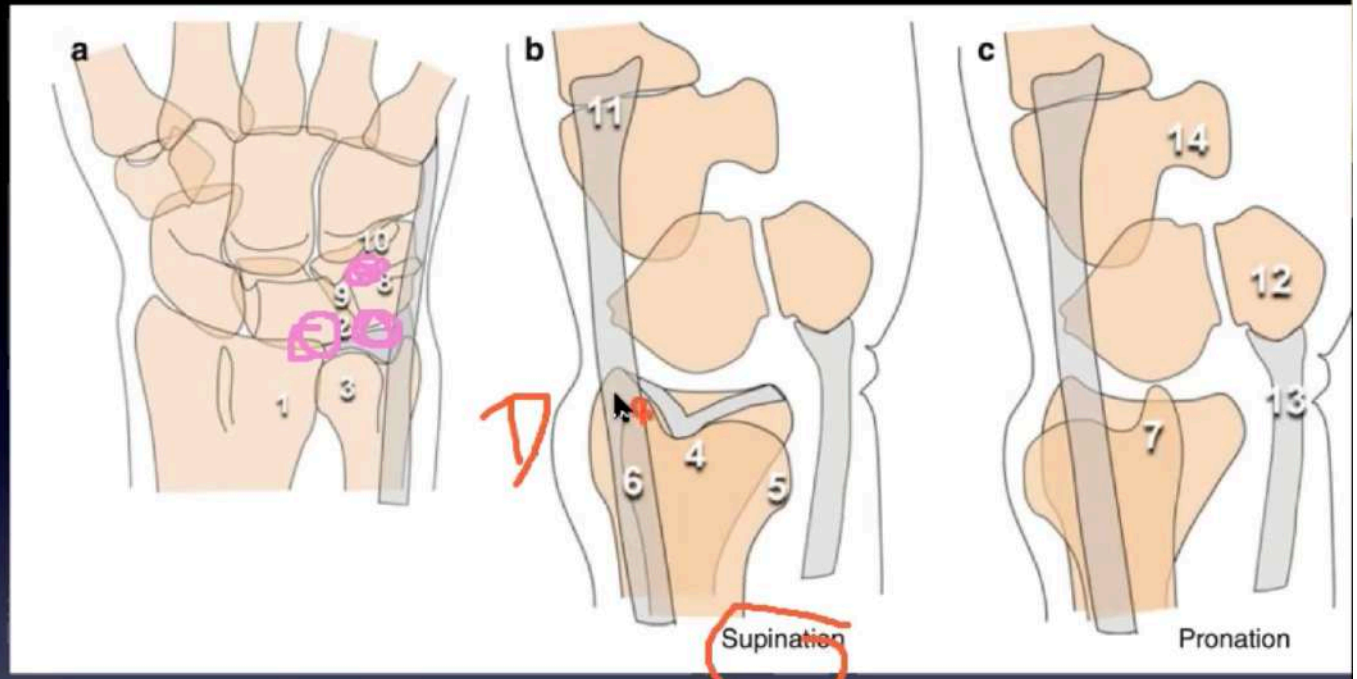
Palpation - set order

Forearm in full pronation



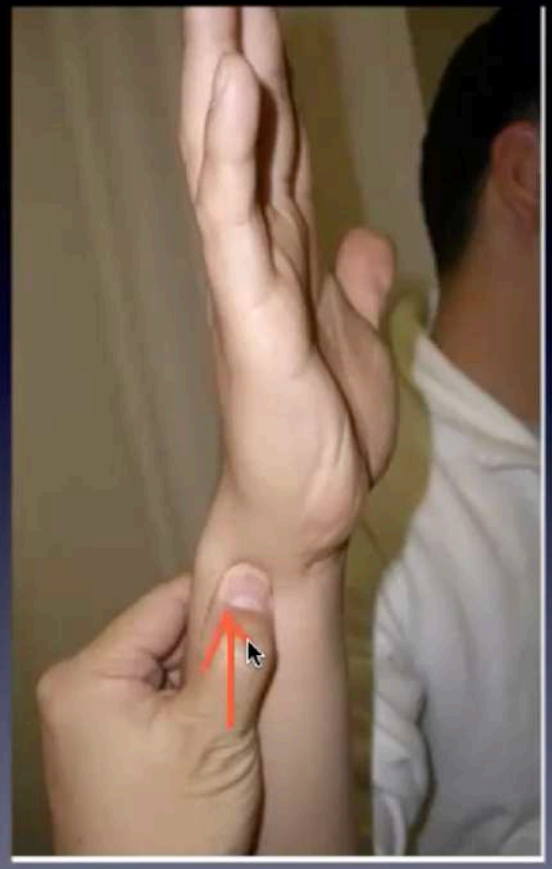
- Dorsal of **radial metaphysis** - tenosynovitis EDC
- Proximal ulnar corner of **lunate** - keinbock , ulnocarpal impaction
- Dorsal surface of **ulnar head** - global degenerative joint disease , chondromalacia

Palpation - set order
Forearm in full supination



- 1.Ulnar snuff box /foveal area consist of from superficial to deep
- 2. Volar articular surface of ulnar head
- 3. ECU tendon sheath

Ulnar snuff box / foveal area in supination - soft tissue structure as follows



- **consist of from superficial to deep**
- Subcutaneous fat and ulnar nerve
- Prestyloid recess palmar to styloid
- Deep fibre of TFC
- Meniscus homologue distal to foveal attachment of TFC

Ulna foveal sign - D/D

- Entrapment ulnar nerve
- Early rheumatoid arthritis
- Ulnar MH injury
- Foveal avulsion

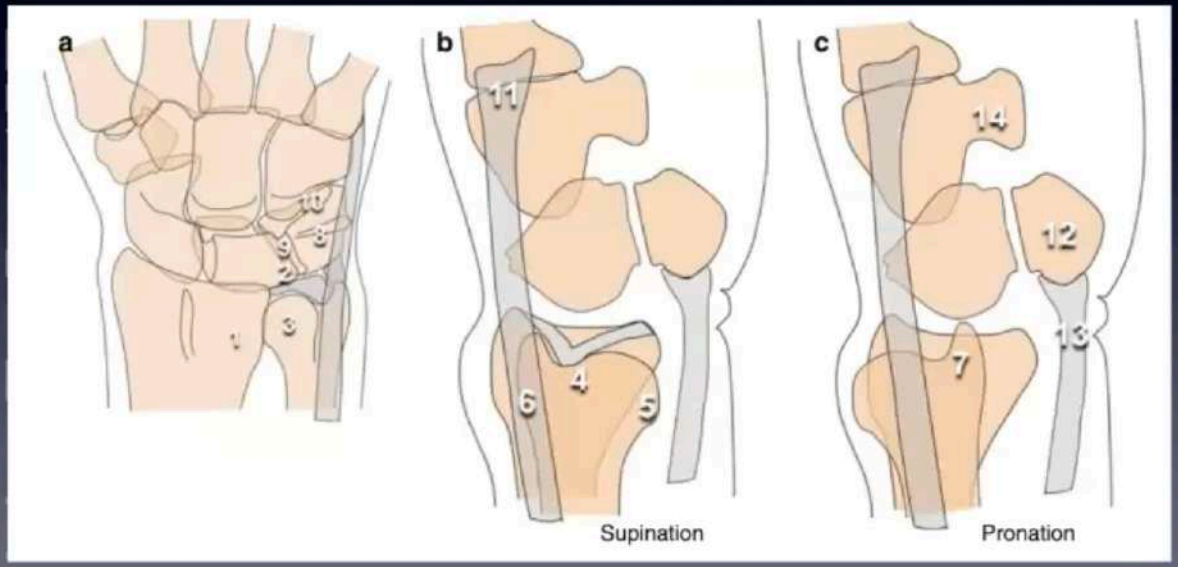
Ulnar snuff box / foveal area in **pronation** - ulna styloid structure as follows

- **Ulnar styloid impingement**
- **TILT [Triquetral impingement ligament tear]- tears in extensor retinaculum and come in-between TQ and ulna styloid tip .**
- **ulnoCarpal detachment - no tear in extensor retinaculum**

After snuff box

Palpate Forearm in **full pronation**

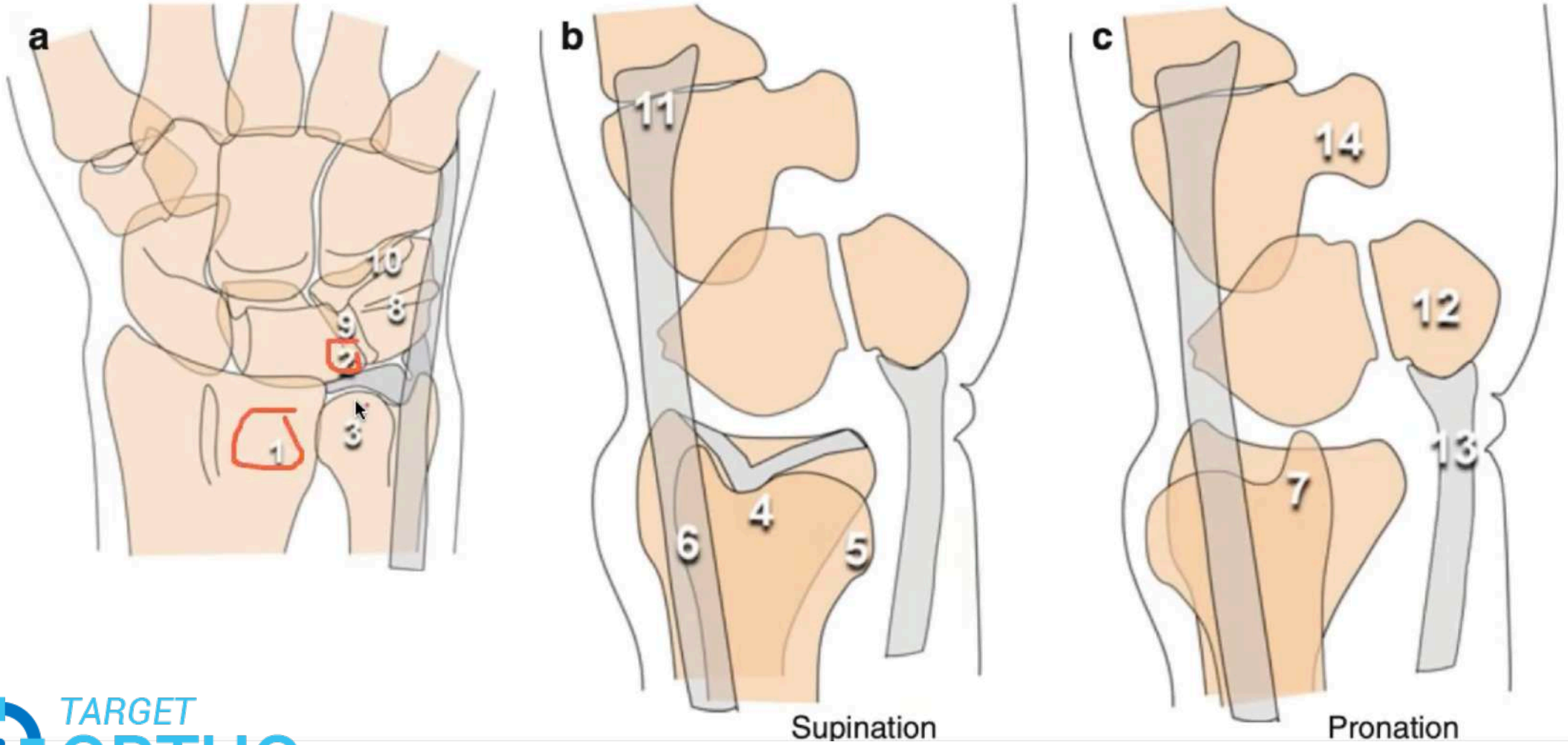
- Dorsal ridge of **TQ**
- **LT joint** - ulno carpal impaction
- **TQ hamate** joint
- Distal insertion of **ECU tendon**



Palpate **forearm in supination**

- Pissiform
- FCU insertion
- Finally hook of hamate

Summary



Range of motion and grip strength

- Grinding sound
- Snap
- Clunk
- GRIT test

Grinding sound

- Caused by rubbing of two bony surface without cartilage
- Seen in fracture of partial LT coalition

Snap sound - sharp sound

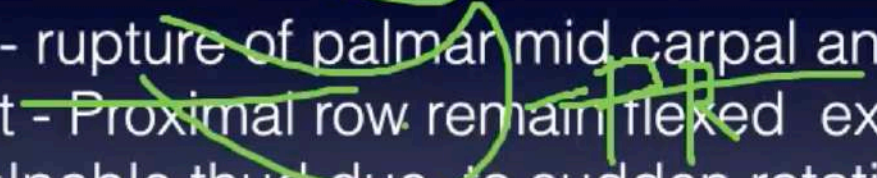
HPitche

- ECU subluxation out of groove on ulna

Clunk sound - low pitch sound

- Produced by sudden **displacement of carpal bone in and out** of its normal position

Types of clunking



- **Anterior mid carpal clunk** - rupture of palmar mid carpal and dorsal Radiocarpal ligament - Proximal row remain flexed except in extreme ulnar deviation - palpable thud due to sudden rotation of proximal row in extension
- **Posterior mid carpal clunk** seen in young patients with hyper mobile joints , absence of dorsal inter carpal ligaments , CLIP wrist

GRIT test

- **Quantifiable** measurement of **ulno carpal impaction**
- Basis - load transfer across ulno carpal joint is **more in pronation than supination**
- Patient with ulno carpal impaction will not able to squeezing dynamometer in pronation as hard as in supination

Passive joint mobilisation test
Ballotmmet /Gliding test

Piano-key sign test
Distal ulna ballottement test
Distal ulna ballottement test in radial deviation
Pisiform boost test (ulnocarpal)
Reagan's ballottement test (LTq)
Pisotriquetral grinding test
Triquetrohamate shear test
Midcarpal drawer's test (anterior and posterior)
Fifth carpometacarpal stress test

Ulnar column of wrist

Seven joint can be tested

- DRUJ - Ballotment test , Piano key test
- Ulno carpal joint
- LT joint - Ballotment test , shut test , Derby test in VISI deformity
- Pisso triquetral joint
- Triquetro hamate joint
- Lunocapitate joint
- 5 th CMC joint

DRUJ joint

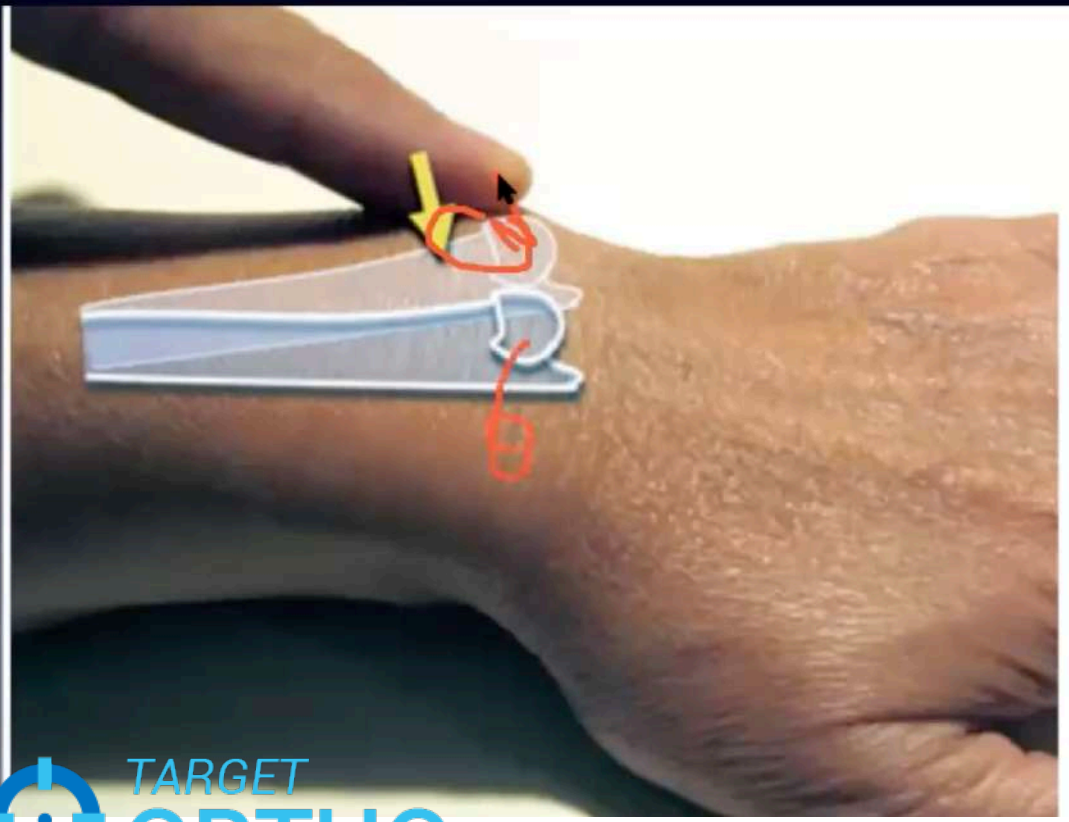
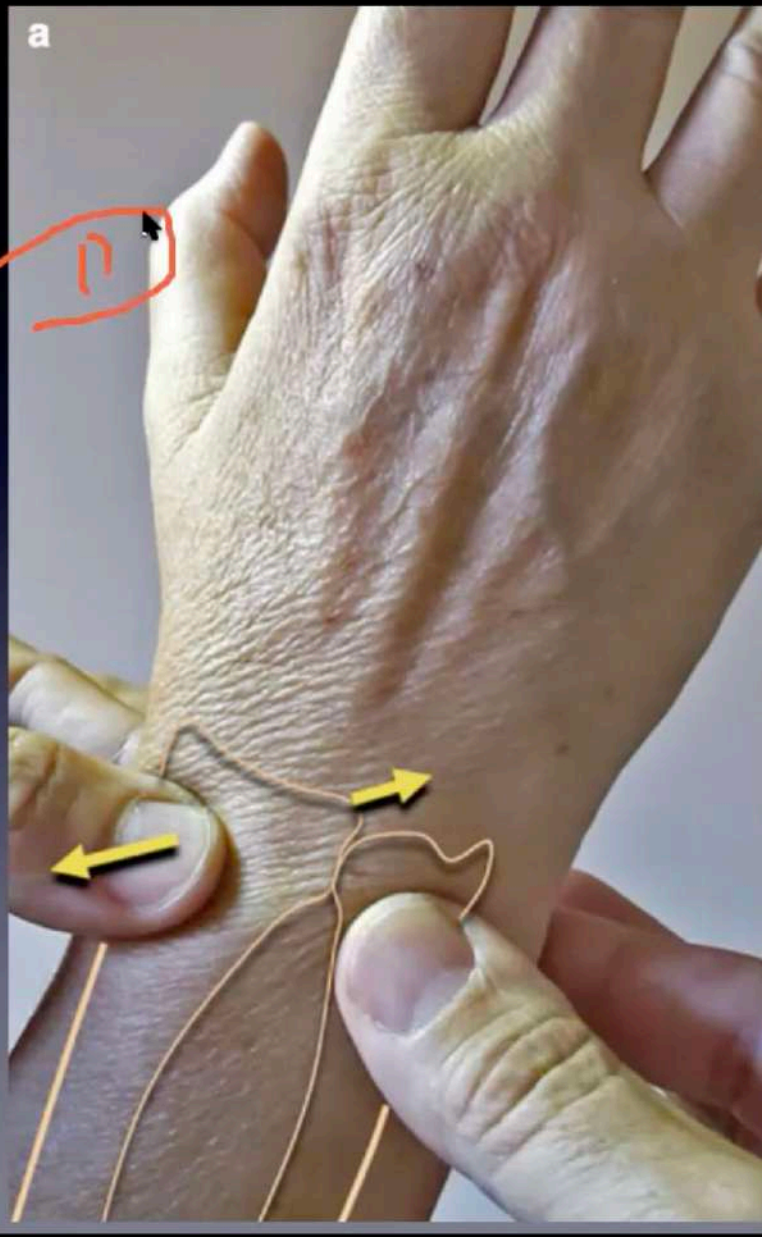


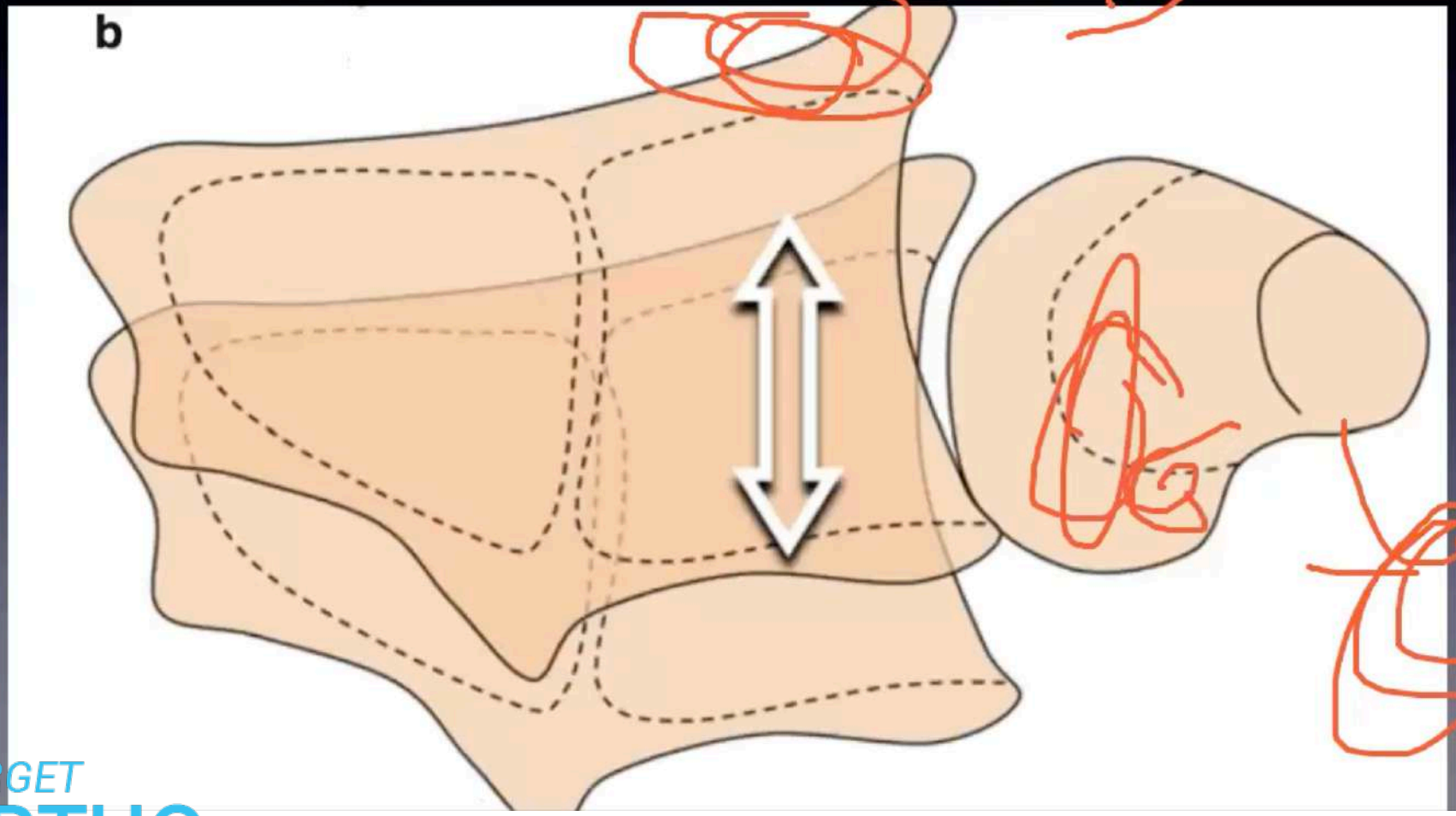
Fig. 3.3 "Piano-key test." Even though the dorsally subluxed distal ulna can be reduced (*yellow arrow*), it springs back to the start position when the reduction force is released

DRUJ joint

Fig. 3.4 (**a**, **b**) "DRUJ instability test," also known as "distal ulna ballottement test." (**a**) Two hands are used to mobilize back and forth the radius relative to the ulna (*yellow arrows*). (**b**) Schematic representation of the test in the transverse plane. The ulna is to be considered a fixed axis about which the radius is mobilized (*white double arrow*)



DRUJ - Ballotment test



TFC shear test

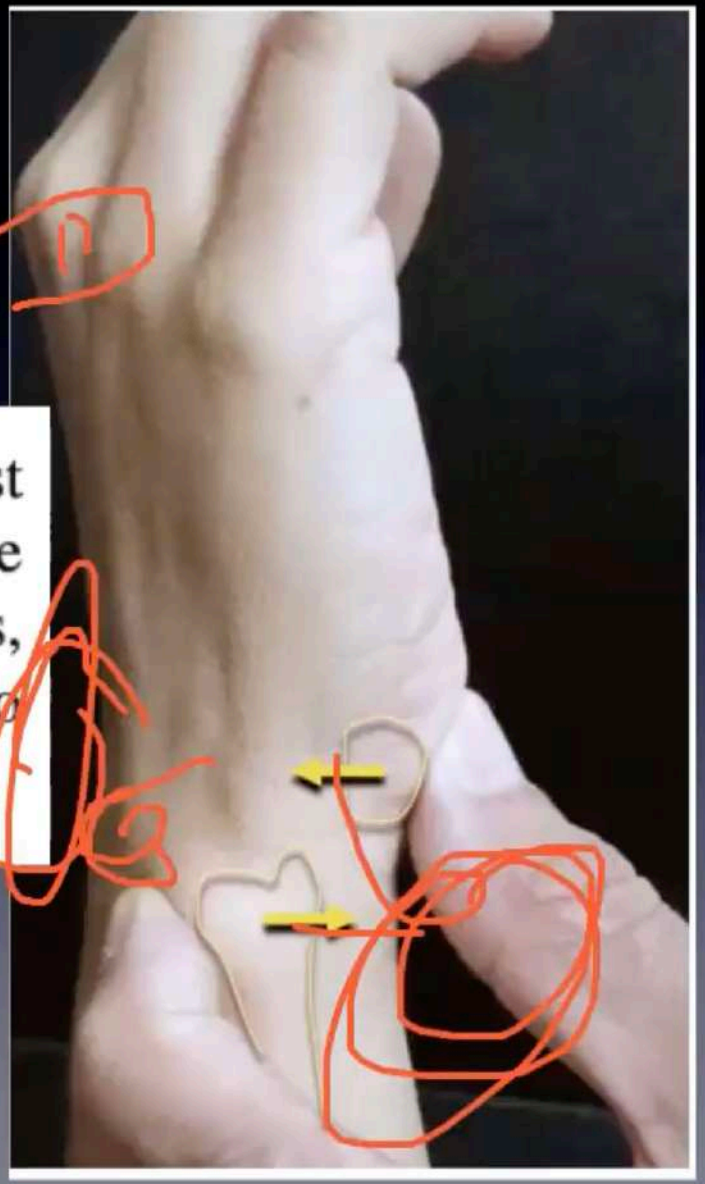


Fig. 3.5 "TFC shear test," also known as "pisiform boost test" or "ulno-menisco-triquetral dorsal glide test." The pisiform and the ulna are pushed in opposite directions, creating an anteroposterior shear stress (*yellow arrows*) to the TFC and ulnocarpal meniscus homologue

T joint - with two hands

Fig. 3.6 (**a**, **b**) The "ballottement test" of the LTq joint described by Reagan and associates [32]. (**a**) With two hands, the explorer creates shear stress to the LTq joint (*yellow arrows*). (**b**) The pisotriquetral unit is pressed posteriorly, while the lunate is constrained palmarly (*red arrows*). The test is positive when the joint exhibits excessive mobility (*yellow arrows*), which may indicate LTq interosseous ligament disruption

LT joint -Ballotment
With two fingers

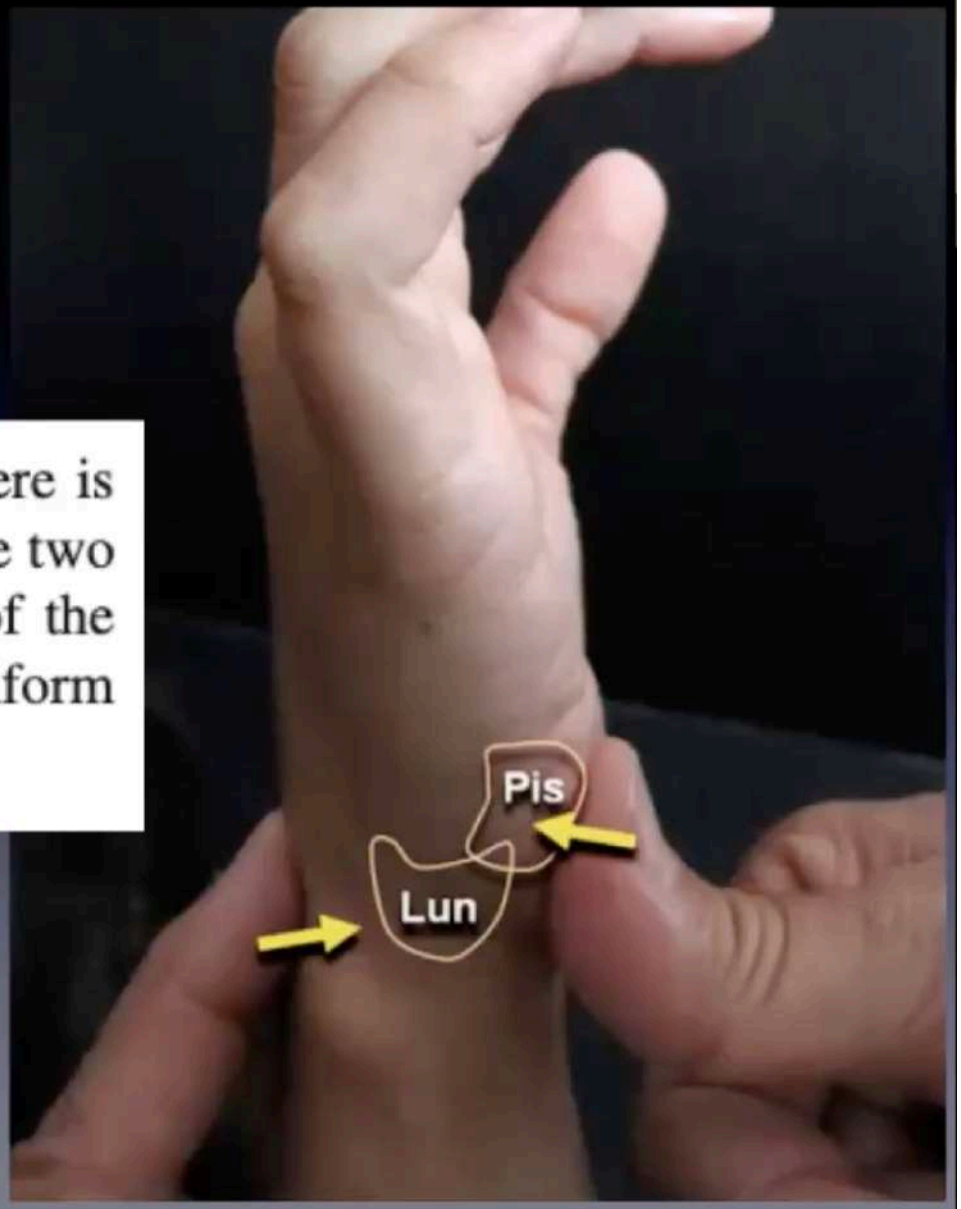


Fig. 3.7 Similar to the "LTq ballottement test," there is the "LTq shear test" or "shuck test." In this case, the two opposite forces (*yellow arrows*) onto the dorsum of the lunate (*Lun*) and the palmar convexity of the pisiform (*Pis*) are exerted by only two fingers

LT joint-with VISI

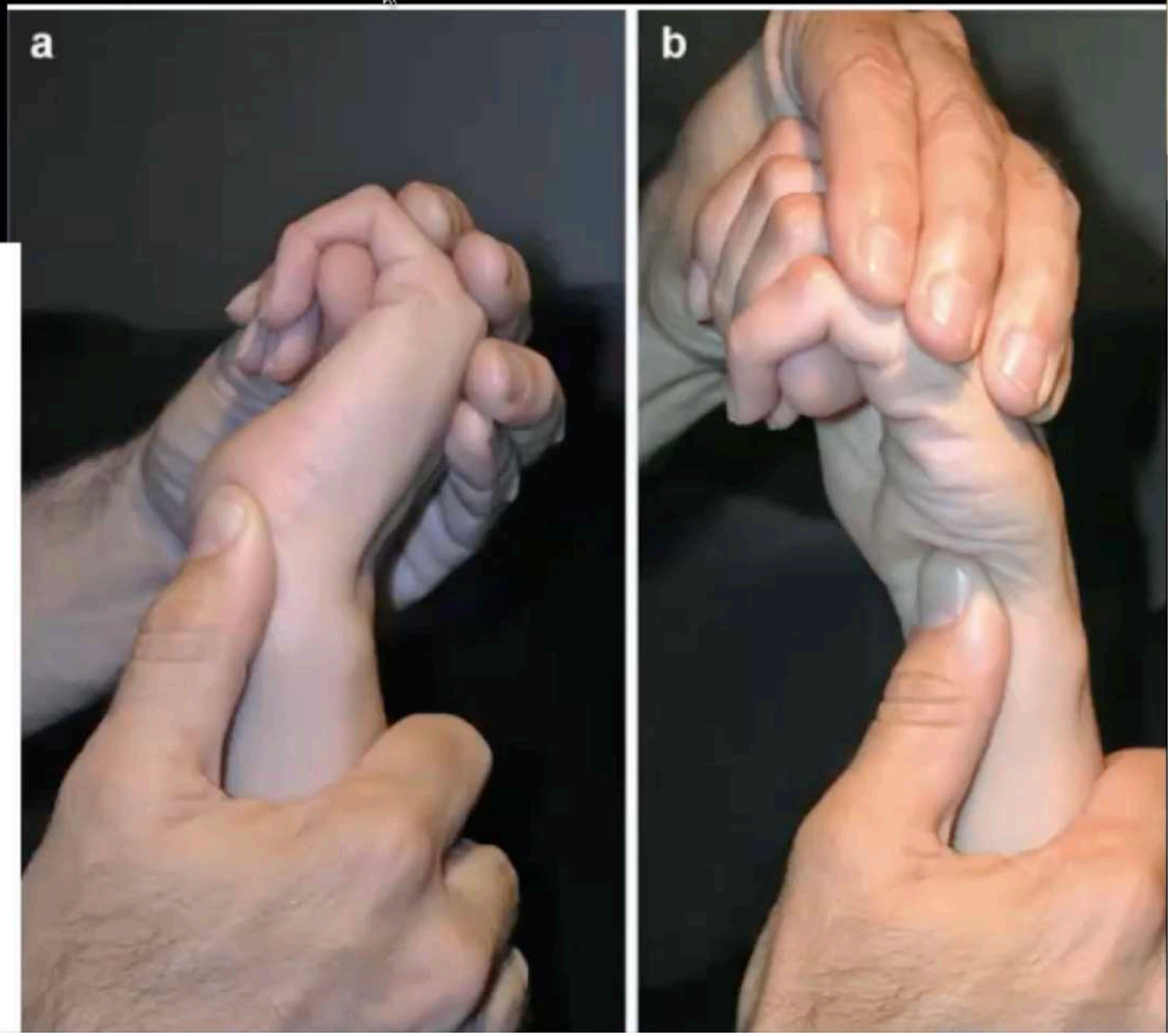
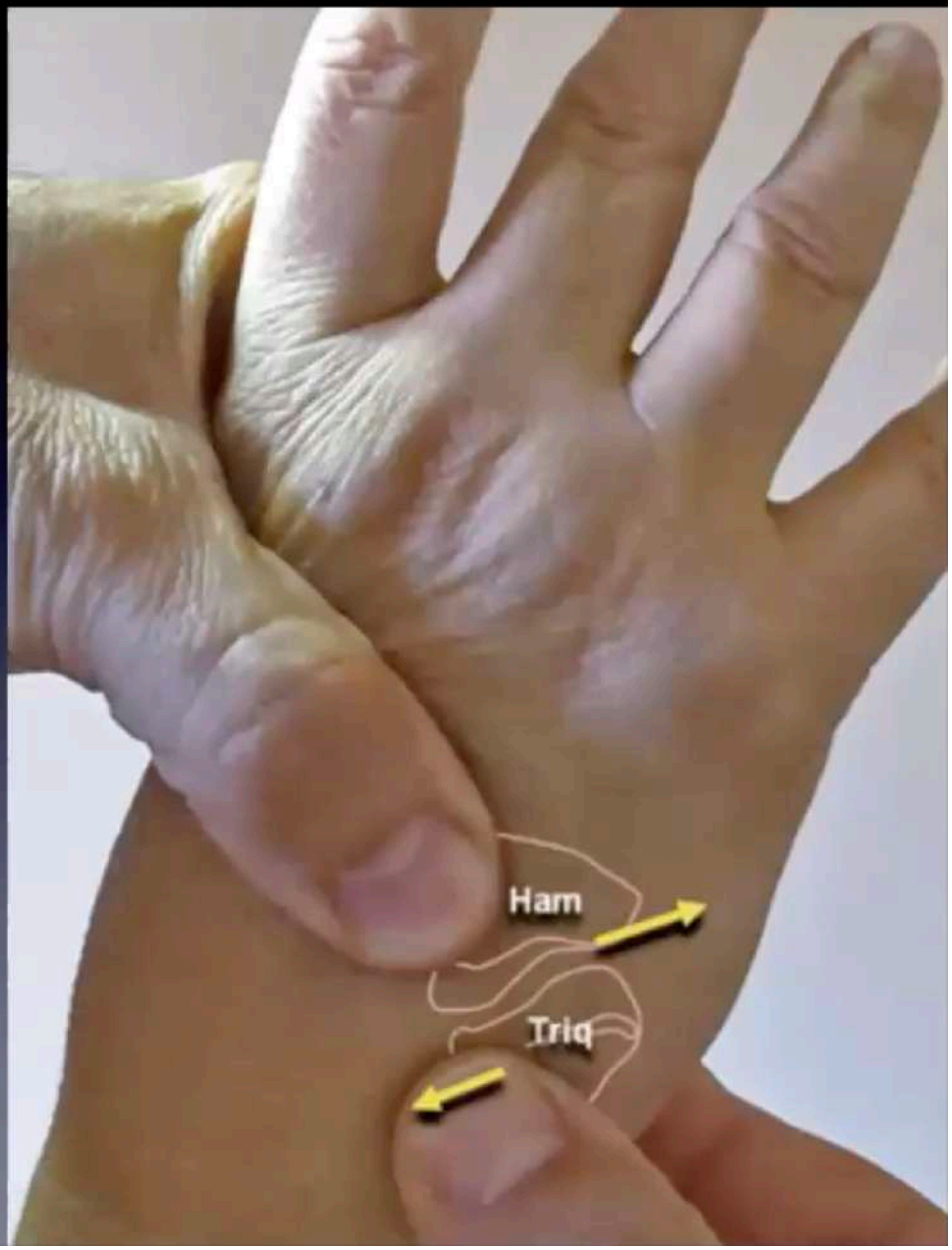


Fig. 3.8 The "Derby test" consists of reducing the VISI pattern of carpal malalignment, present both in LTq instabilities as in palmar midcarpal instabilities, by pushing dorsally the triquetrum. This generates an extension moment to the triquetrum that mitigates the patient's discomfort both in radial inclination (**a**) as in ulnar deviation (**b**)

TQ-Hamate joint

Fig. 3.10 The "triquetrohamate grinding (or shear) test" consists on mobilizing the hamate against the triquetrum (*yellow arrows*) searching for pain and crepitus, a finding that indicates the presence of chondromalacia of the proximal pole of the hamate



Midcarpal joint

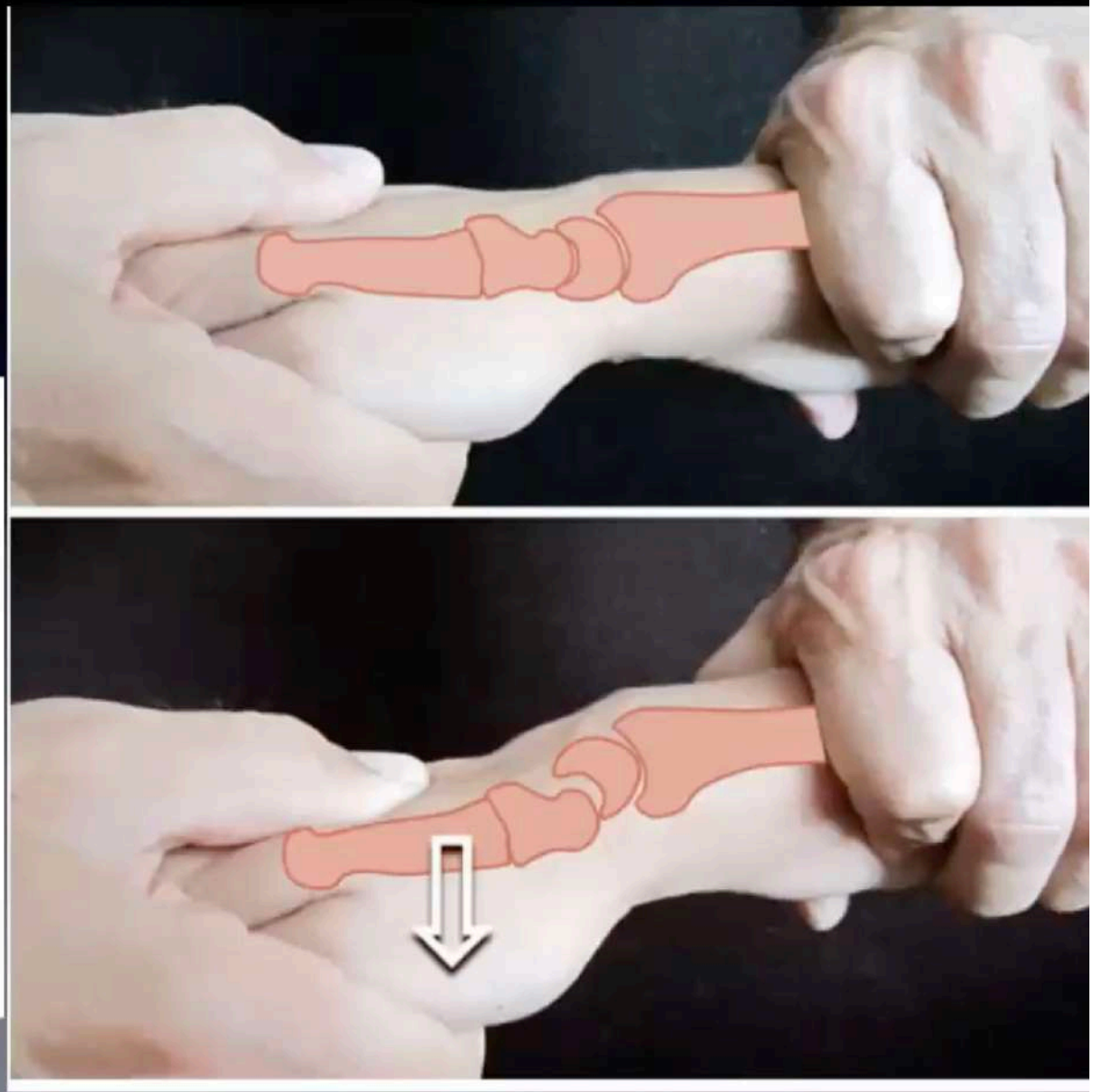


Fig. 3.11 "Anterior drawer's test." A palmar directed force (*white arrow*) to the distal row may be used to investigate the existence of a palmar midcarpal instability

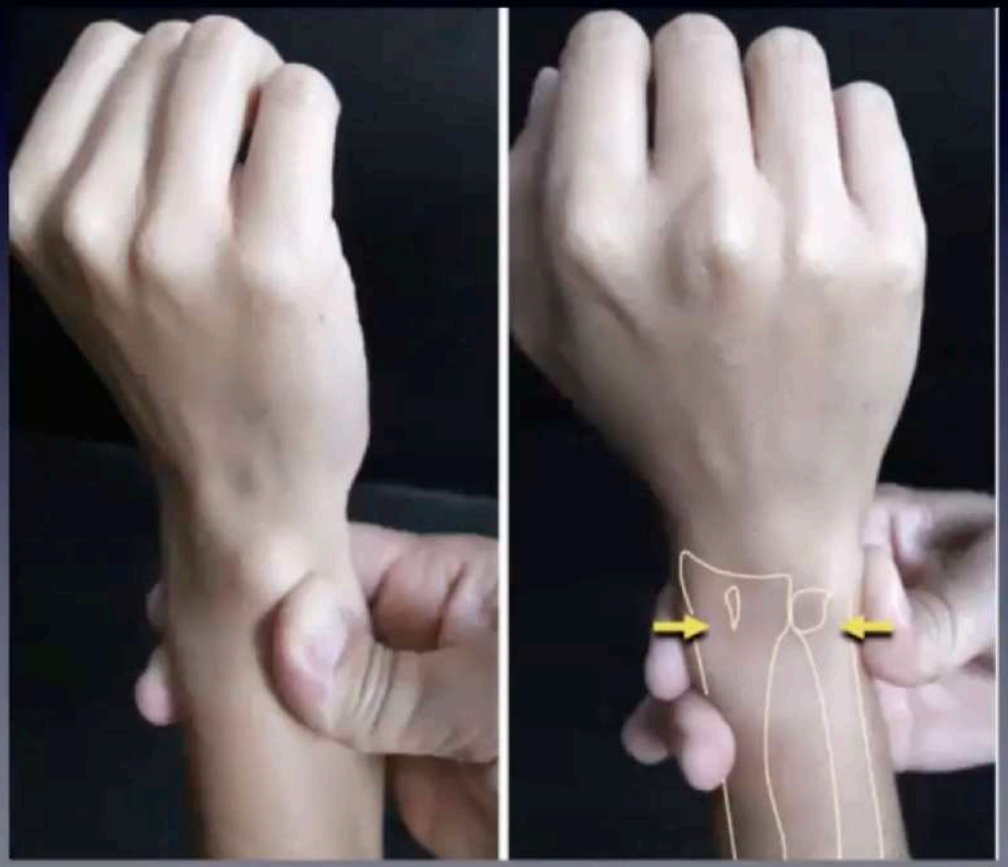
Provocative test for ulnar side pain

Table 3.3 Provocative test for ulnar-sided pain

Radioulnar compression test
Loaded pronosupination test
ECU tendon subluxation test
ECU synergy test (Ruland and Hogan test)
TFC grind test (Nakamura's ulnocarpal stress test)
Ulnar styloid impaction test (Ruby's test)
Ulnocarpal meniscoid test (waiter's test)
Lunotriquetral compression or "ulnar snuffbox test"
Triquetral shift maneuver of Sennwald
Lichtman's midcarpal shift test
Hook of the hamate pull test

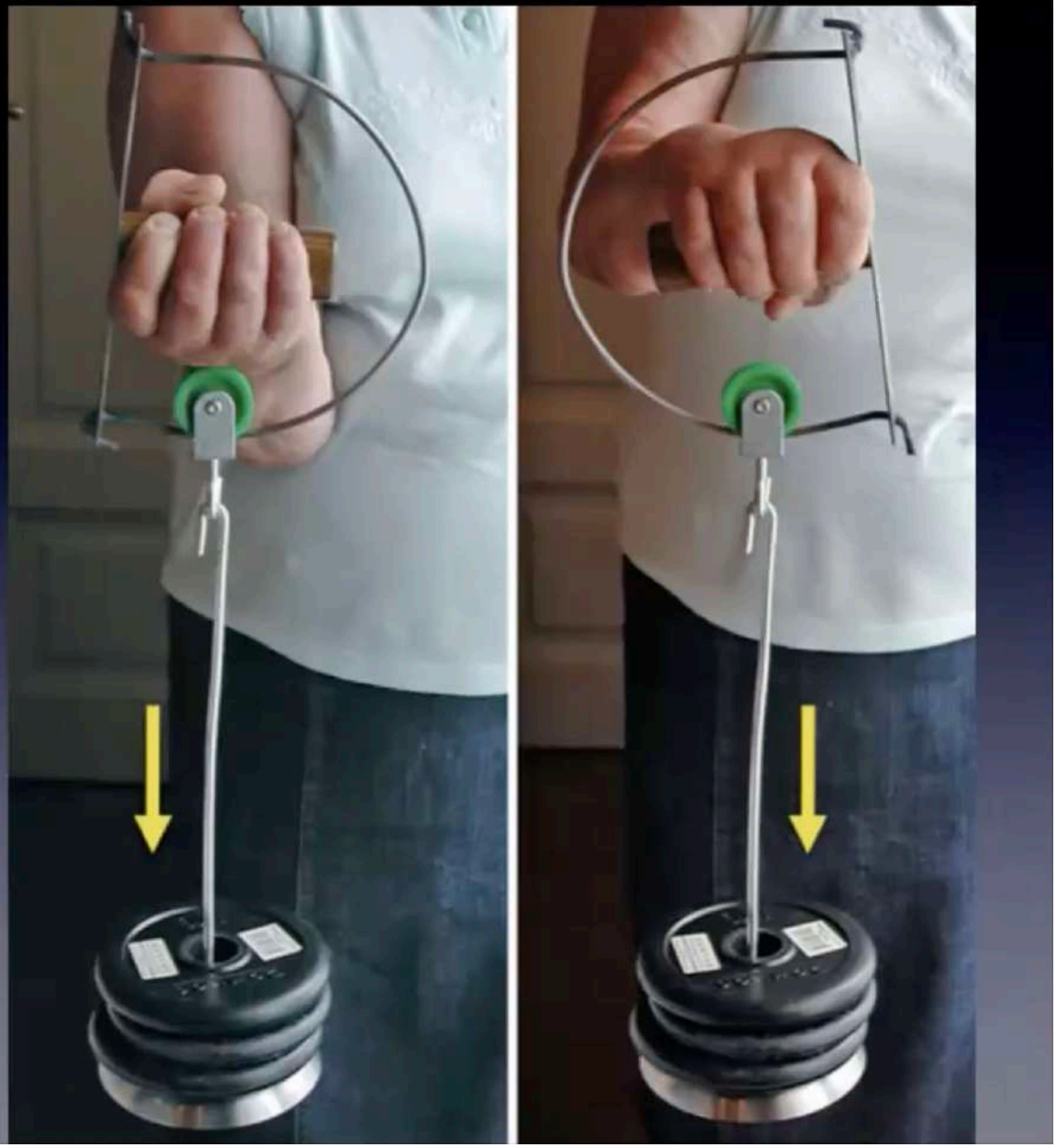
DRUJ

Fig. 3.12 "Radioulnar compression test." The ulna is pressed against the radius while the forearm is passively rotated. Pain and crepitus indicates degenerative osteoarthritis of the radioulnar joint



DRUJ -5 kg

Fig. 3.13 "Loaded pronosupination test." A hanging weight (*yellow arrows*) creates a constant transverse loading to the distal radioulnar joint throughout the entire range of pronosupination. On average, the maximal load that can be tolerated without experiencing pain is 5 kg [13]. The more damaged the radioulnar joint, the less load the patient can tolerate



ECU tendinitis

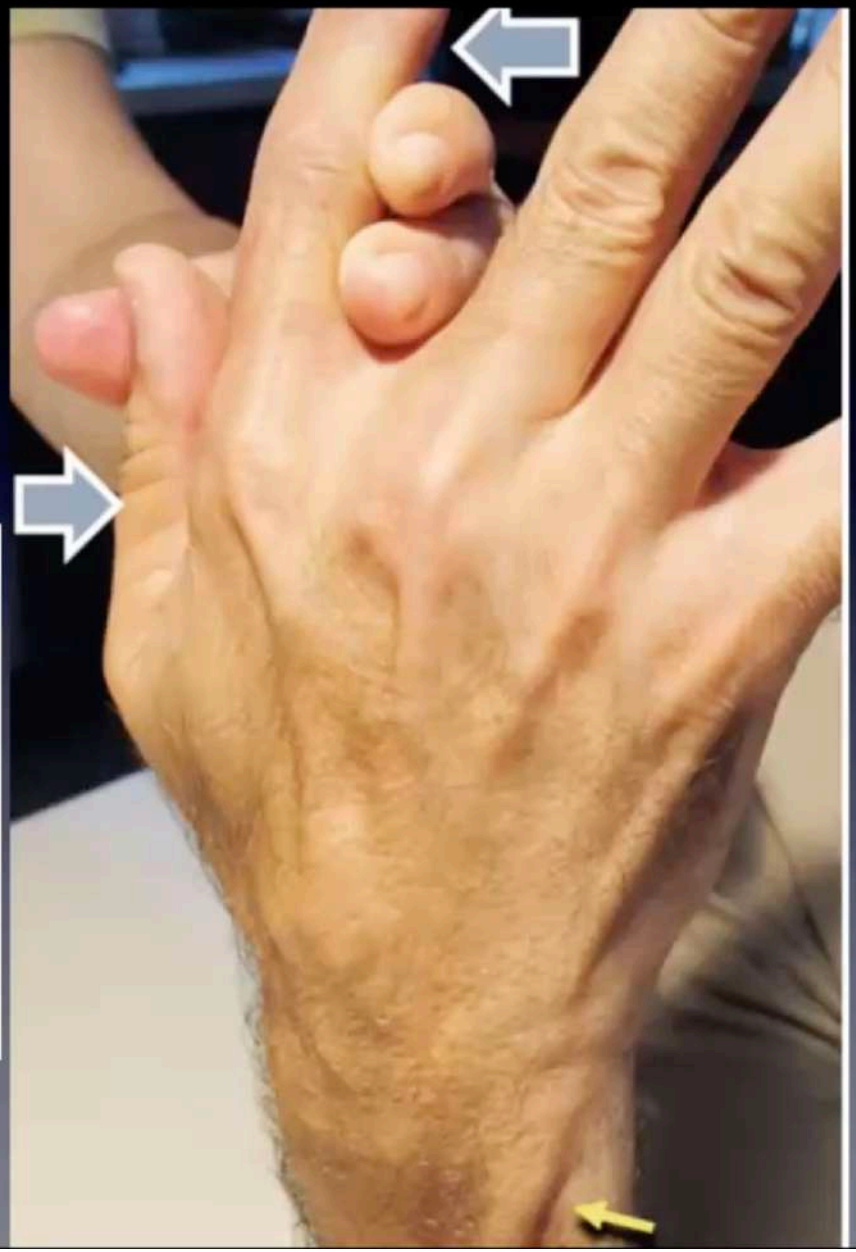


Fig. 3.14 "ECU synergy test." Described by Ruland and Hogan [33], this test is useful to differentiate between ECU tendonitis and intracarpal pathology. Isometric contraction of the abductor pollicis longus and brevis (*gray arrows*) induces synergistic contraction of the ECU tendon (*yellow arrows*). Should the latter tendon be inflamed, pain in the ulnar corner of the wrist is likely when this test is done

TFC shear test

Fig. 3.15 "TFC grind test," also known as "ulnocarpal stress test." The hand is placed in ulnar deviation; the explorer applies an axial load to the hand (*yellow arrow*), and the forearm is rotated from full pronation to supination (*curved arrow*). If this causes a painful grinding sensation, either a TFC lesion or an ulnocarpal impaction syndrome is likely

Fig. 3.18 "LTq compression test." (**a**) The wrist is in neutral position and the explorer exerts thumb pressure onto the "ulnar snuffbox" (*yellow arrow*). (**b**) If that pressure is not discontinued, the triquetrum will be forced against the lunate when the wrist is forced into radial deviation (*white arrow*). Should the LTq joint be pathological, this maneuver would provoke exquisite local pain

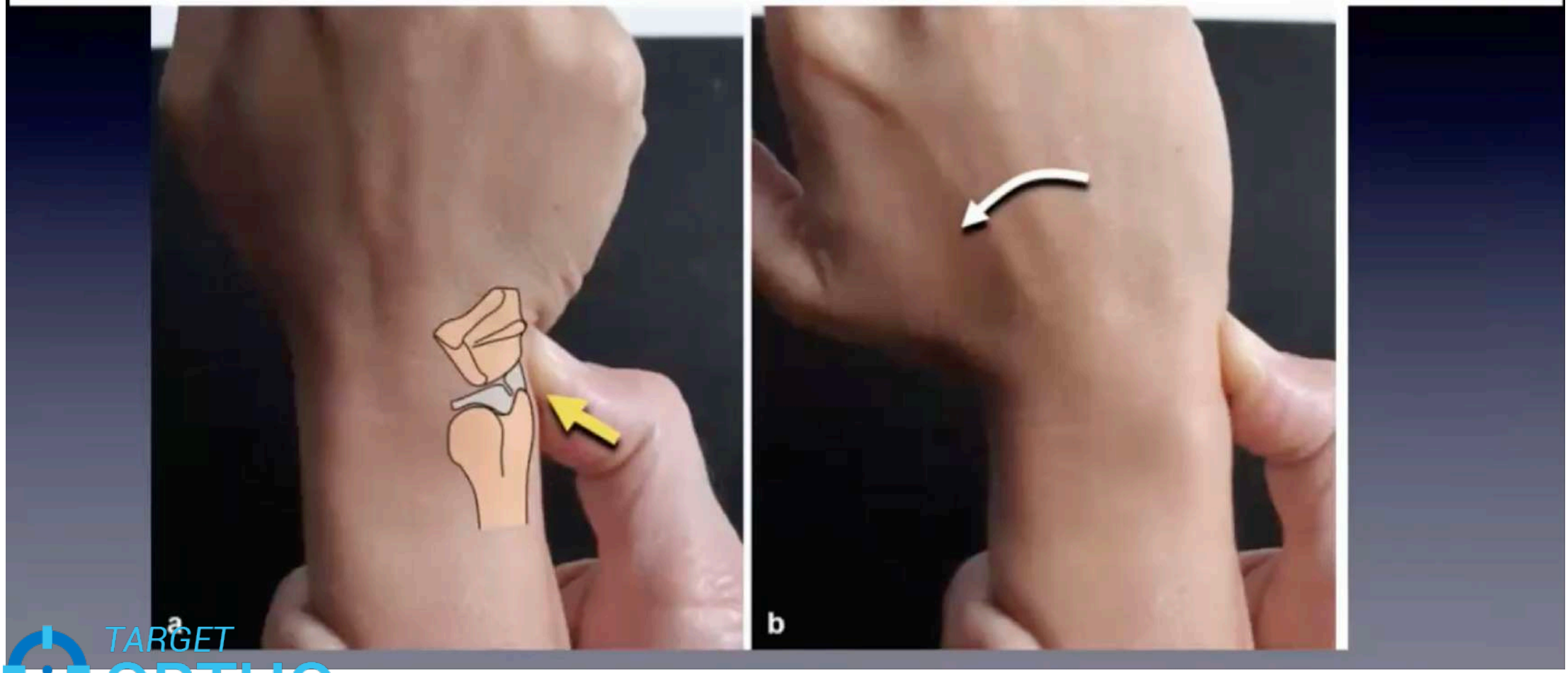
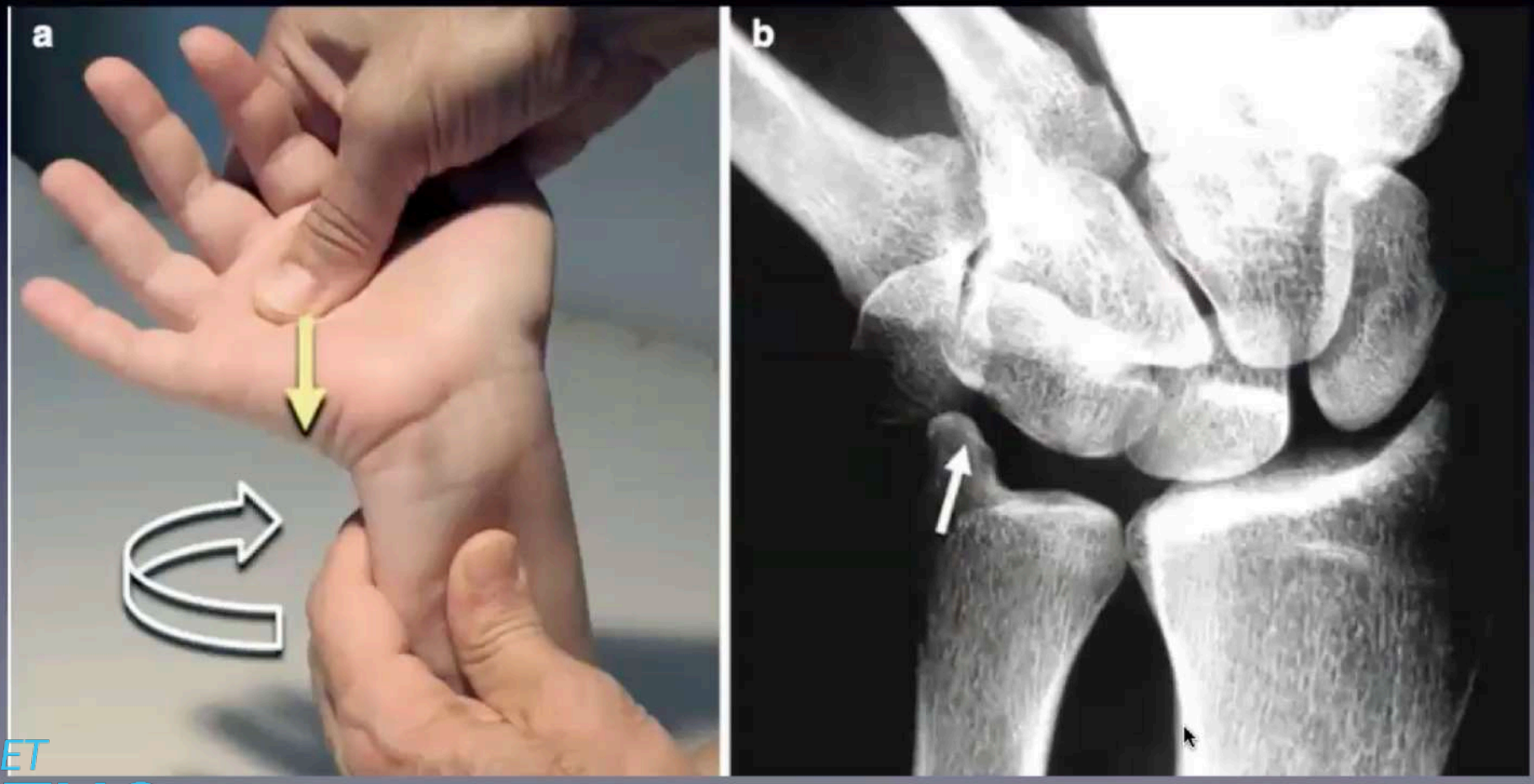


Fig. 3.16 "Ulnar styloid triquetrum impaction test." (**a**) When the wrist is in ulnar deviation and full supination (*white arrow*), if an axial compressive force (*yellow arrow*) is exerted in the palm, the ulnar styloid may contact the dorsal ridge of the triquetrum. (**b**) Radiological demonstration of how close the ulnar styloid (*white arrow*) gets to the triquetrum in such circumstances



TFCC tears

PALMER'S CLASSIFICATION OF TFCC LESIONS

Class I: Traumatic (acute)
- A. Central perforation
- B. Ulnar avulsion
  - With styloid fracture
  - Without styloid fracture
- C. Distal avulsion (from carpus)
- D. Radial avulsion
  - With sigmoid notch fracture
  - Without sigmoid notch fracture

Class II: Degenerative (ulnar impaction syndrome)
- A. TFCC wear
- B. TFCC wear
  + lunate and/or ulnar head chondromalacia
- C. TFCC perforation
  + lunate and/or ulnar head chondromalacia
- D. TFCC perforation
  + lunate and/or ulnar head chondromalacia
  + lunotriquetral ligament perforation
- E. TFCC perforation
  + lunate and/or ulnar head chondromalacia
  + lunotriquetral ligament perforation
  + ulnocarpal arthritis

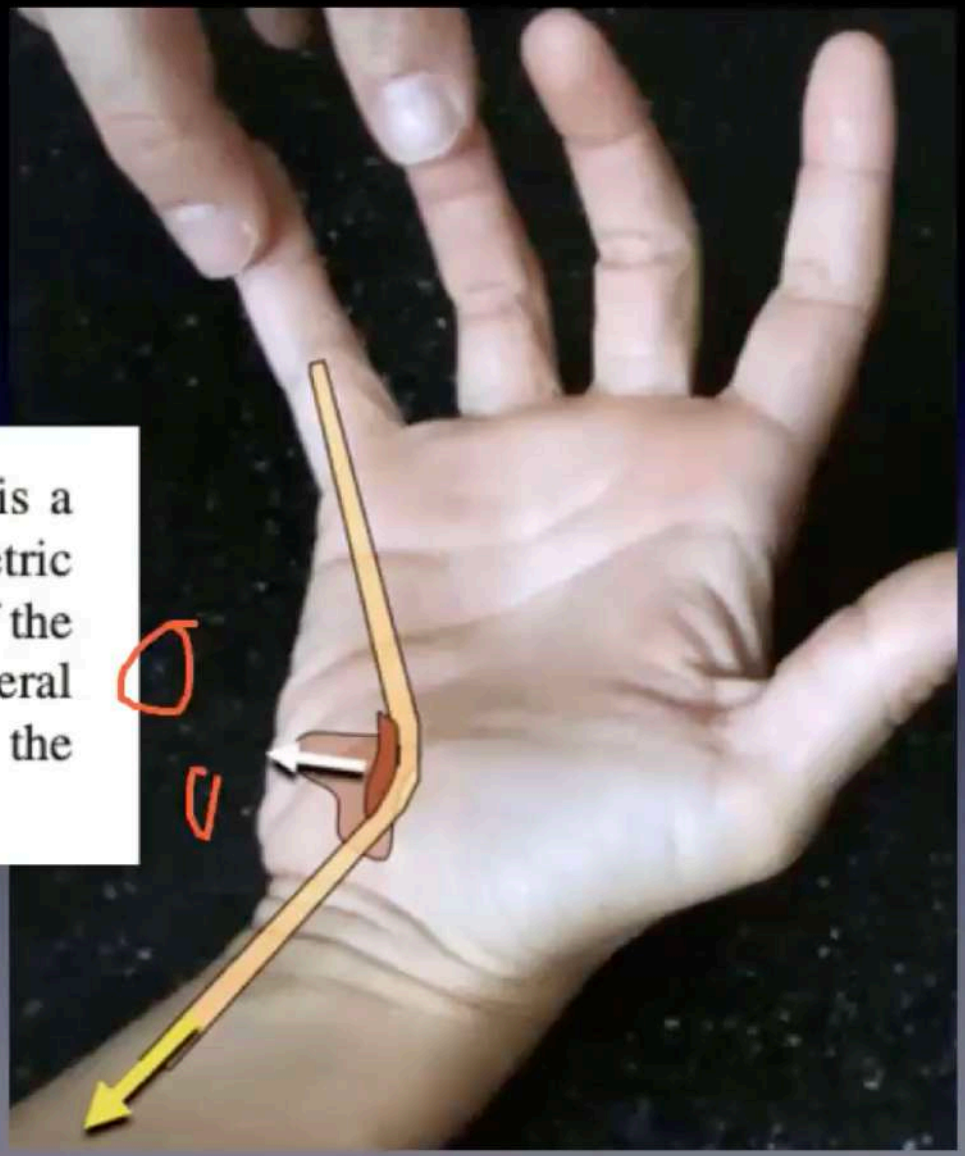
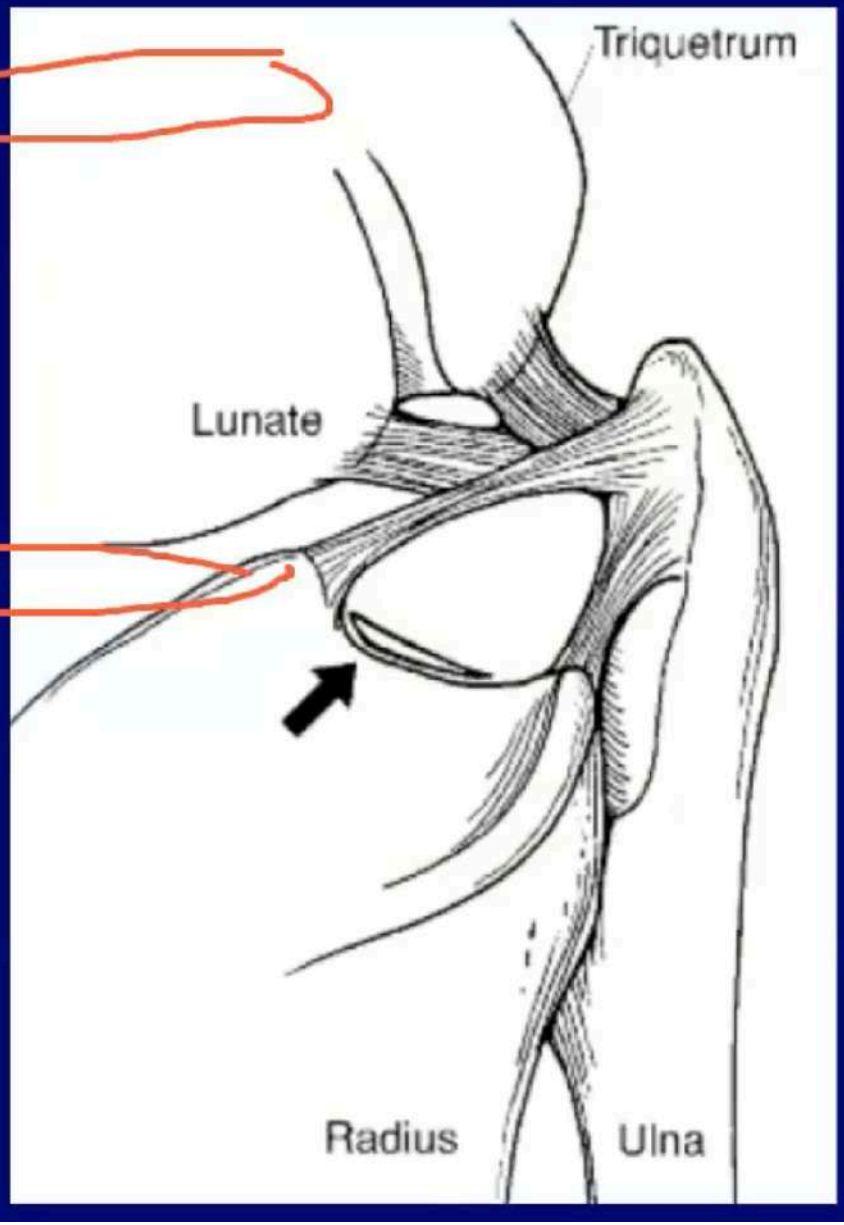


Fig. 3.20 "Hook of the hamate pull test." If there is a non-united fracture of the hook of the hamate, isometric contraction (*yellow arrow*) of the two flexor tendons of the little finger will provoke pain, as a result of the lateral directed vector generated by this tendon compressing the fracture site (*white arrow*)

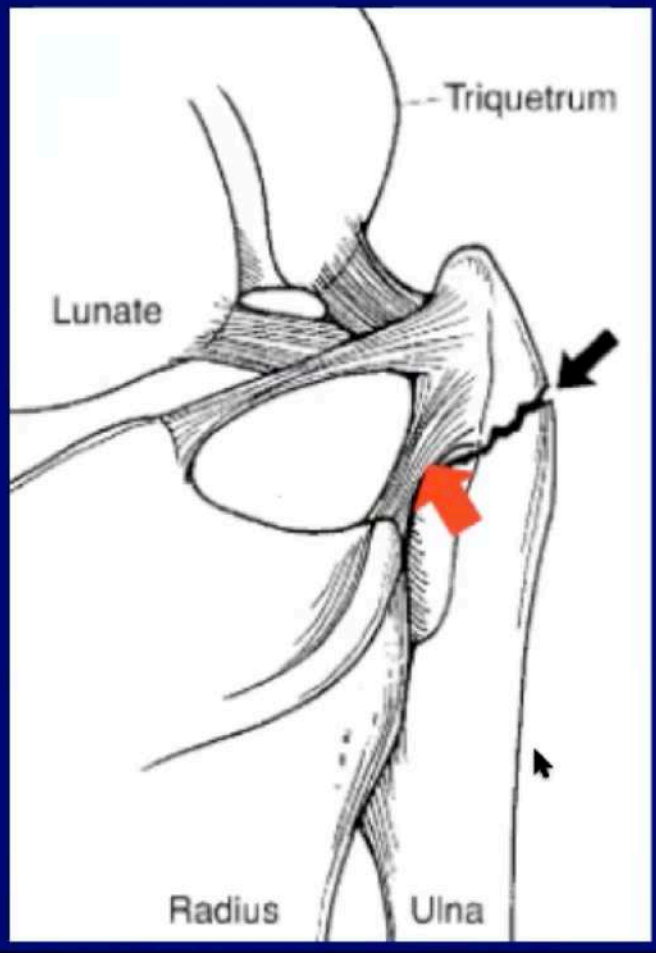
Class 1 A – central

- Most common



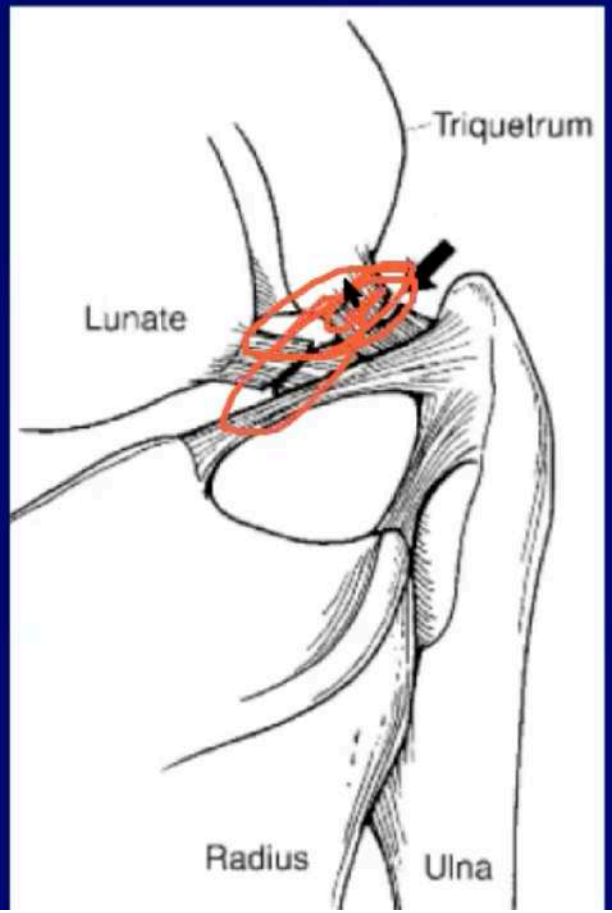
Class 1 B

- Peripheral TFCC tear in vascular zone of TFCC with or without ulna styloid fracture



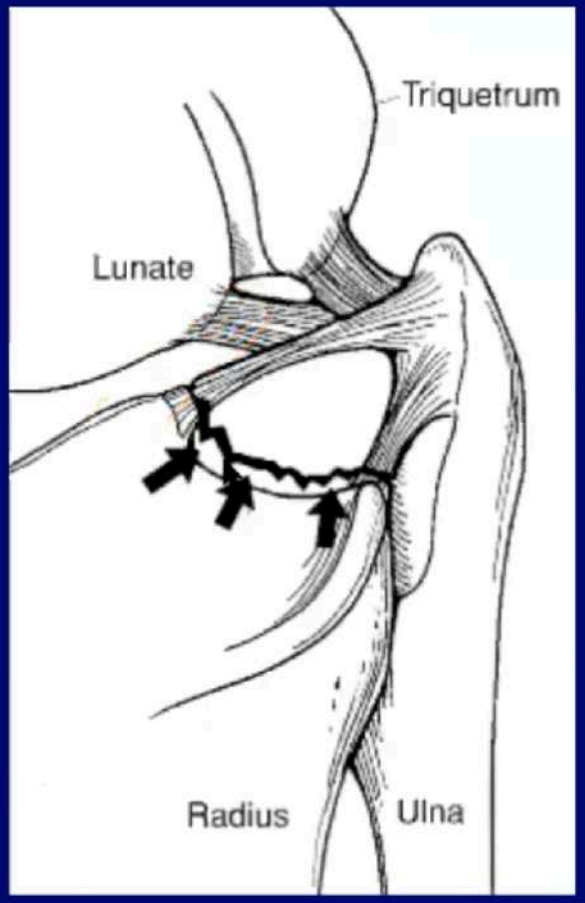
Class 1C

- Detachment of TFCC from its distal attachment to the lunate

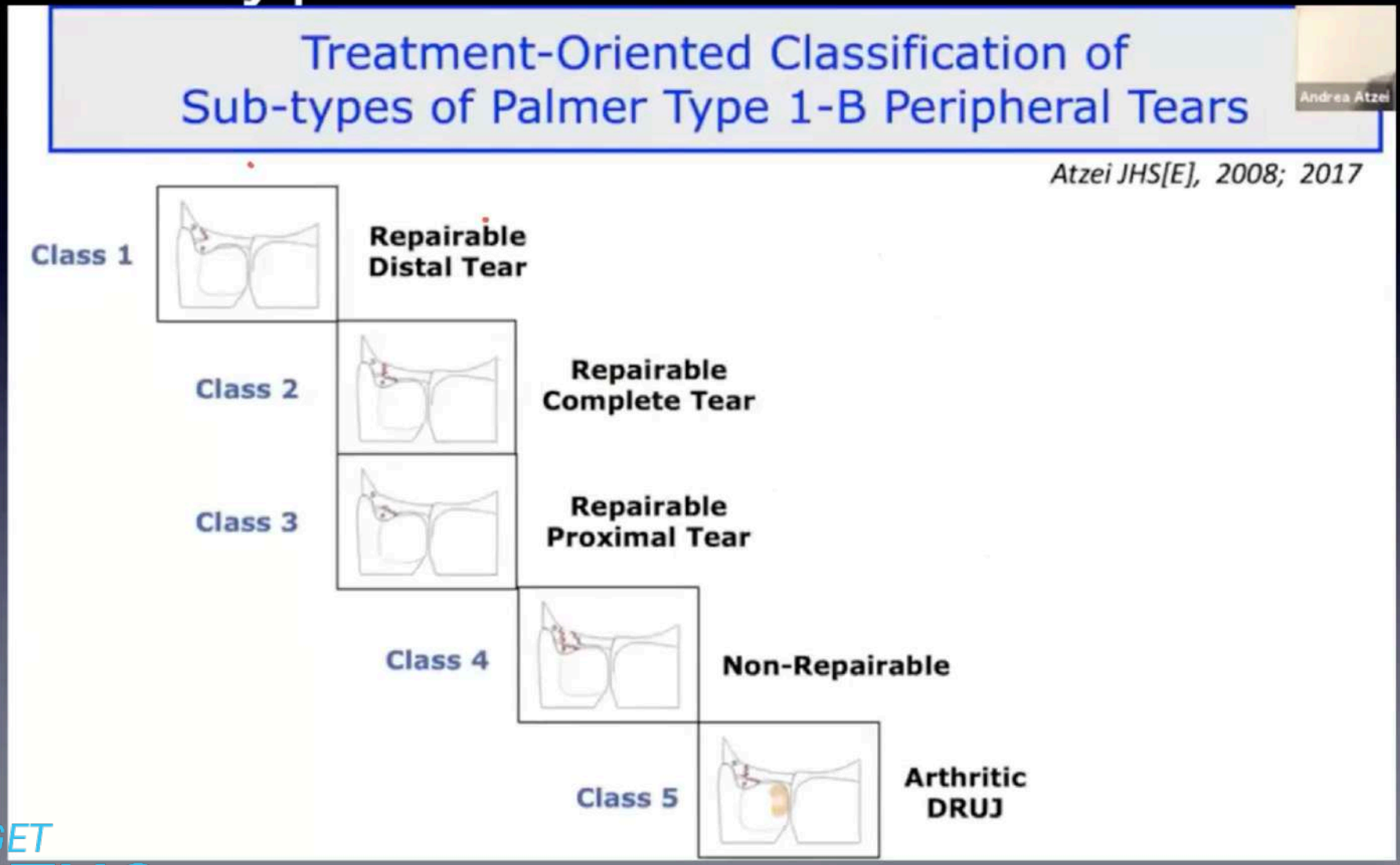


Class 1 D

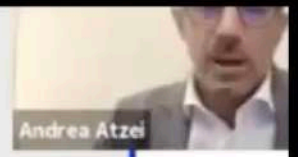
- Detachment of the TFCC from its radial attachment at sigmoid notch



Type B - subdivision



Treatment-Oriented Classification of Sub-types of Palmer Type 1-B Peripheral Tears



Atzei JHS[E], 2008; 2017

Class 1

Repairable Distal Tear

Class 2

Repairable Complete Tear

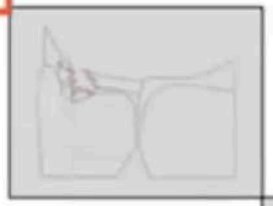
Class 3

Repairable Proximal Tear

Major DRUJ Instability

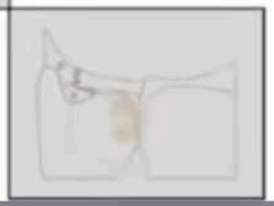
Foveal Refixation

- Suture Anchor
- Knotless Sut A
- Transosseous



Class 4

Non-Repairable

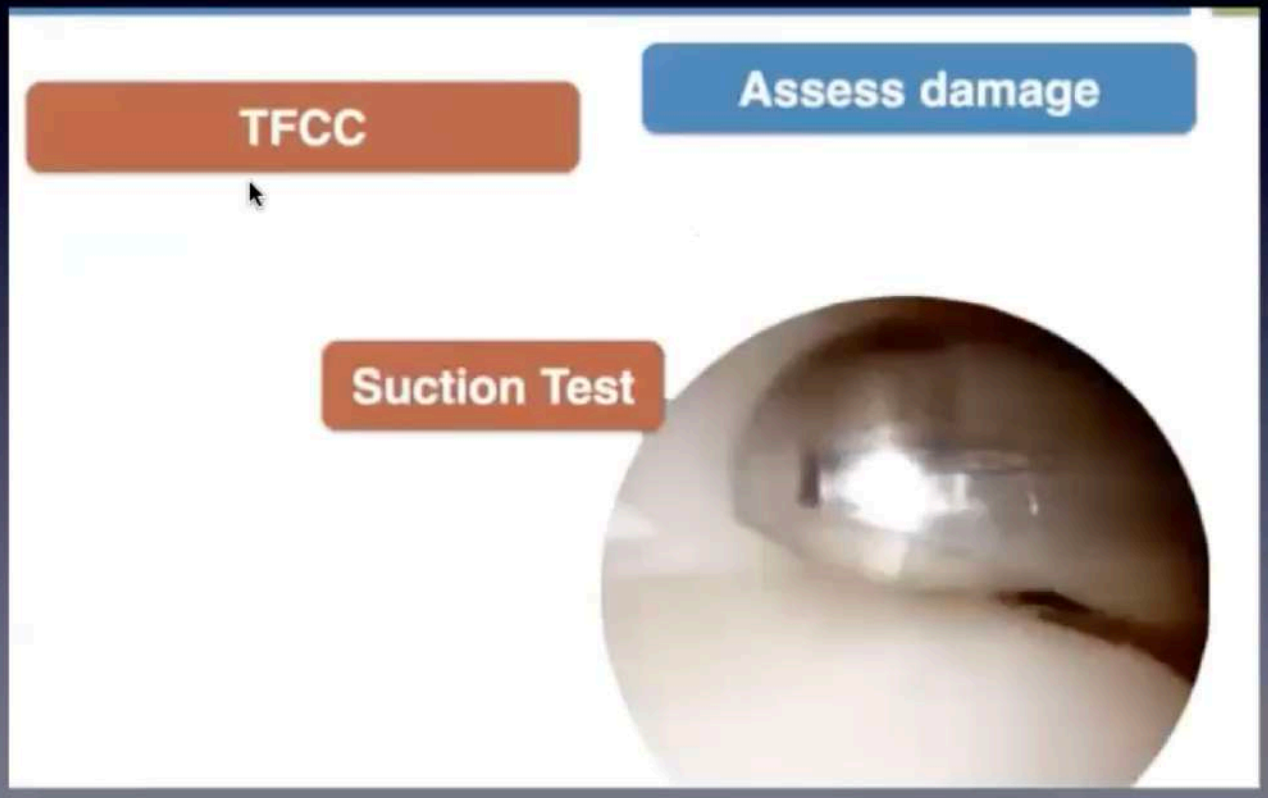


Class 5

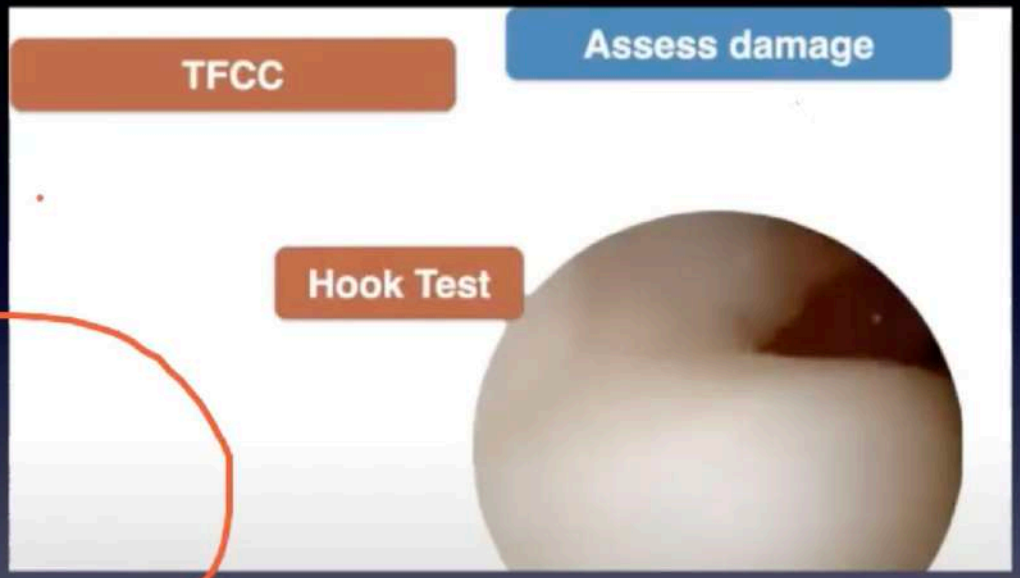
Arthritic DRUJ

Superficial Tfcc tested by

- Loss of Trampoline test
- Suction test



Test foveal insertion



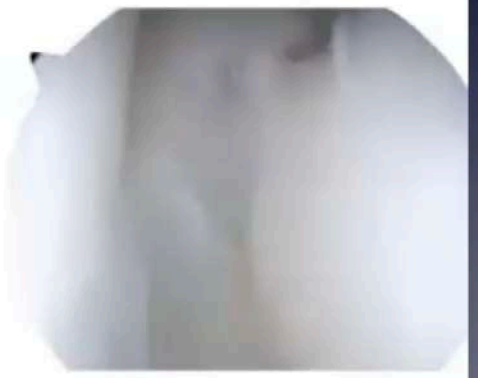
- Best to do DRUJ Scopy
- Through radioiocarpal Scopy - Hook test - from prestyloid recess hook Tfccc

S L tear- arthroscopic grading

Scapholunate

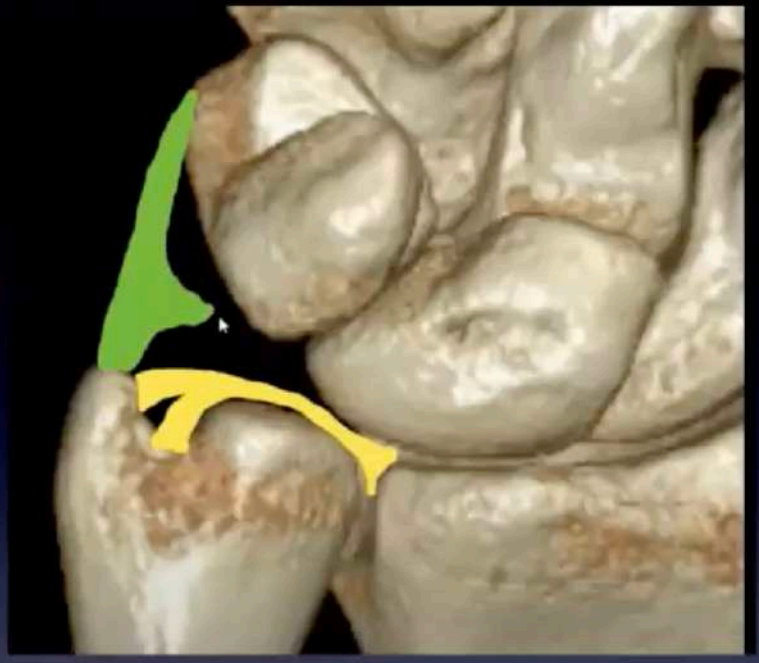
Assess damage

Geissler	RC vision	MC widening	Step
1	Intraligamentary hemorrhage	None	None
2	Incomplete tear No attenuation	<3mm Probe Introduced	Just MC
3	Incomplete tear Attenuation	>3mm Probe Rotated	MC y RC
4	Complete tear	2,7mm Arthoscope can be passed	MC y RC

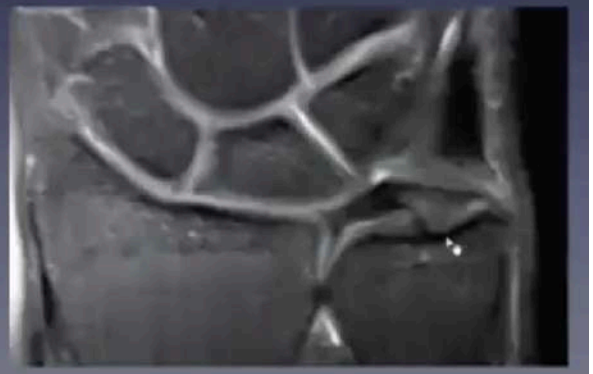


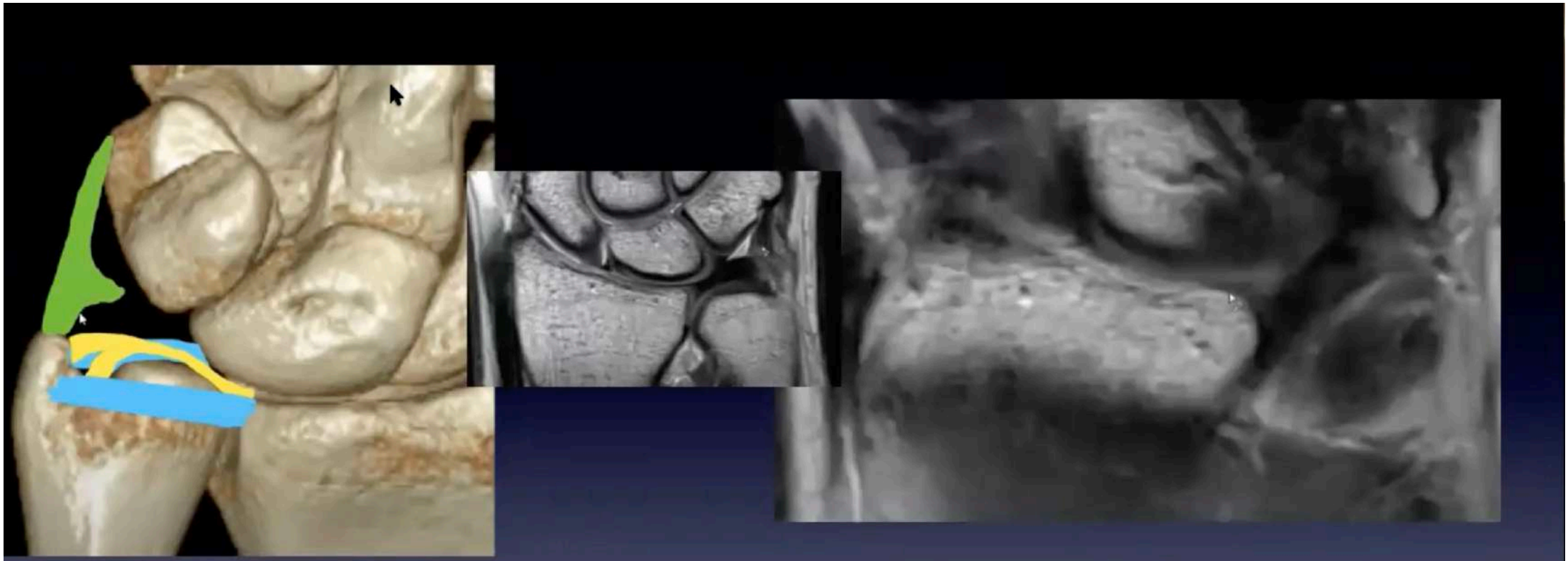
Dry Arthroscopy

Coronal view



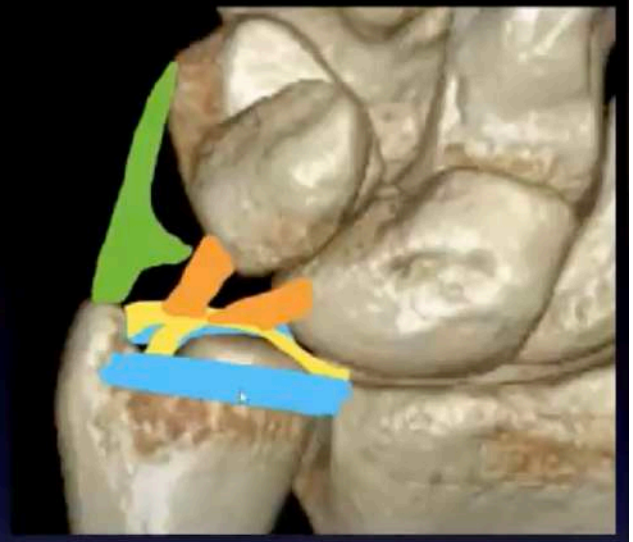
- Yellow - Disc with foveal and styloid lamina
- Disc originate from cartilage flare of radius and not bone
- Subcretanuum - in between two lamina





- Blue colour - volar and dorsal radio ulnar ligament
- Green colour - meniscus homologue and MRI as well at level of disc
- MRI - dorso radio ulnar ligament originating from bone and not cartilage flare

Coronal view



- Mri - volar ulno carpal ligaments
- Orange colour - ulno lunate and ulno triquetrum ligament