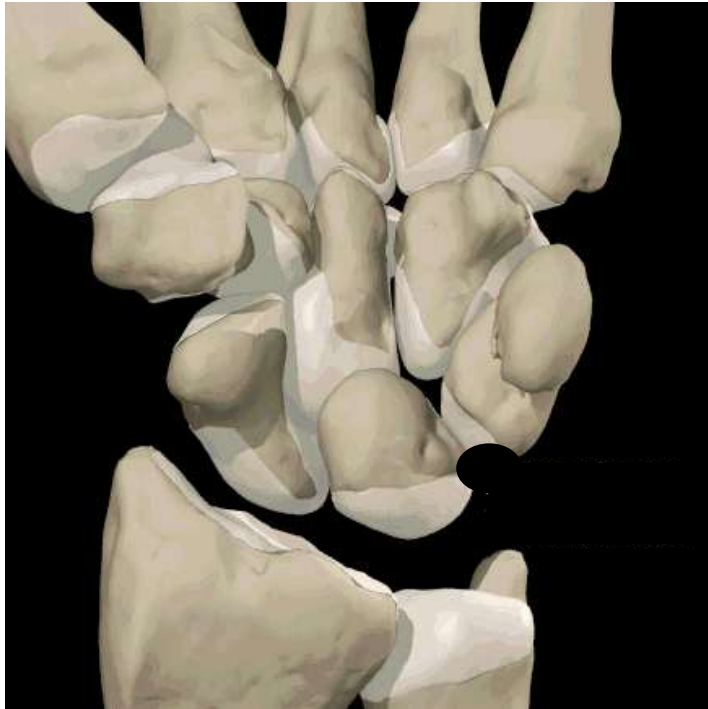


Anatomy and radiological evaluation of the wrist

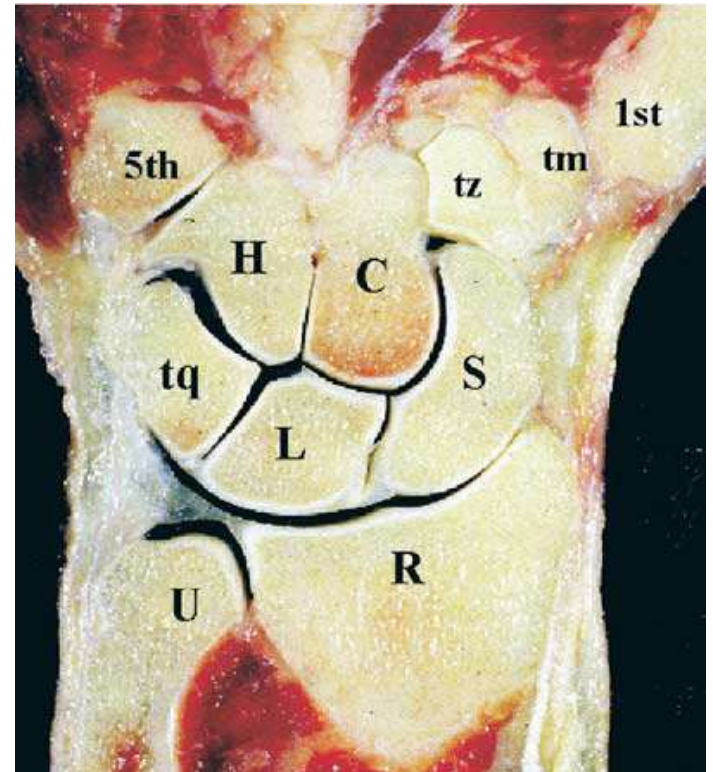


**Andreas Panagopoulos, M.D., Ph. D.
Assistant Professor in Orthopaedics,
University Hospital of Patras**

Osseous anatomy

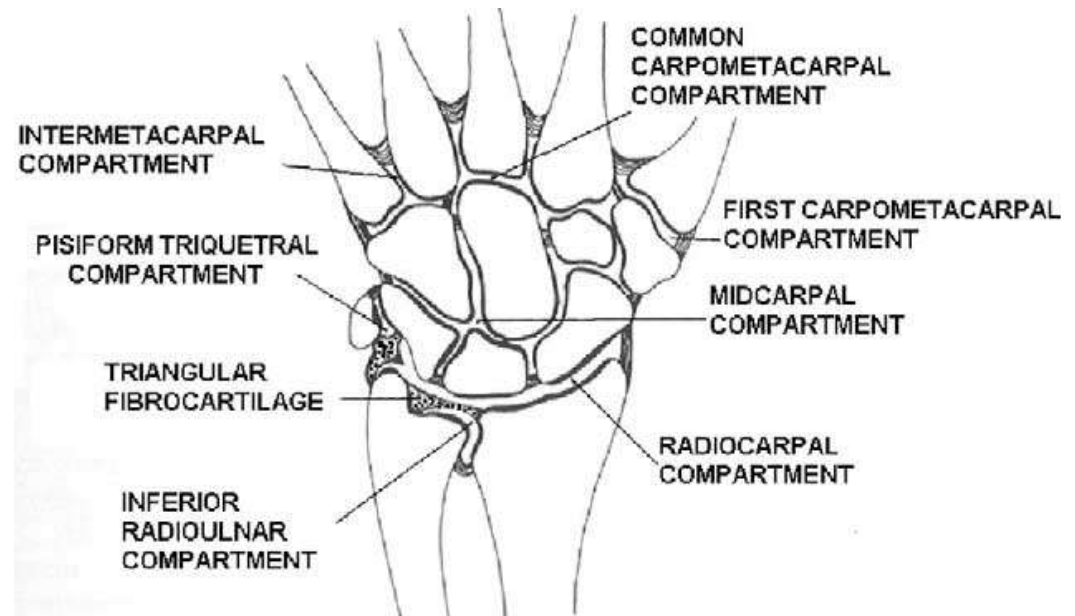
- distal portions of radius and ulna,
- the proximal and distal rows
- bases of the metacarpals

The proximal carpal row is termed an **intercalated segment** because forces acting on its proximal and distal articulations determine its position



Articular Compartmental Anatomy

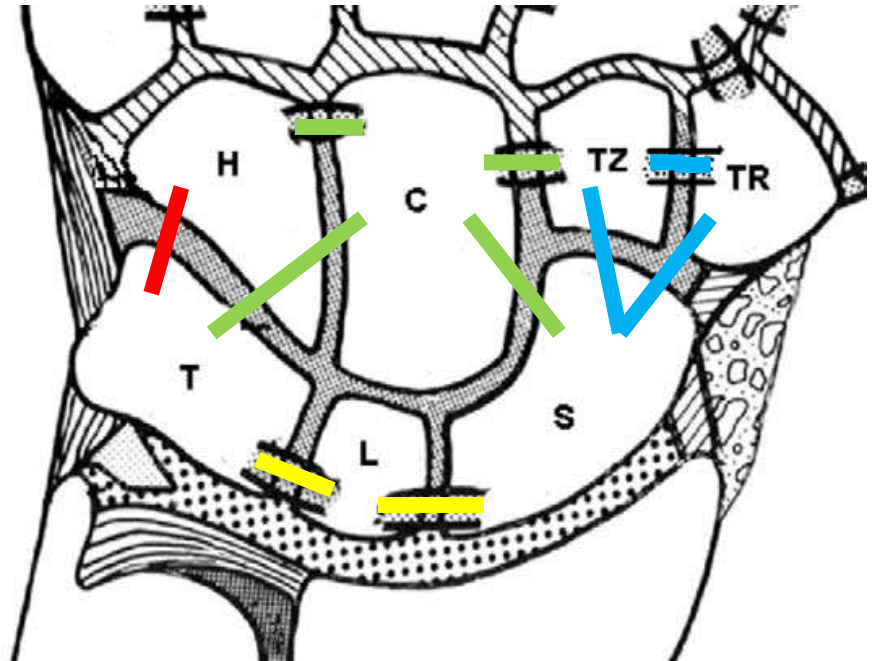
1. Radiocarpal
2. Midcarpal
3. Pisiform-triquetral
4. Common carpometacarpal
5. First carpometacarpal
6. Intermetacarpal
7. Inferior (distal) radioulnar



Ligamentous Anatomy

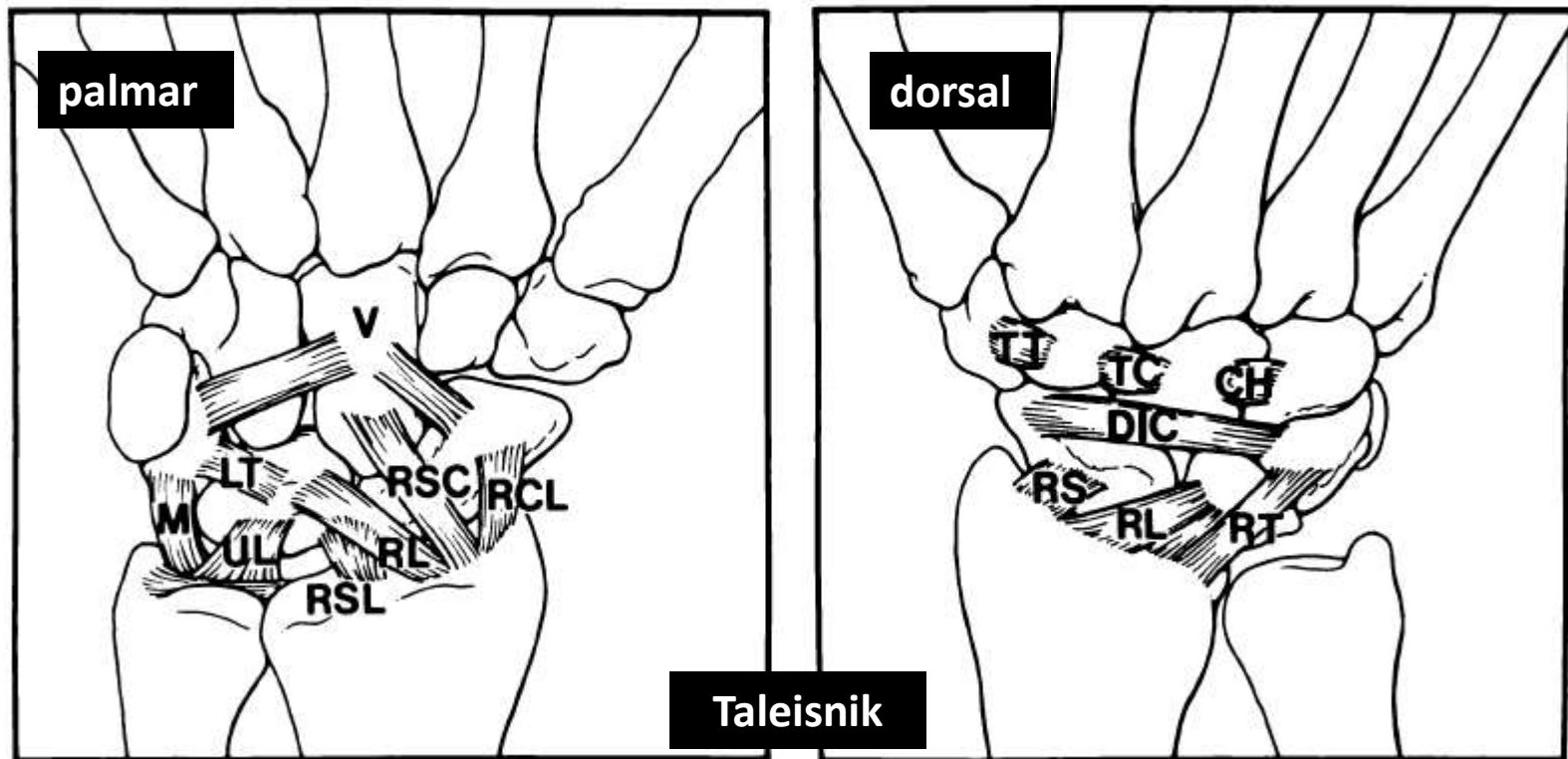
Intrinsic ligaments

- scapholunate
- lunotriquetral
- capitotrapezoid
- capitolhamate
- capitolriquetral
- capitoscaphoid
- triquetrohamate
- scaphotrapeziumtrapezoid
- trpeziotrapezoid

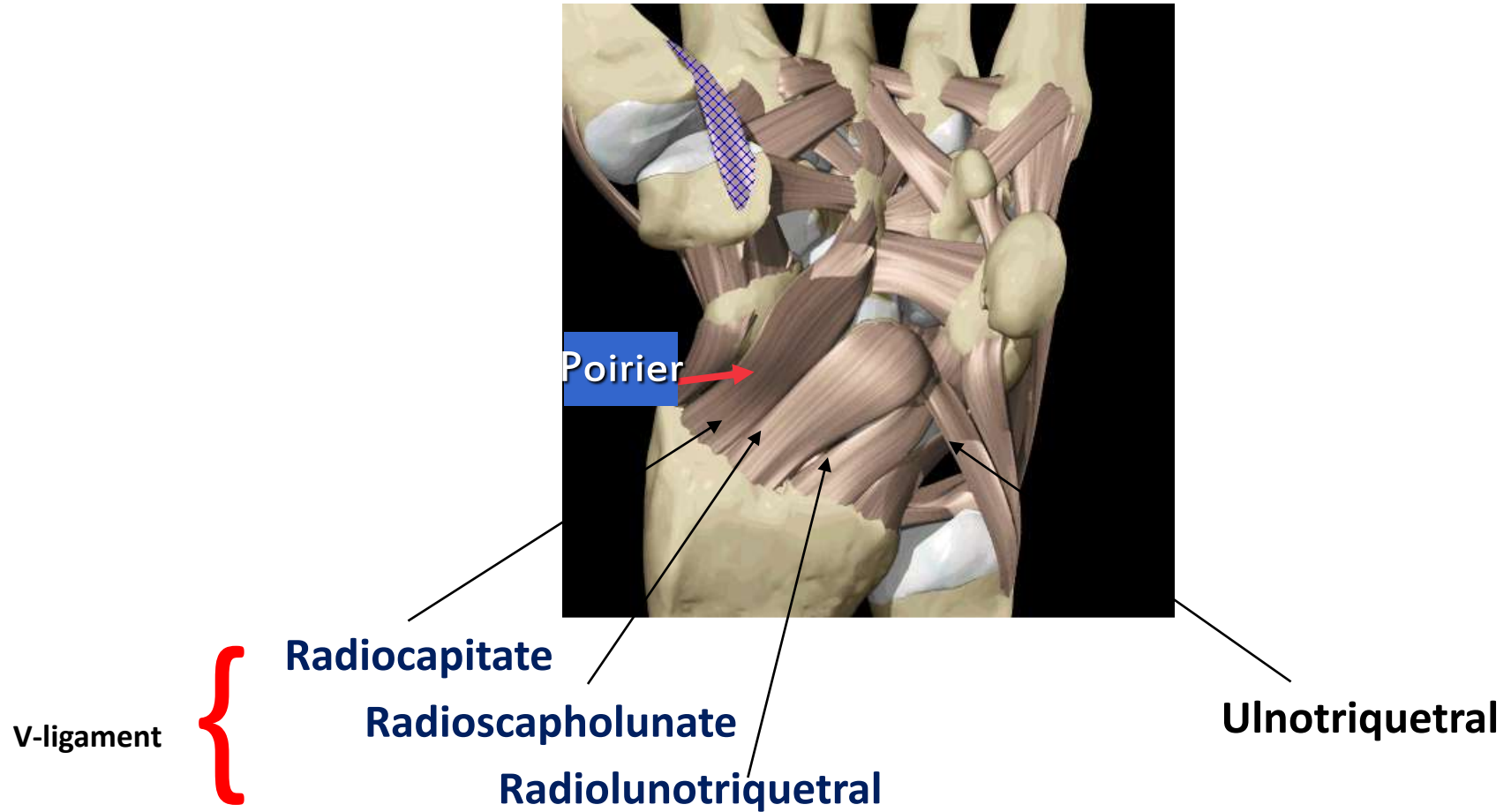


Ligamentous Anatomy

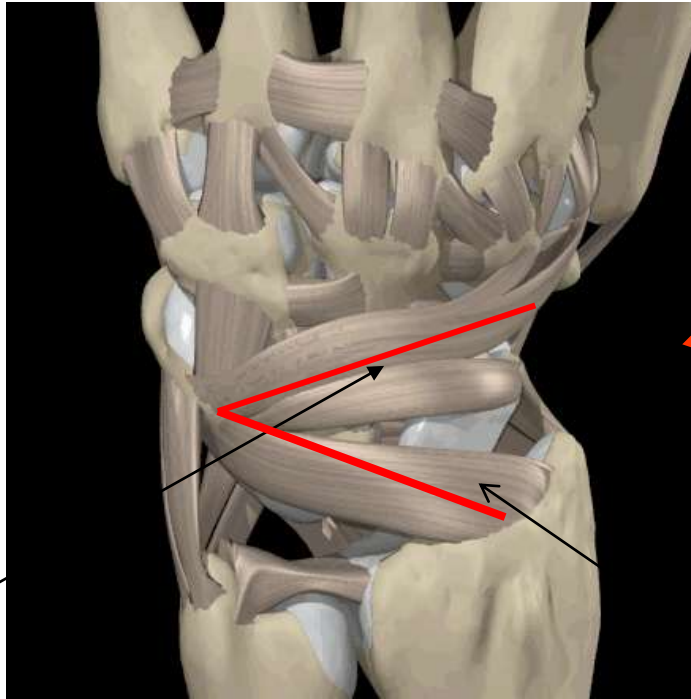
Extrinsic ligaments



Palmar ligaments



Dorsal ligaments



Dorsal (inter)(radio)carpal

dorsal radio(scapho)triquetral

MR Imaging of Anatomy and Tears of Wrist Ligaments¹

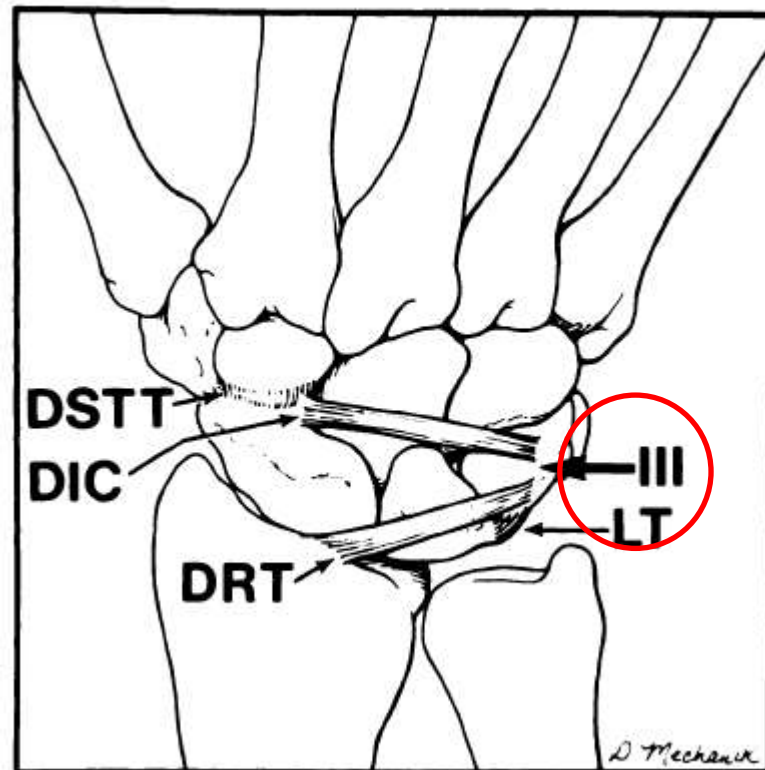
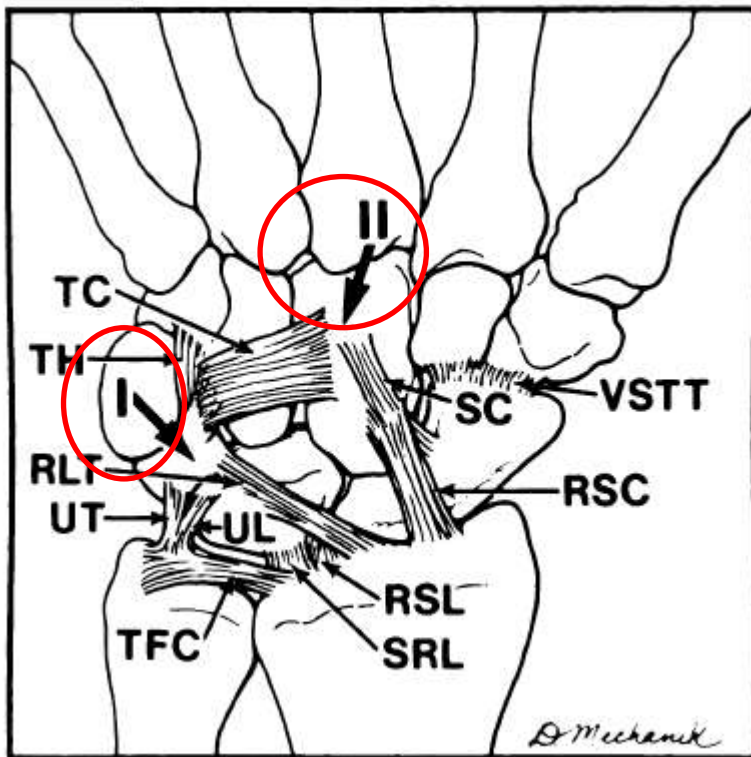
Marga B. Rominger, MD²
Wanda K. Bernreuter, MD
Philip J. Kenney, MD
Donald H. Lee, MD

Functional “V” concept

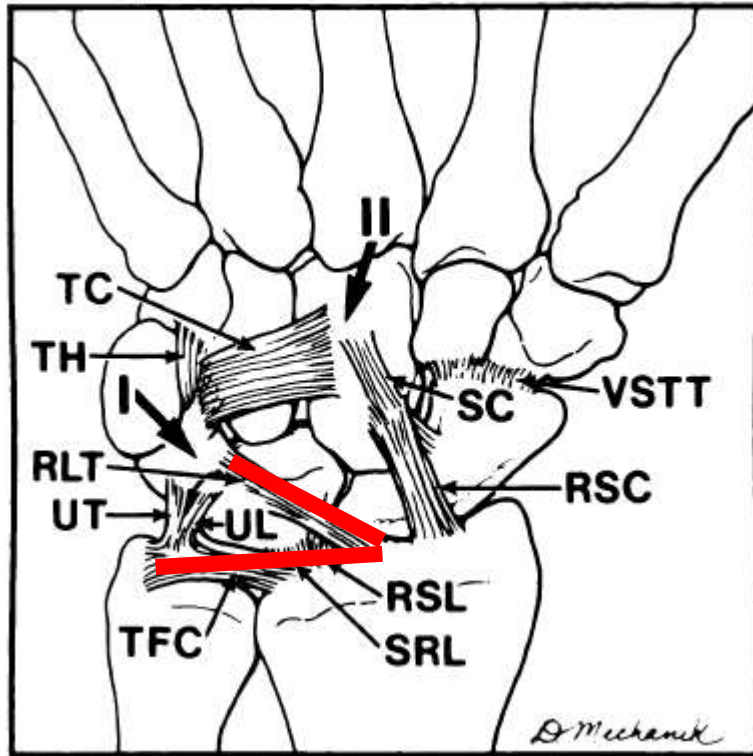
Proximal volar

Distal volar

Dorsal volar



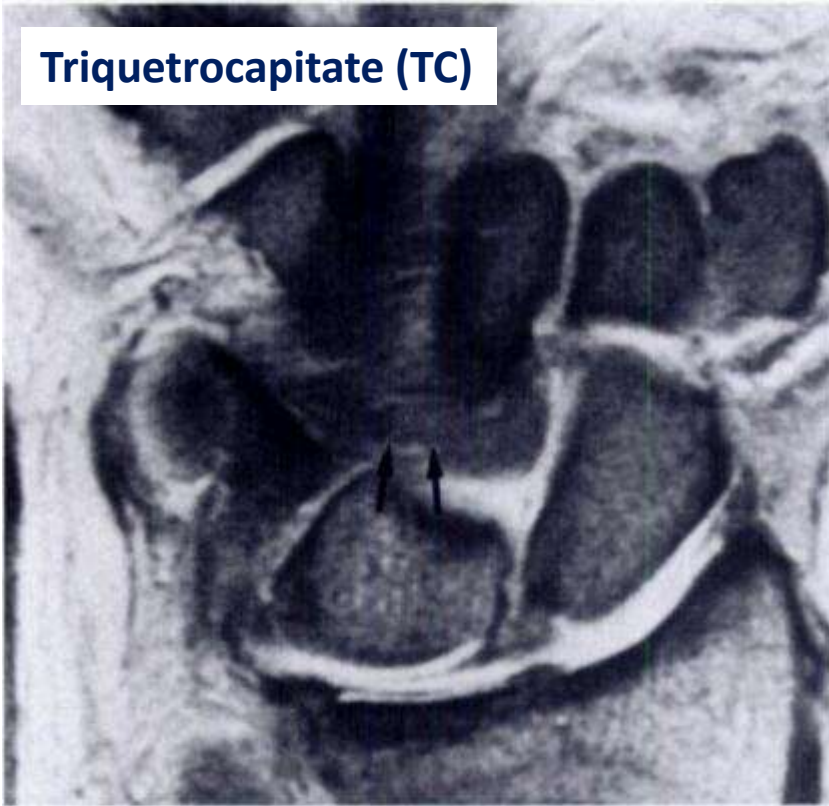
Proximal volar V group



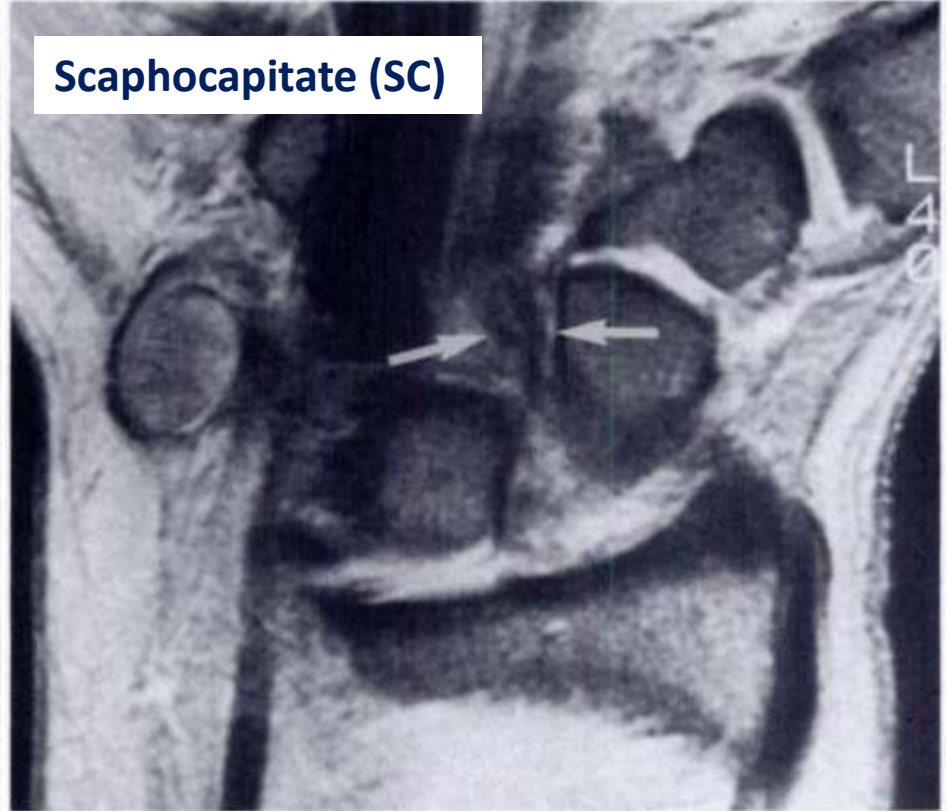
ulnocarpal complex and the radiolunotriquetral (RLT) ligament, both of which are extrinsic

Distal volar V group

Triquetrocapitate (TC)

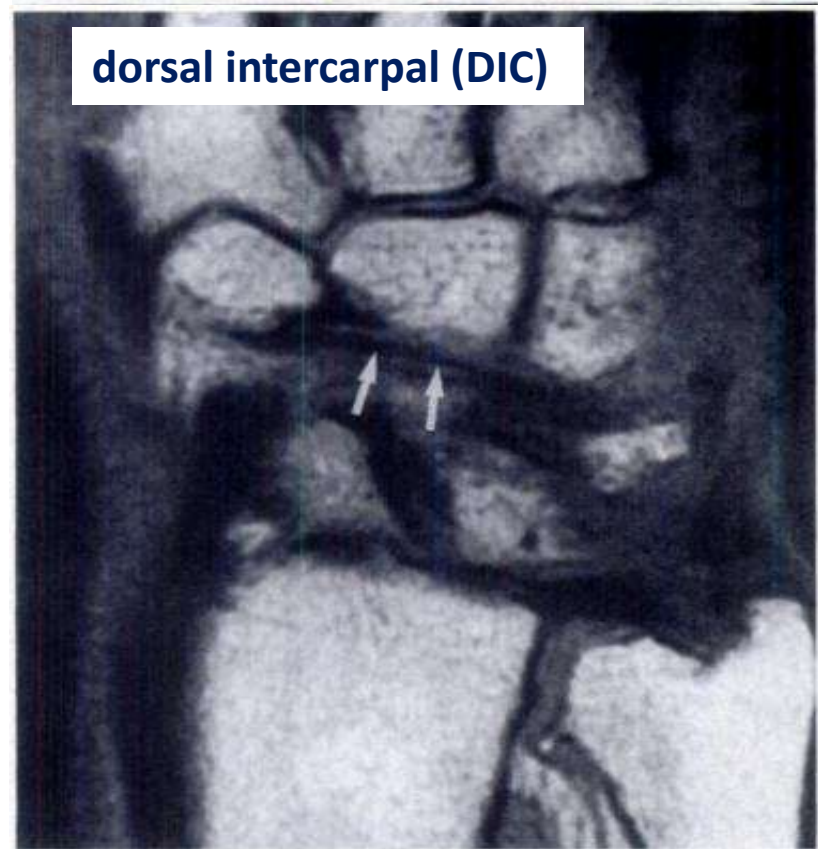
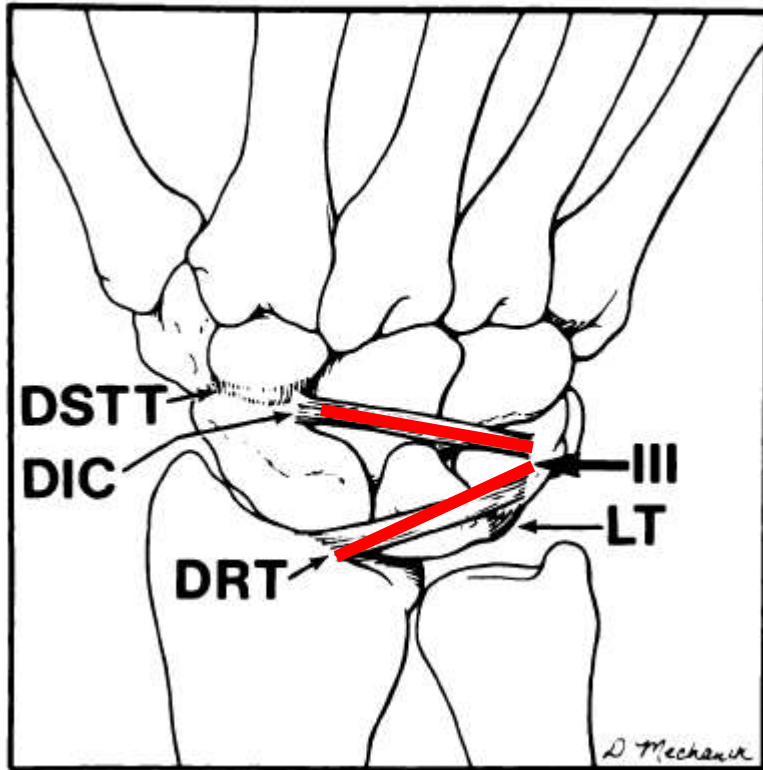


Scaphocapitate (SC)



Radioscaphocapitate (RSC),
Scaphocapitate (SC),
Triquetrocapitate (TC)

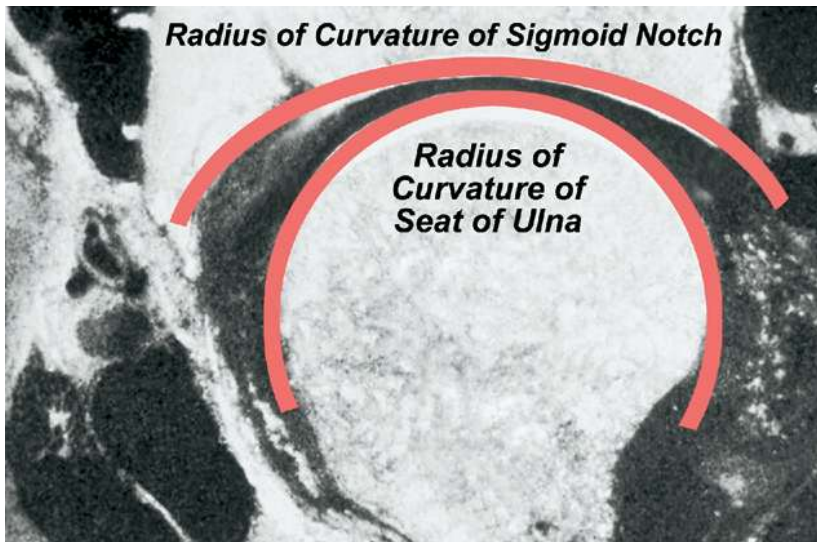
Dorsal V group



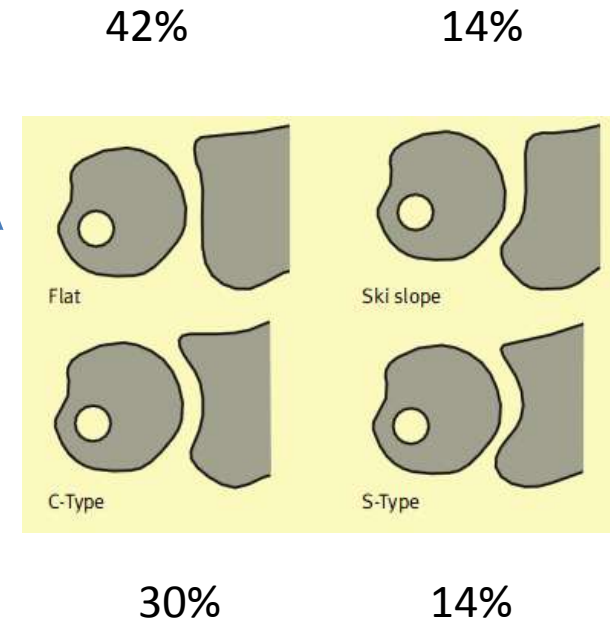
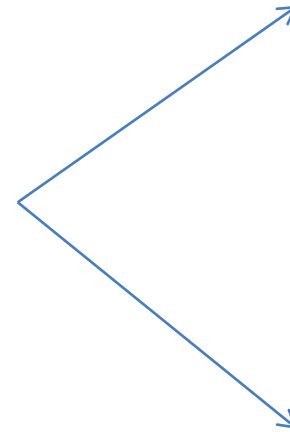
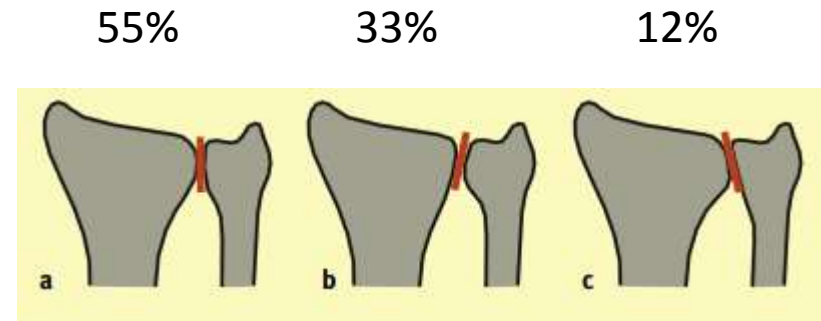
dorsal intercarpal (DIC)

dorsal radio(scapho)triquetral (DRT)

RDJU joint

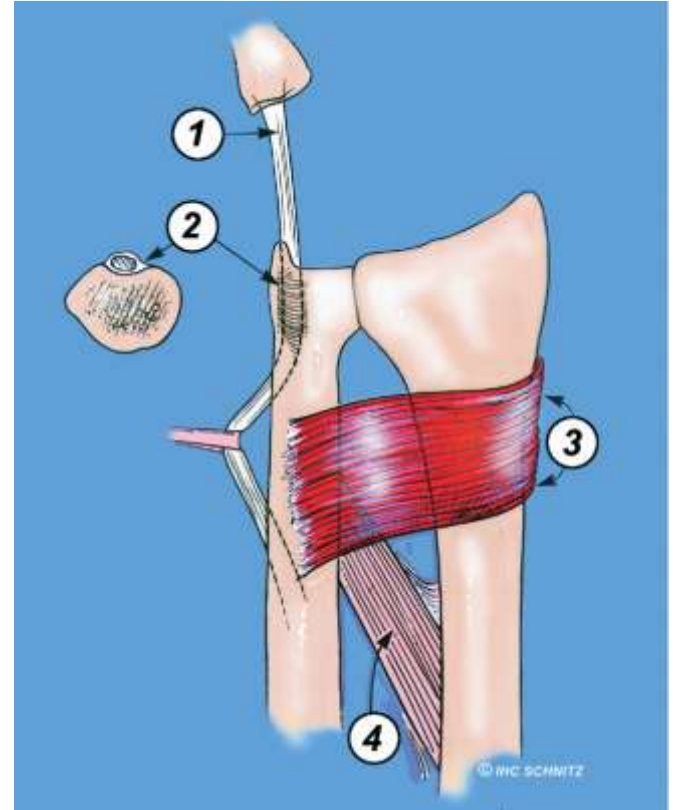


The radius of curvature of the sigmoid notch (15 mm) is greater than that of the ulna (10 mm), allowing both rotational and sliding motions in the normal joint.

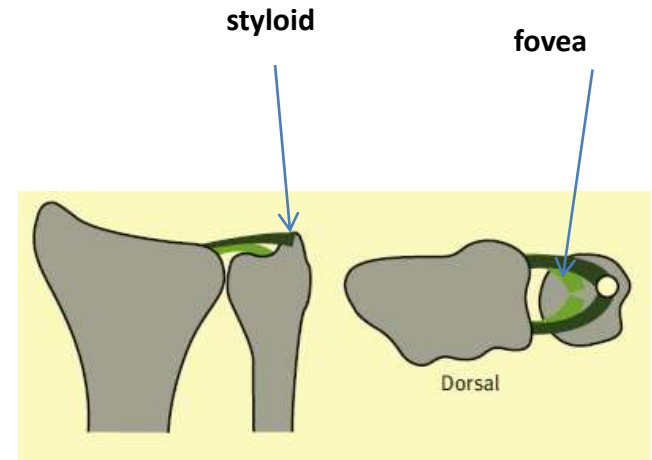
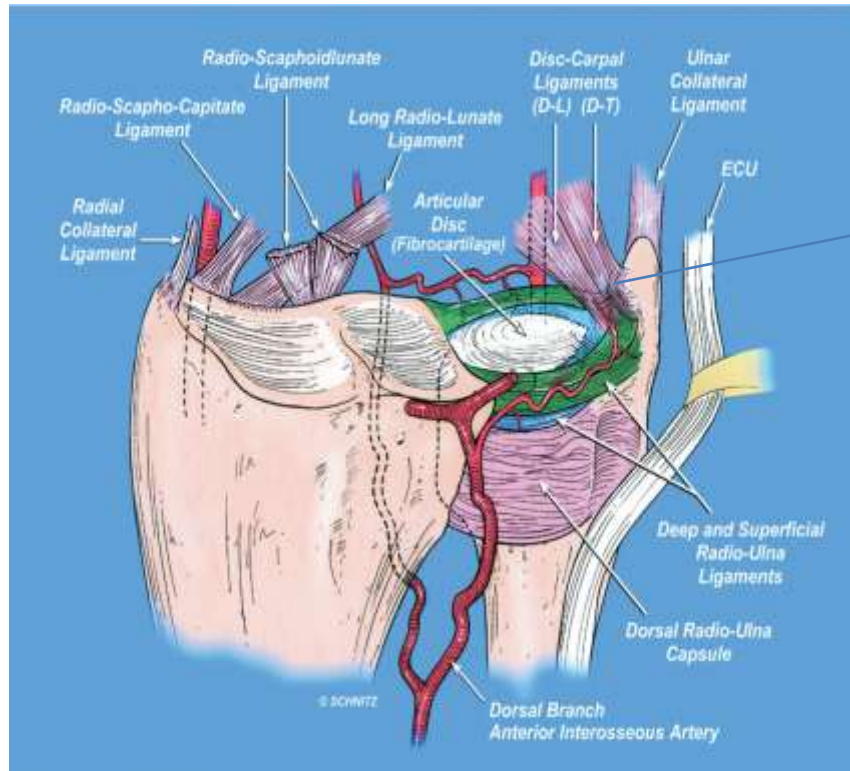


Extrinsic stabilizers

- (1) dynamic tensioning of the ECU
- (2) the semirigid sixth dorsal compartment subseath
- (3) the dynamic support provided by the superficial and deep heads of the pronator quadratus, and
- (4) the interosseous ligament of the midforearm

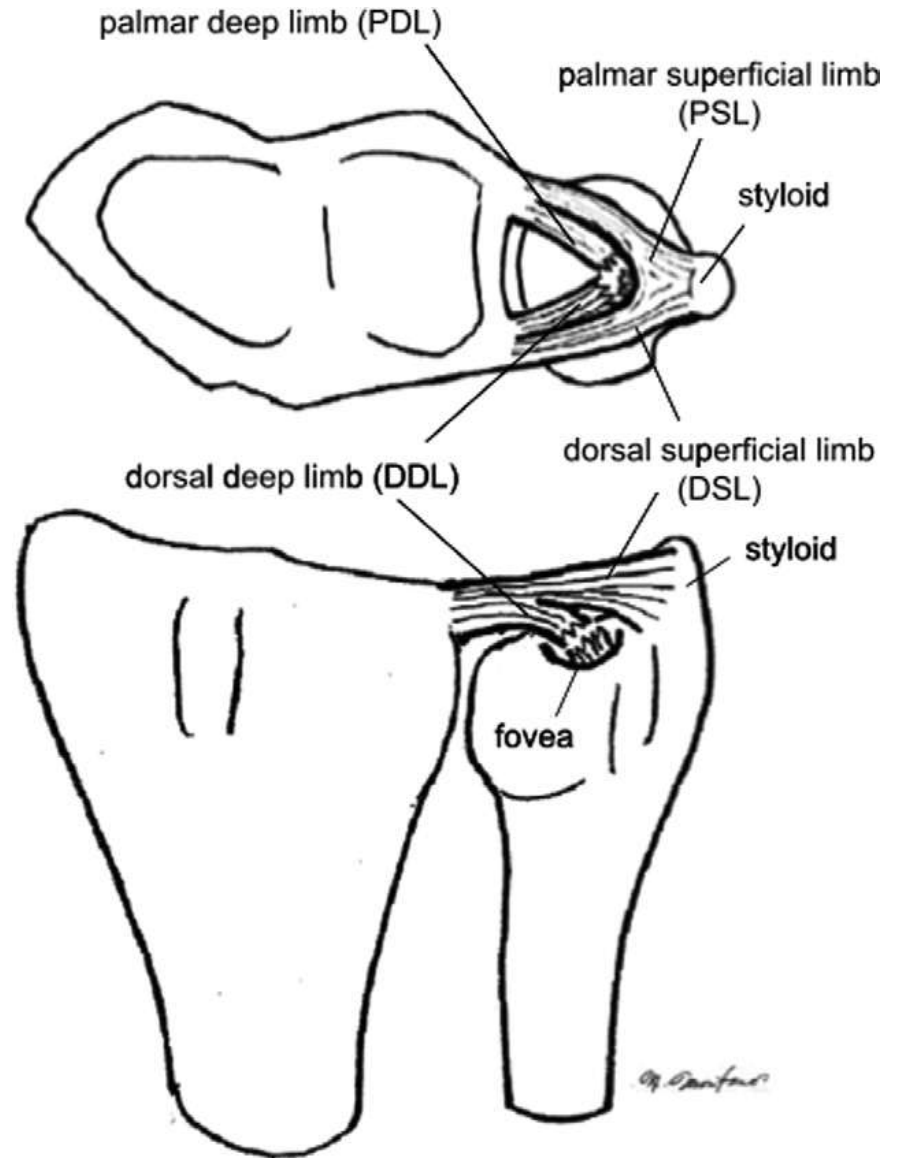
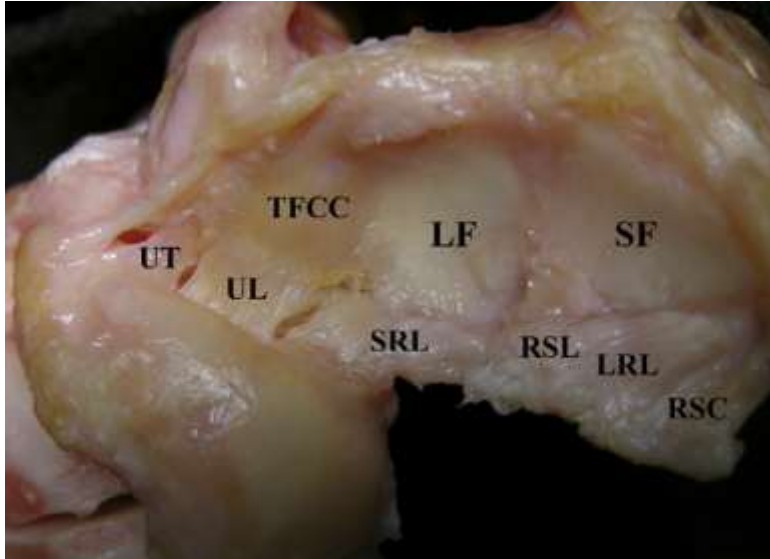


Intrinsic stabilizers

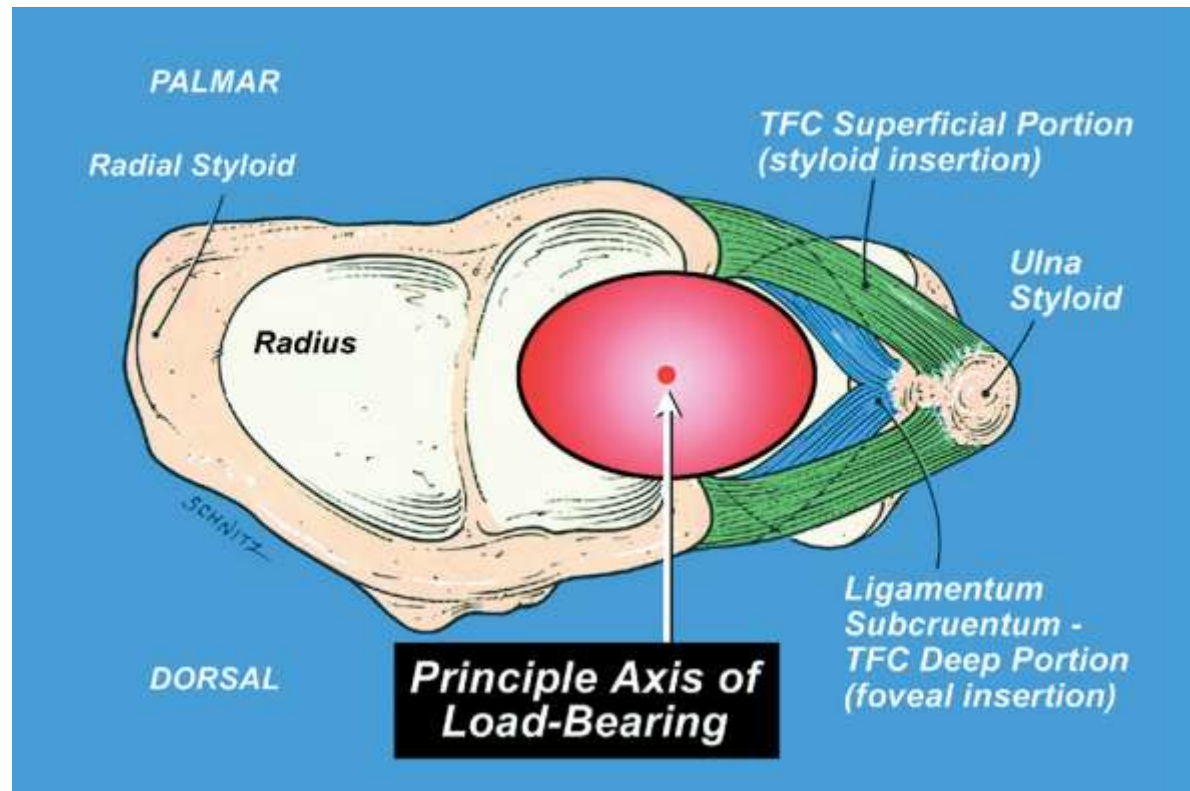


The TFC complex: superficial (green) and deep (blue) radioulna fibers, the two disc-carpal ligaments (disc-lunate and disc-triquetral), and the central articular disc (white).

The articular disc is responsible for transferring load from the medial carpus to the pole of the distal ulna.



DRJU Biomechanics



Common radiographic views

Posteroanterior

Oblique

Lateral

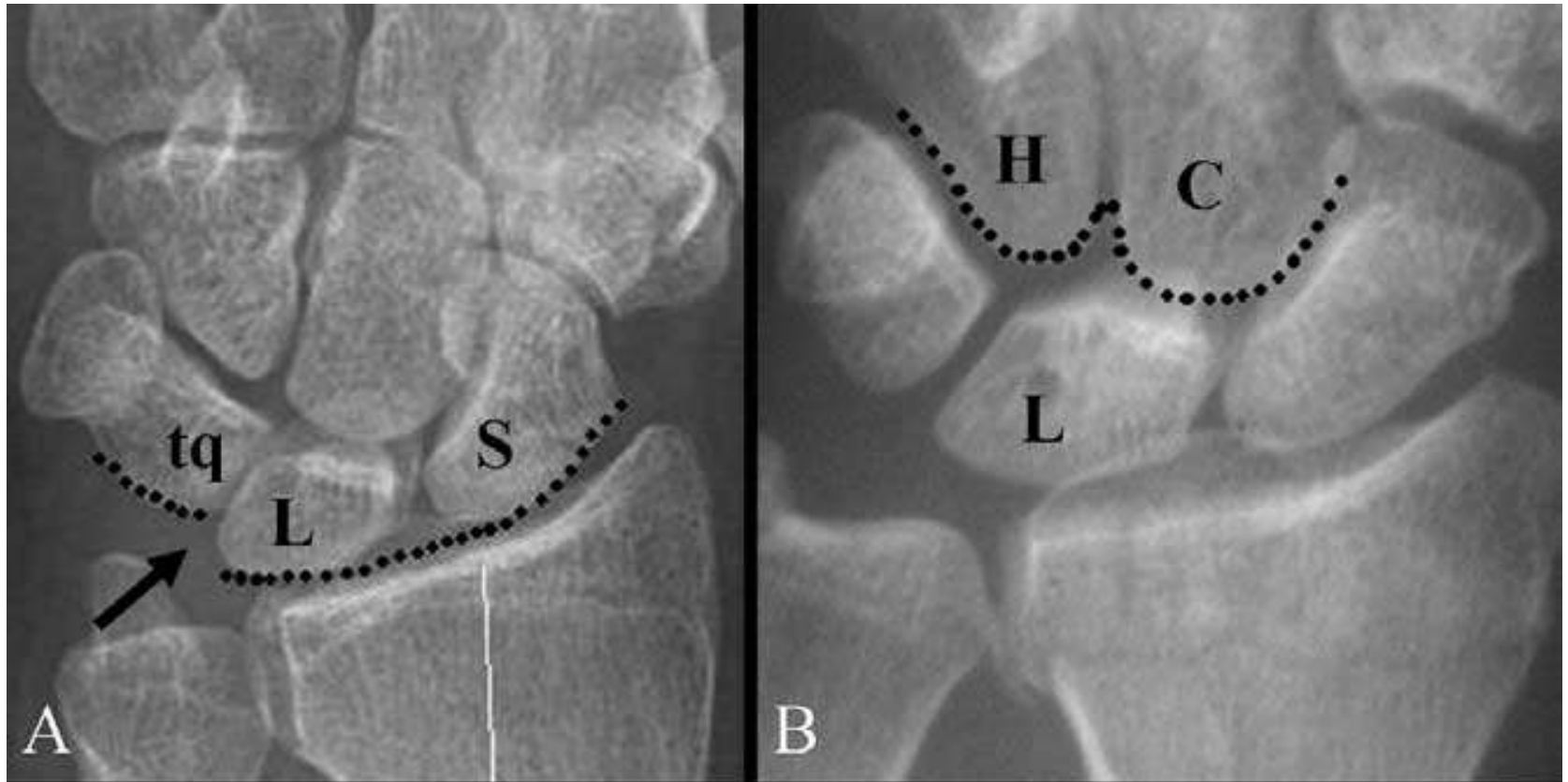


PA View



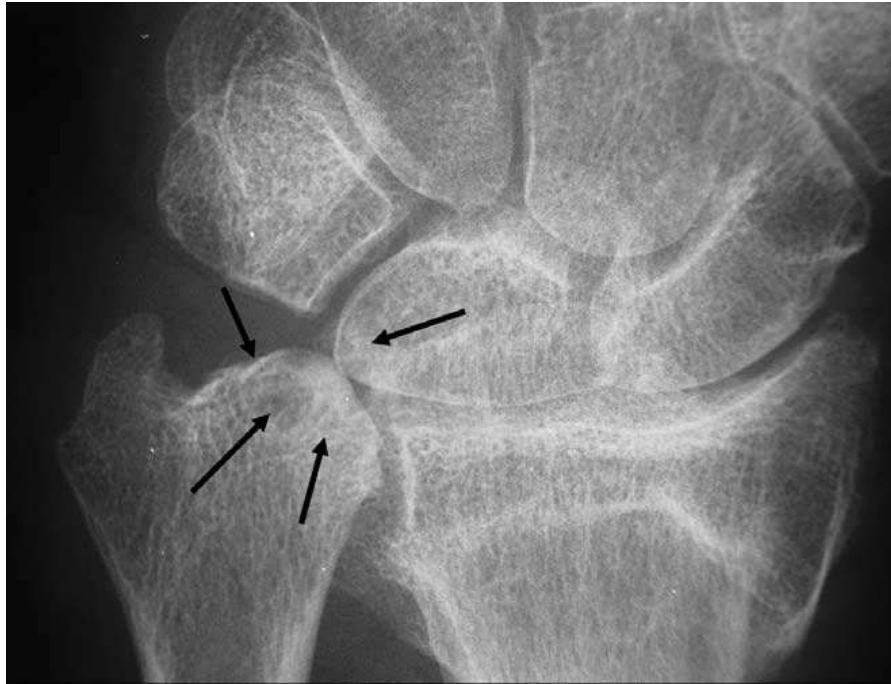
supination

Carpal arcs



- Variations
1. short triquetrum = lunotriquetral step-off
 2. proximally prominent hamate (H) with type II lunate = bilobate second and third carpal arc

Ulnar Variance



PUV = ulnar impaction syndrome



NUV = Kienbocks disease

Lateral view

the long axis of 3rd metacarpal should be parallel with the long axis of the radius.

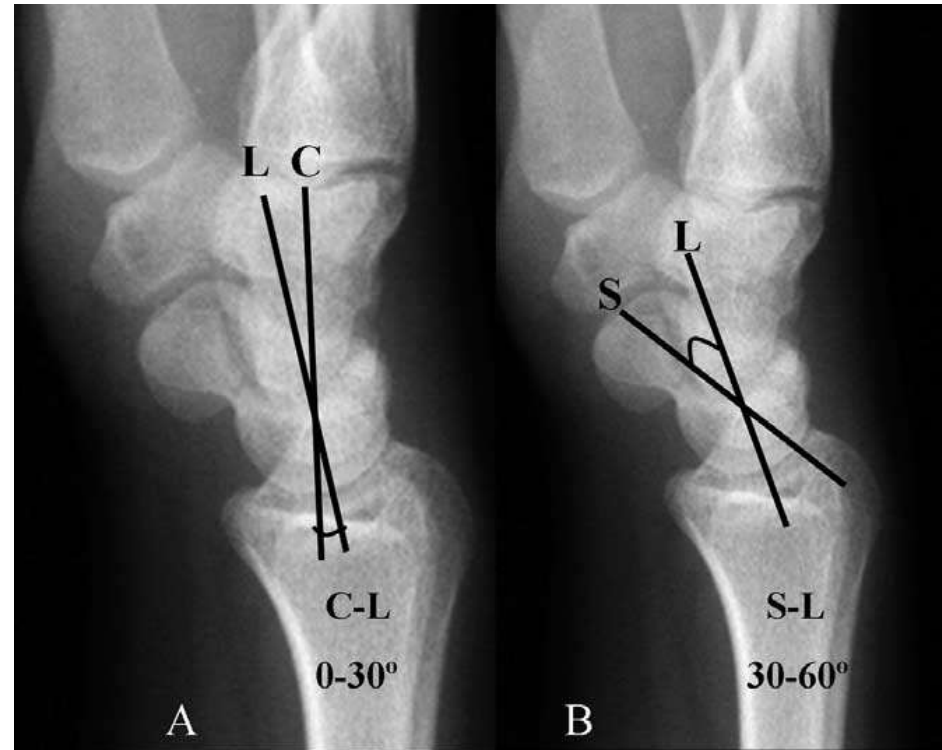
The pisiform projects directly over the dorsal pole of the scaphoid.



Lateral view

The axes of the radius, lunate, and capitate should superimpose (0 to 30° is the normal capitate-lunate angle)

The scapholunate angle ranges between 30 and 60°



Distal Radial Measurements

Palmar tilt

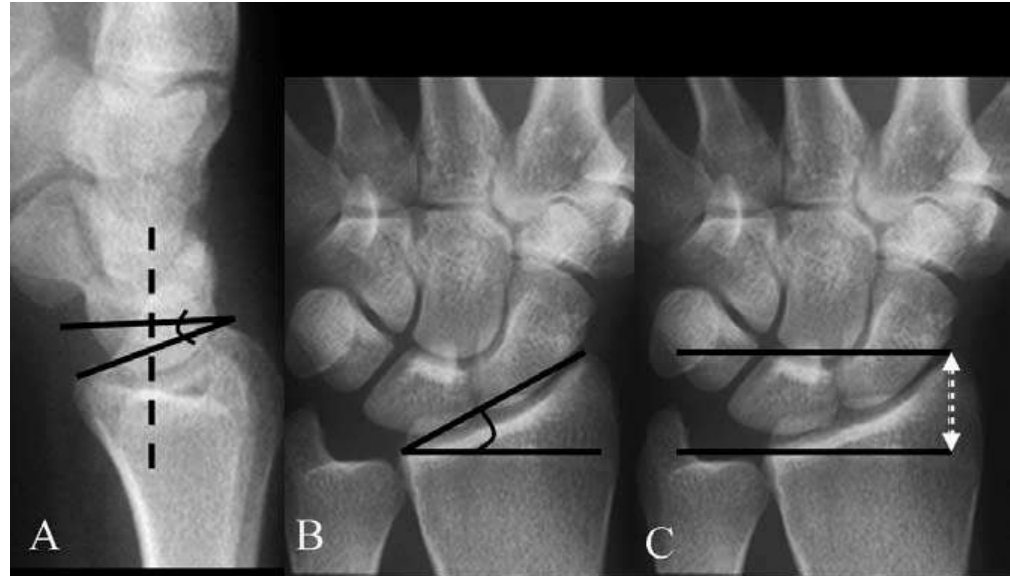
(11° of volar tilt to 4° of dorsal tilt)

Radial inclination

(Averages 11 to 30 degrees)

Radial length

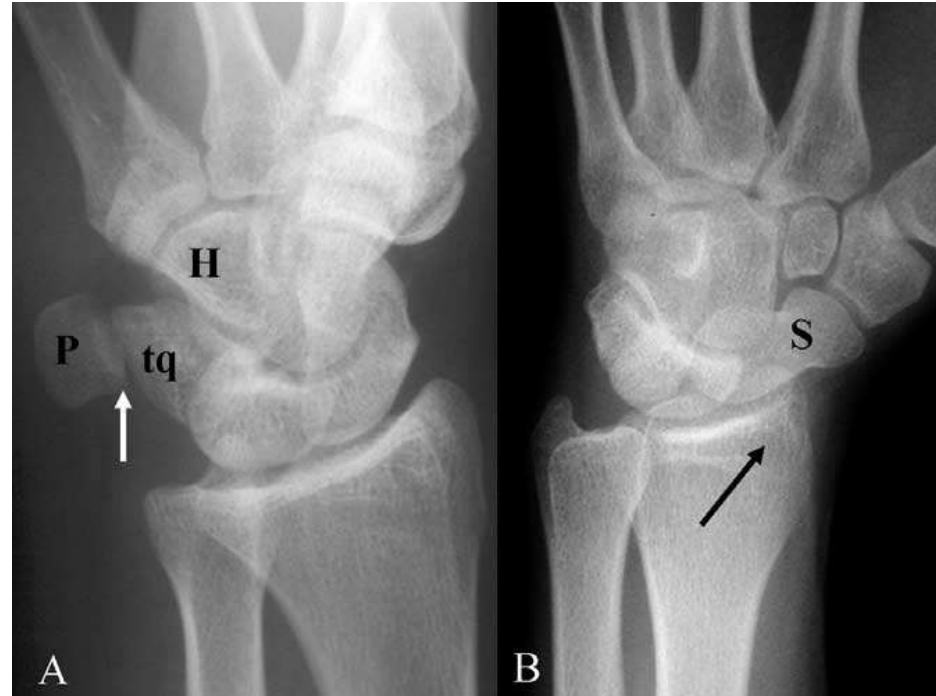
averages 11 to 22 mm



Oblique views

Semisupinated oblique:
the pisiform bone is separated from the remaining carpal bones.

Semipronated oblique:
allows examination of the radial aspect of the wrist, particularly the scaphoid and radial styloid



Deviation views

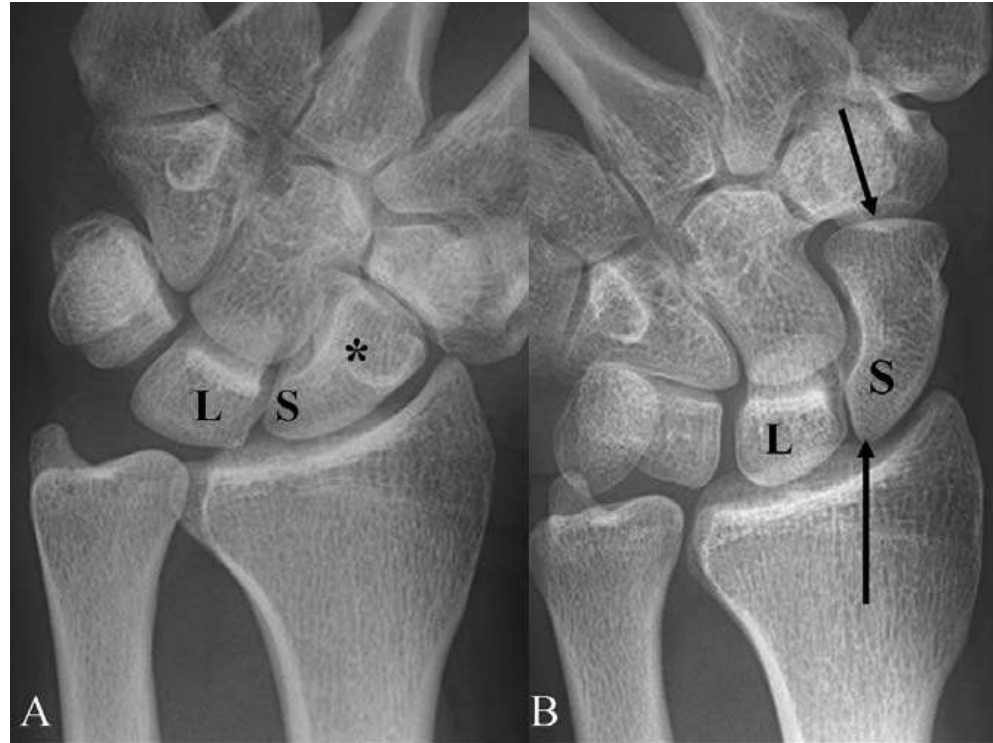
In **radial** deviation, the scaphoid rotates and appears foreshortened.

The distal scaphoid appears as a circular density.

The SCL distance remains normal (less than 2 mm).

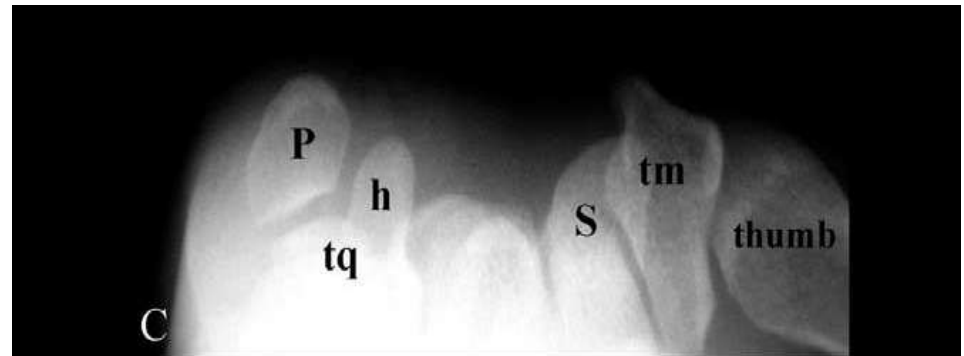
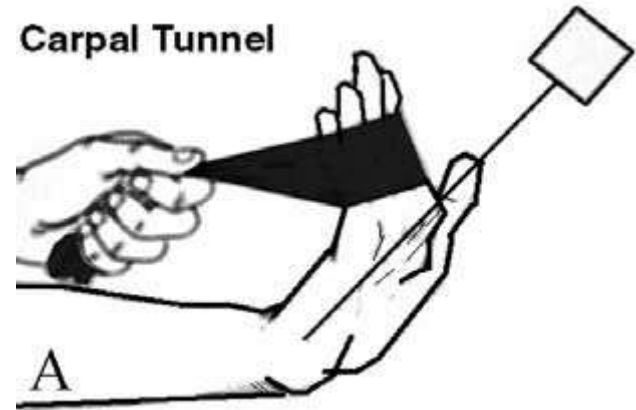
In **ulnar** deviation, the scaphoid is seen in full length. The scaphoid rotates and appears elongated.

The SLD interval may increase slightly.



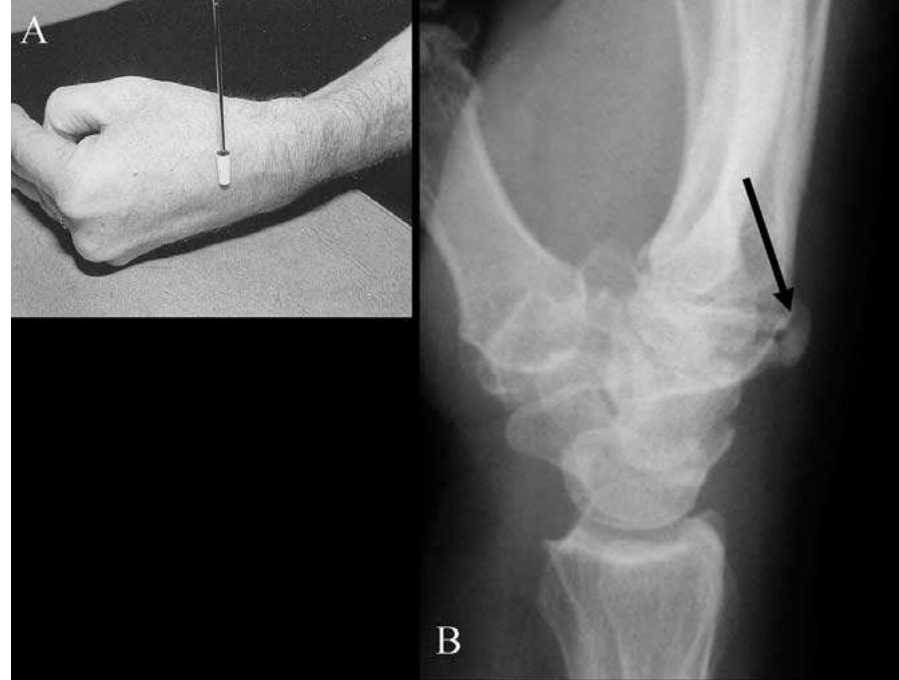
Carpal tunnel view

Hyperextension of the hand and the central ray is directed along the volar aspect at an angle of 25 to 30°



Carpal boss view

- (1) a separate os styloideum
- (2) a bony prominence
- (3) degenerative osteophytes
- (4) a fracture of the dorsal prominence



Clenched Fist View

With a tight fist, the contracting tendons and muscles create a force within the wrist that drives the capitate proximally toward the scapholunate joint (scapholunate dissociation)

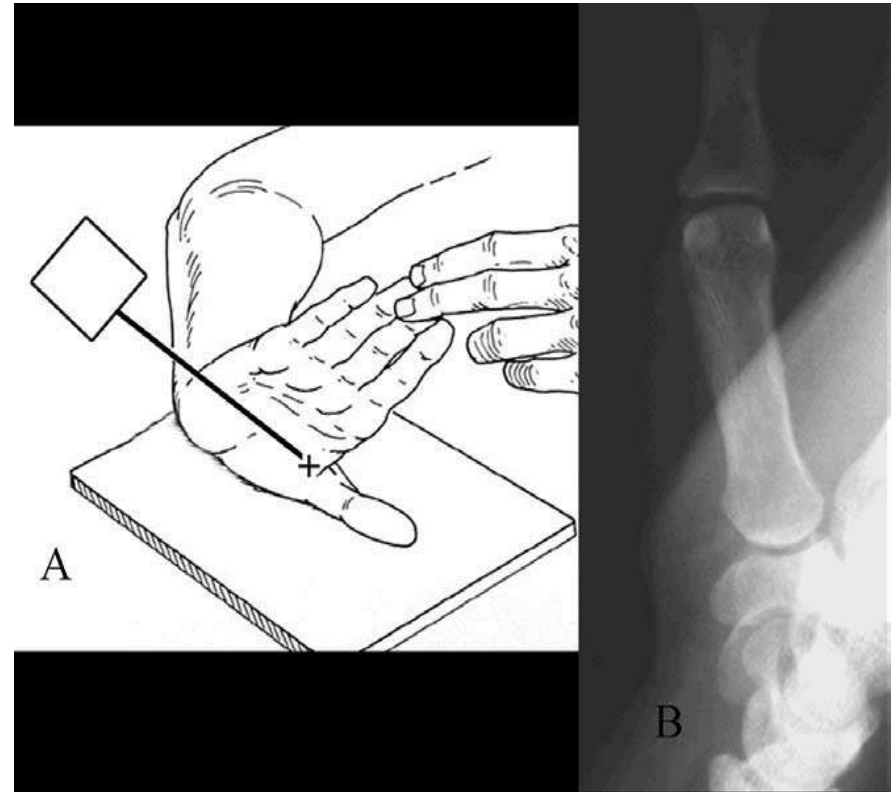


First Carpometacarpal Joint View

The hand is hyperextended and the thumb is placed in a horizontal position.

The central ray is angled approximately 45° toward the elbow.

Basal arthritis, fractures of the base of the 1st metacarpal



CT arthrography of the wrist using a novel, mobile, dedicated extremity cone-beam CT (CBCT)

Seppo K. Koskinen • Ville V. Haapamäki • Jari Salo •
Nina C. Lindfors • Mika Kortenesniemi • Lauri Seppälä •
Kimmo T. Mattila

New method to evaluate the wrist ligaments and radiocarpal cartilage. The hand and wrist can be placed freely in any desired position

overall accuracy of 82–86 %
specificity 81–91 %.



ORIGINAL RESEARCH

Open Access

Diagnostic and therapeutic impact of SPECT/CT in patients with unspecific pain of the hand and wrist

Florian S Schleich¹, Maja Schürch², Martin W Huellner³, Urs Hug², Urs von Wartburg², Klaus Strobel¹ and Patrick Veit-Haibach^{1,3*}

Lunate osteomalacia

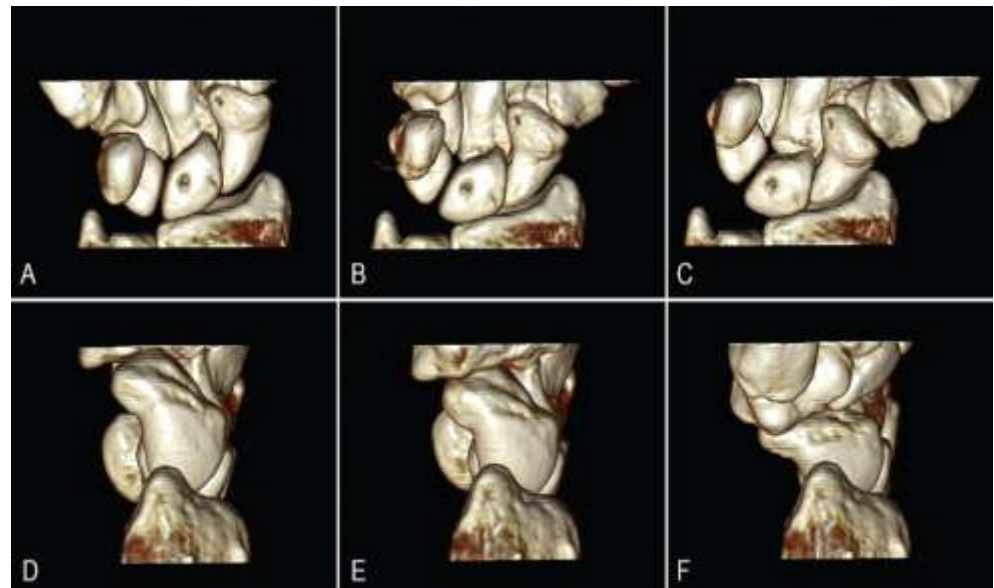
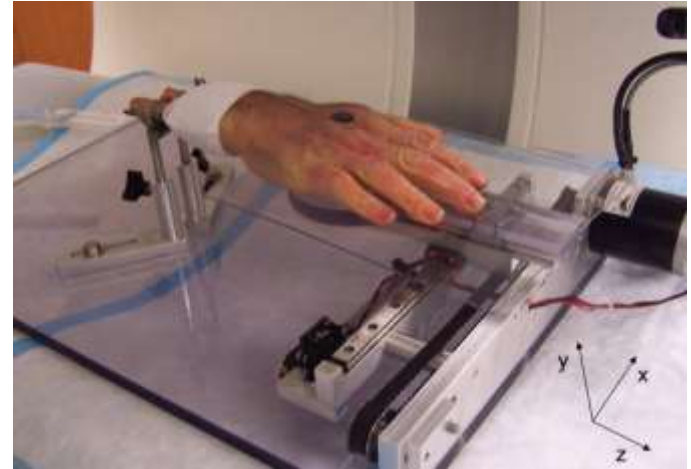


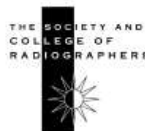
SPECT/CT might be added to the workup of a specific patient population when standard imaging fails to detect the patient's main pathology.

Dynamic CT technique for assessment of wrist joint instabilities

4D CT (3D and time) technique to detect joint instability in a cadaveric model

In the future using special segmentation techniques it will be possible to evaluate real time wrist kinematics





REVIEW ARTICLE

MRI of the wrist

Elizabeth A. Dick*, Carole Burnett, Wladyslaw M.W. Gedroyc

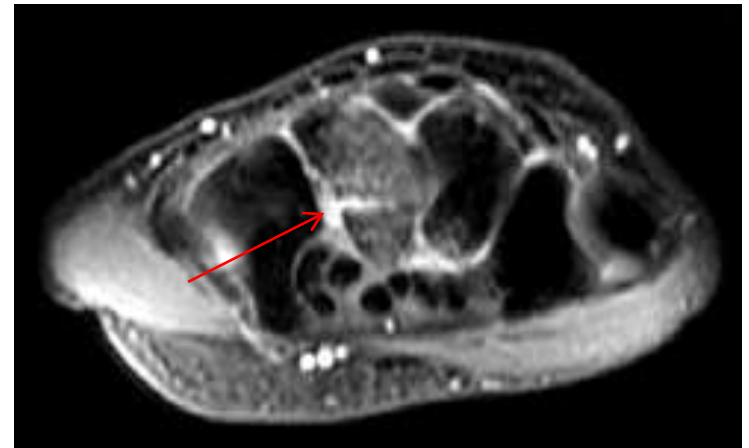
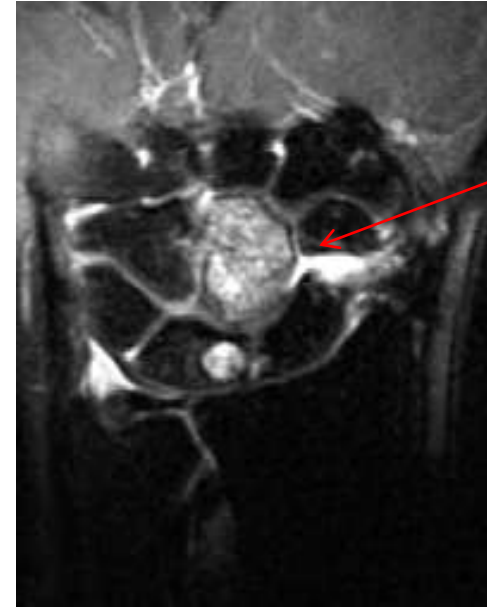
Obtaining the best possible image quality enables optimal interpretation and relies on several factors including field strength (a minimum of 1.0 T is recommended), and Positioning (“superman”)

Table 1 Image viewing checklist

- Alignment – all 3 planes
 - Carpal alignment (coronal)
 - DISI/VISI (sagittal)
 - DRUJ (axial)
 - Ulnar variance (+ve lunate degenerative joint disease, –ve lunate AVN)
- Carpal bones
 - Coalition
 - #
 - AVN
- Interosseous ligaments
 - Scapholunate (SLL)
 - Lunatotriquetral (LTL)
 - TFC complex
 - TFC
 - Dorsal and volar radioulnar ligaments
 - Ulnotriquetral and ulnolunate ligaments
 - Meniscus homologue
 - Ulnar collateral ligament (UCL) and extensor carpi ulnaris (ECU)
- Extrinsic ligaments of carpal bone
- Tendons and Tunnels
 - Extensor – 6 compartments
 - Flexor
 - Carpal Tunnel and median nerve
 - Guyons canal and ulnar nerve
- Fluid and synovium

MRI of the wrist

- Occult fracture
- Ganglion Cyst
- Tumor
- Ligament tear
- Avascular necrosis
- Arthritis
- Tendon Pathology
- Nerve Impingement
- Infection



MRI of the wrist



MRI of the wrist

Coronal 3D gradient echo MRI, demonstrates anatomical site of Class 1/traumatic TFC tear





Wrist injuries in young adults: The diagnostic impact of CT and MRI

Anastasia Fotiadou^a, Arpit Patel^b, Tony Morgan^a, Apostolos H. Karantanas^{c,*}

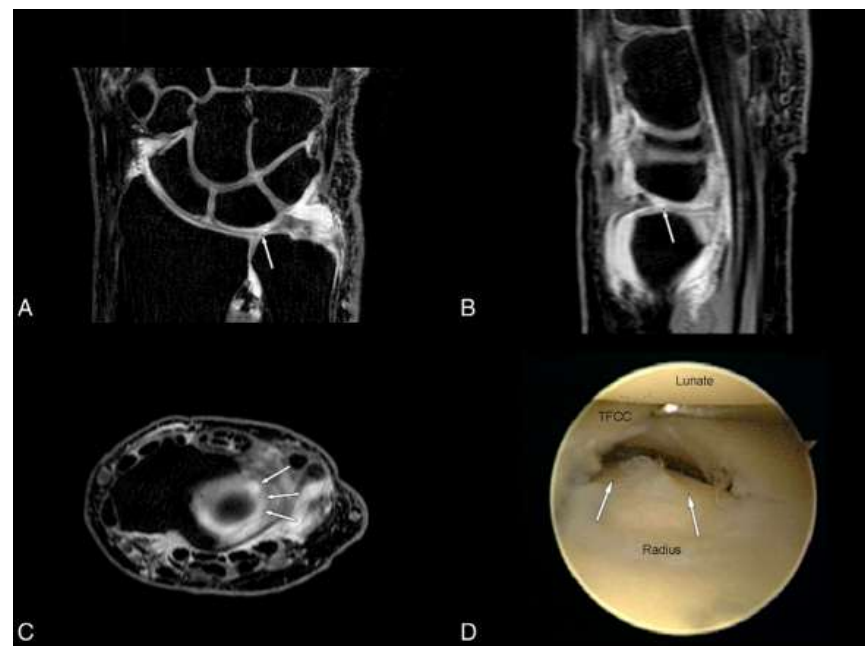
... both CT and MRI might be incorporated in the initial investigation of patients with wrist trauma and a strong index of clinical suspicion.



Intrinsic ligament and triangular fibrocartilage complex (TFCC) tears of the wrist: comparison of isovolumetric 3D-THRIVE sequence MR arthrography and conventional MR image at 3 T

Young Han Lee^a, Yun Rak Choi^b, Sungjun Kim^a, Ho-Taek Song^a, Jin-Suck Suh^{a,*}

three-dimensional T1 high-resolution isovolumetric examination (3D-THRIVE) MRA on a 3-T MR vice conventional MRI of the wrist



central tear of the TFCC

The beneficial role of arthroscopy in the investigation of wrist disorders: A retrospective evaluation of 116 cases

Andreas Panagopoulos

Jonathan Compson

Richard Allom

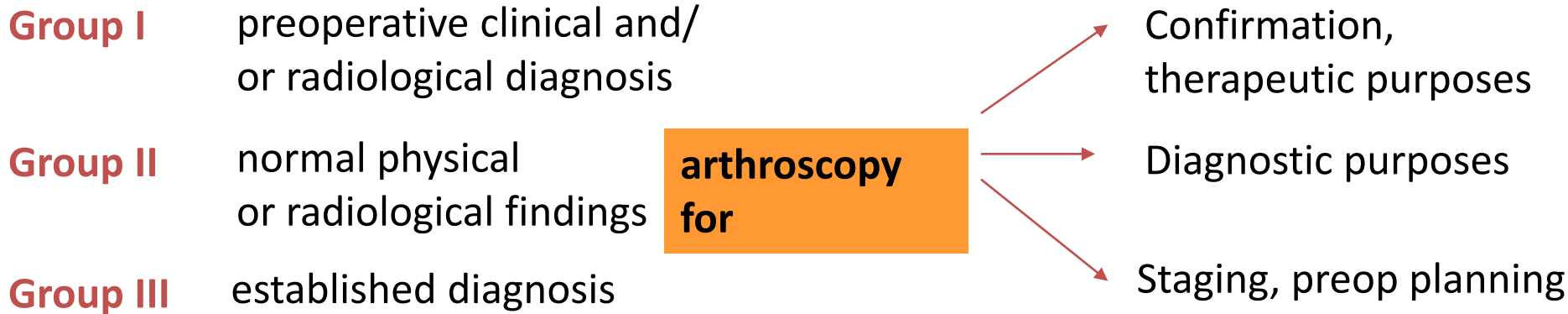


Study design

Retrospective review of 116 patients with wrist pathology

Correlation of clinical and radiological diagnosis with arthroscopic findings

Investigation of how **beneficial** was the arthroscopic procedure for either diagnostic or therapeutic purposes



Material

116 consecutive wrist arthroscopies

Seven year period (2002-2009)

49 male, 76 female

Mean age at operation 38 years (range 17-64 years)

57 patients (45.6%) had a documented previous injury

320 conventional diagnostic tests and 456 imagine studies!

Group I	preoperative clinical and/ or radiological diagnosis	94 patients (75.2%)
Group II	Pain, but normal physical or radiological findings	12 patients
Group III	established diagnosis	19 patients

Results

Group I: Arthroscopy was beneficial in 51/94 patients **(54%)** from in whom the pre-operative diagnosis was changed or augmented sufficiently to alter subsequent management.

Group II: A beneficial arthroscopy establishing a definitive diagnosis was conducted for 9/12 patients **(75%)**

Group III: Arthroscopy was of benefit to 14/19 patients **(74%)** for whom the subsequent definite management plan was modified.

For all groups, arthroscopy was deemed of benefit when a therapeutic intervention was successfully conducted, independently of the ultimate outcome. There were 66/125 **(53%)** such patients.

Speculations...

9/12 (25%) of the patients in Group II (no diagnosis) had a normal arthroscopic appearance (9.4 investigations per patient!!!)

- work compensation, malingering, simulation?
- undiagnosed chronic wrist pain?

31/51 (61%) arthroscopies in Group I where the pre-operative diagnosis was changed, revealed significant unsuspected intra-articular pathology

- unrelated to the clinical findings or misdiagnosed?



Conclusion

- These data demonstrate the importance of wrist arthroscopy both as a diagnostic and therapeutic tool in the management of wrist disorders
- A thorough **clinical examination** is still the **best way** to reach the diagnosis
- Correlation of the unexpected arthroscopic findings with the symptoms of the patient to avoid over-treatment
- Useful tool in preoperative planning when a diagnosis is already exist

Thank you

