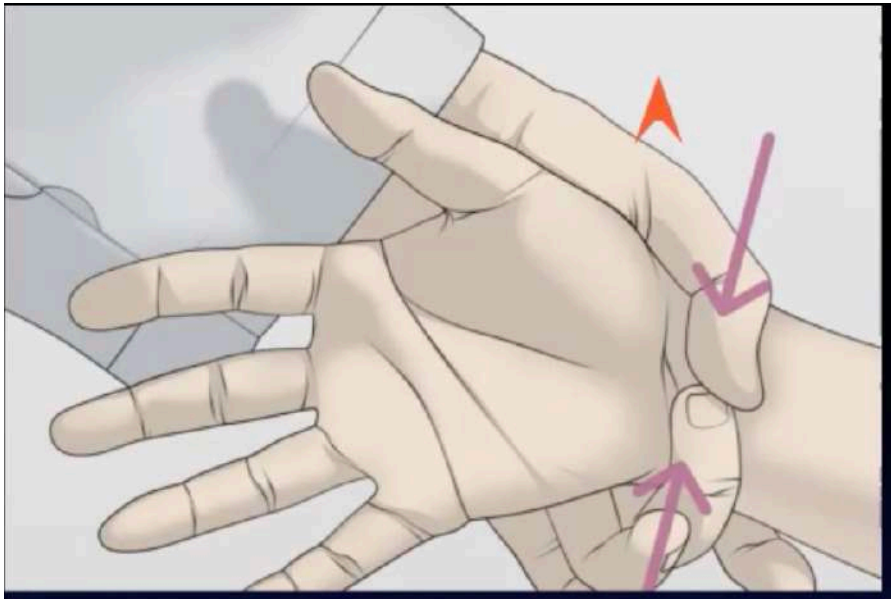
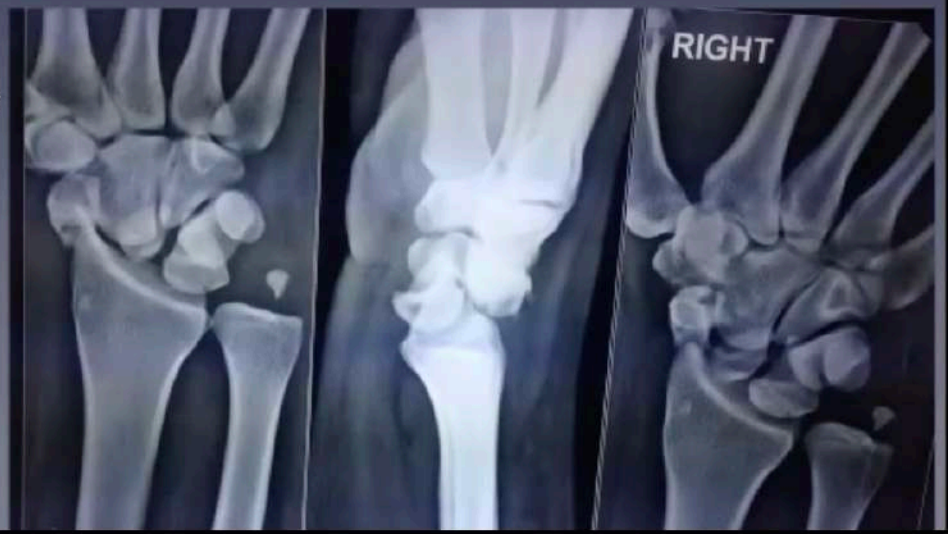


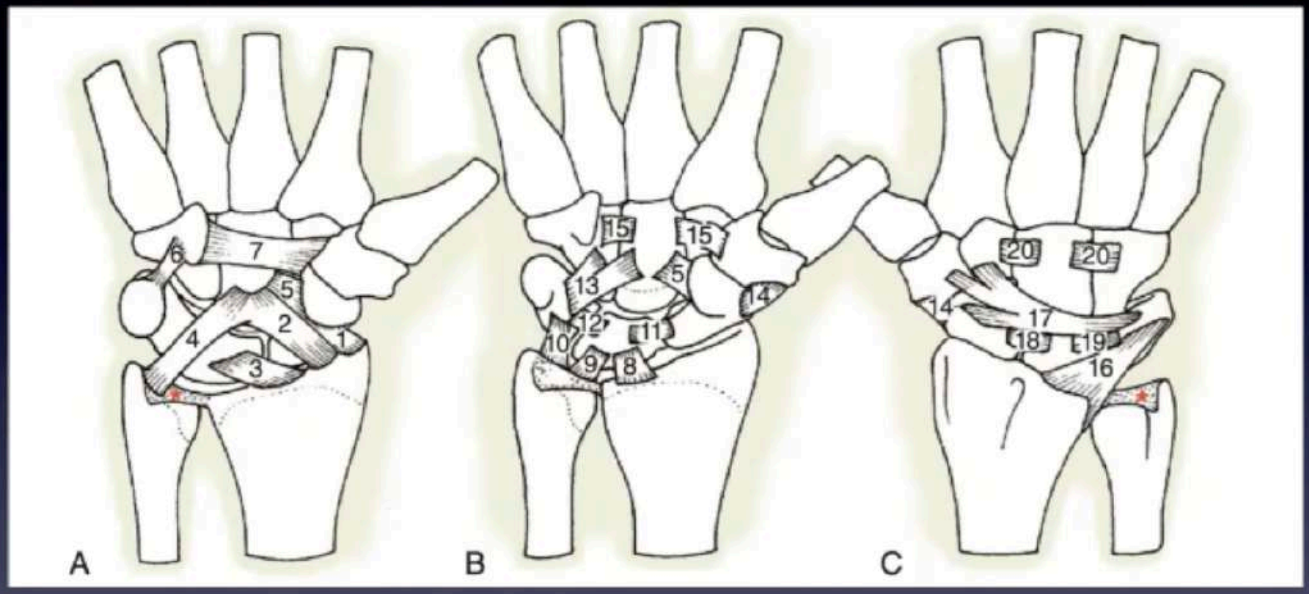
Concepts of Carpal Instability



Despite increased awareness of clinicoradiologic features

- Diagnosis of perilunate dislocation is still missed [16 - 25 %] resulting in chronic wrist dysfunction and degenerative arthritis .
- Delay in treatment found to be important factor in influencing long term outcome .
- So decided to take this topic for Discussion

Wrist Ligament anatomy
Extrinsic / Intrinsic



- **Extrinsic** - connect forearm bones [Radius ,ulna to carpus]
- **Intrinsic** - connect carpal bones of same or different row

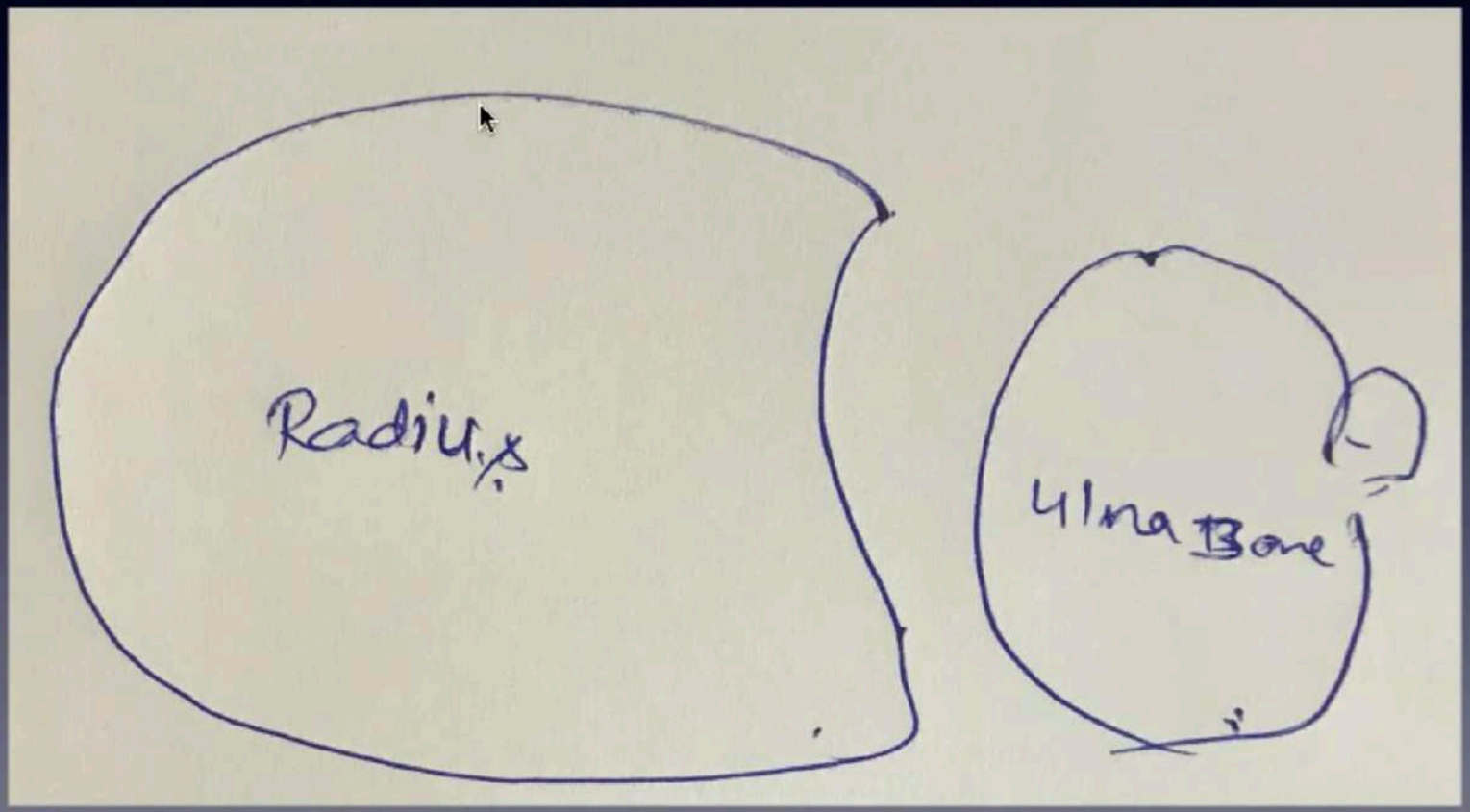
Wrist Extrinsic ligaments

- Are stiffer and lower yield strength than intrinsic ligaments
- Usually extrinsic ligaments get rupture through midsubstance
- 1. Palmar Radoiocarpal ,
- 2. Palmar Ulnocarpal ,
- 3. Dorso - Radio- Carpal [i.e Radio-triquetrum ligament not attached to scaphoid]
- There are no Dorsal -ulno -carpal ligaments

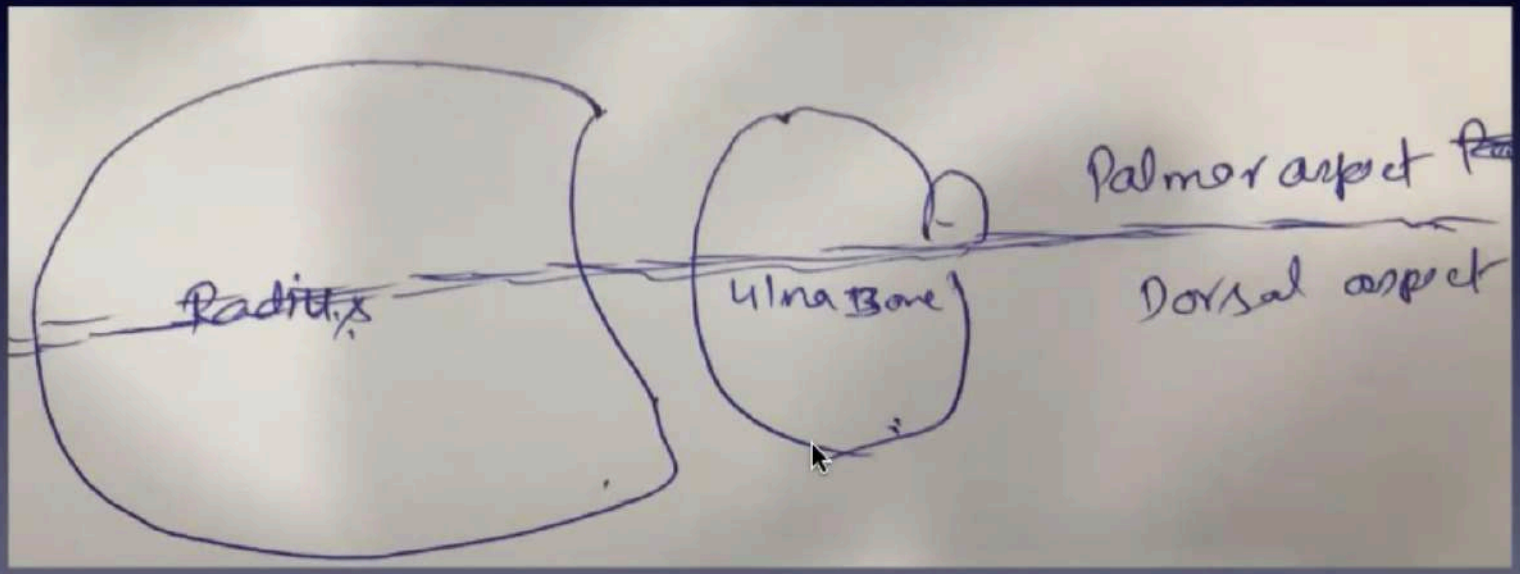
Wrist Intrinsic ligaments

- Usually get avulsed and not rupture
- Eg. - SLD , LTD

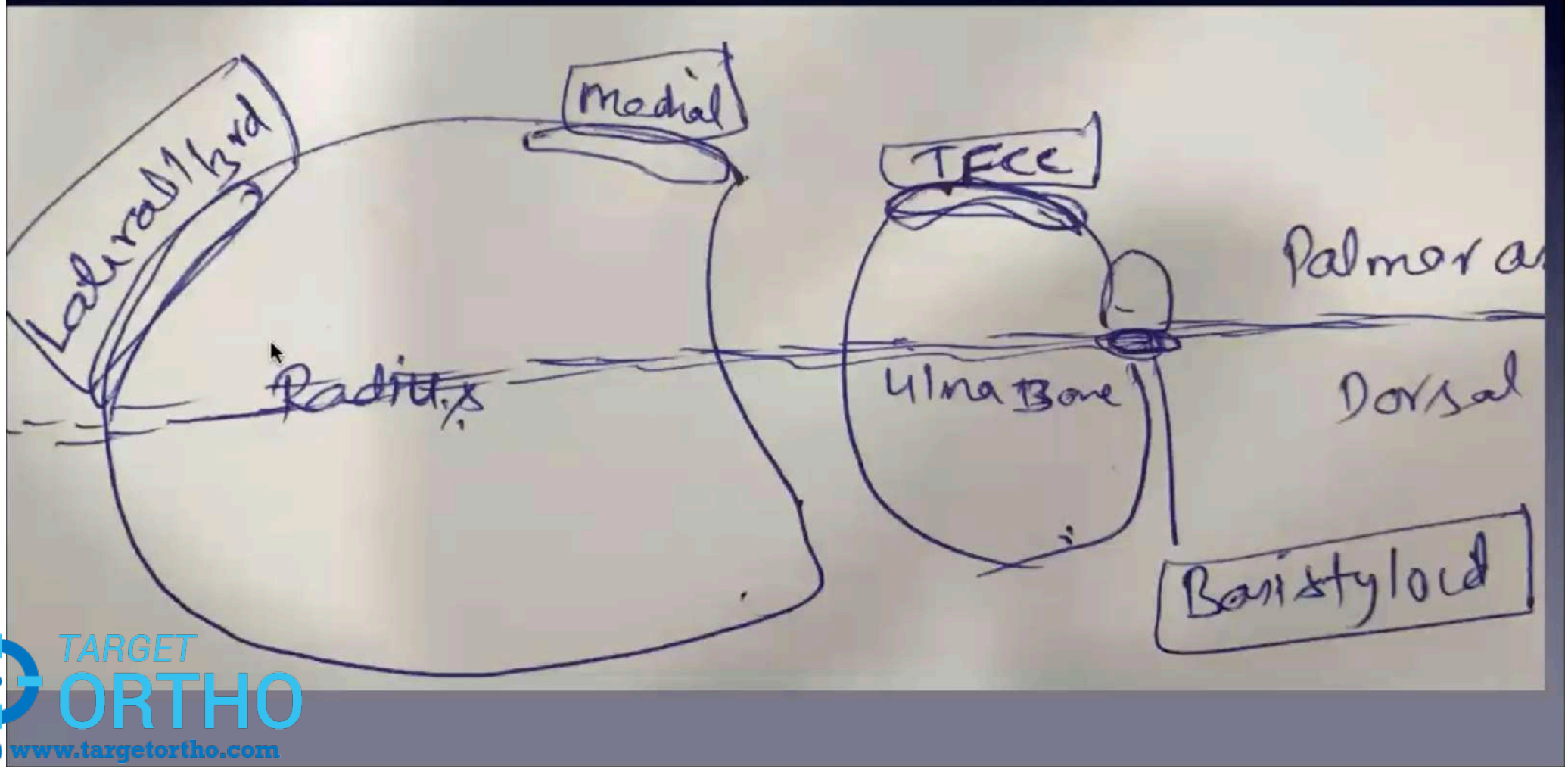
Lets learn location of wrist extrinsic ligaments



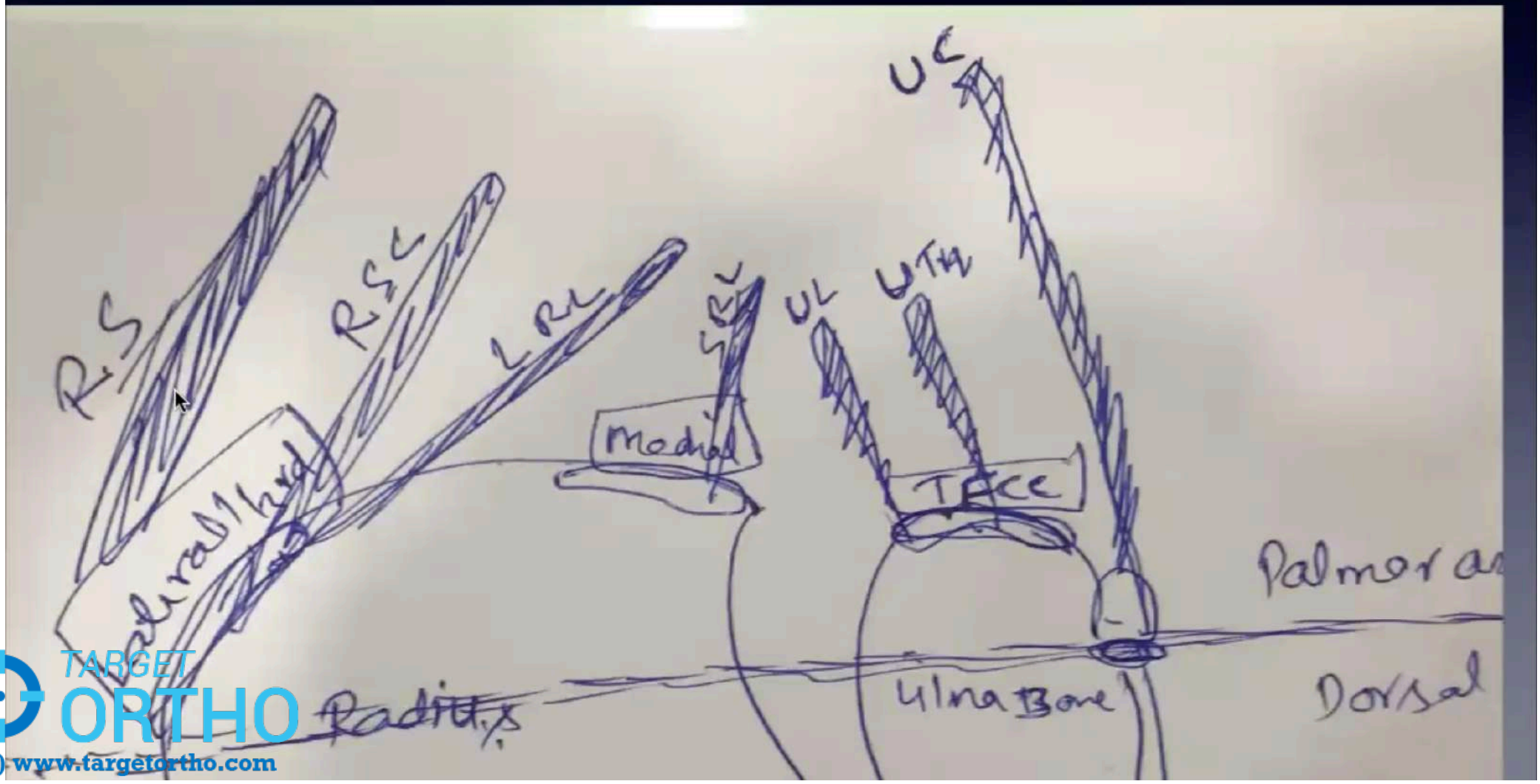
Cross section - Dorsal and Volar radius rim



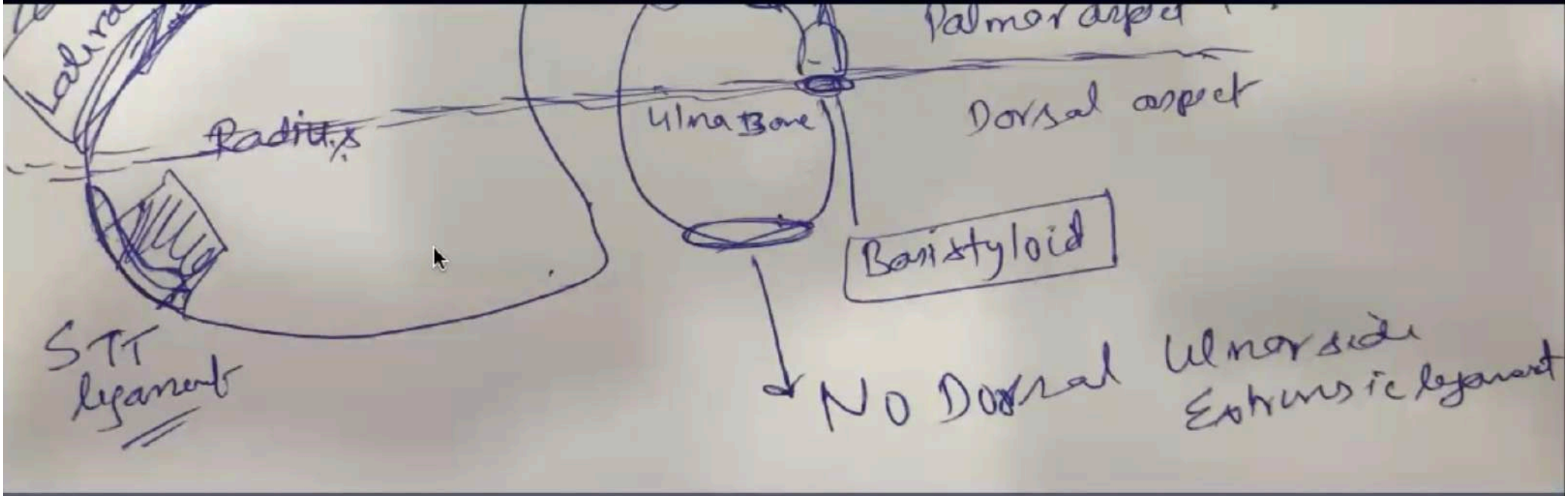
Palmar aspect of Radius and Ulna



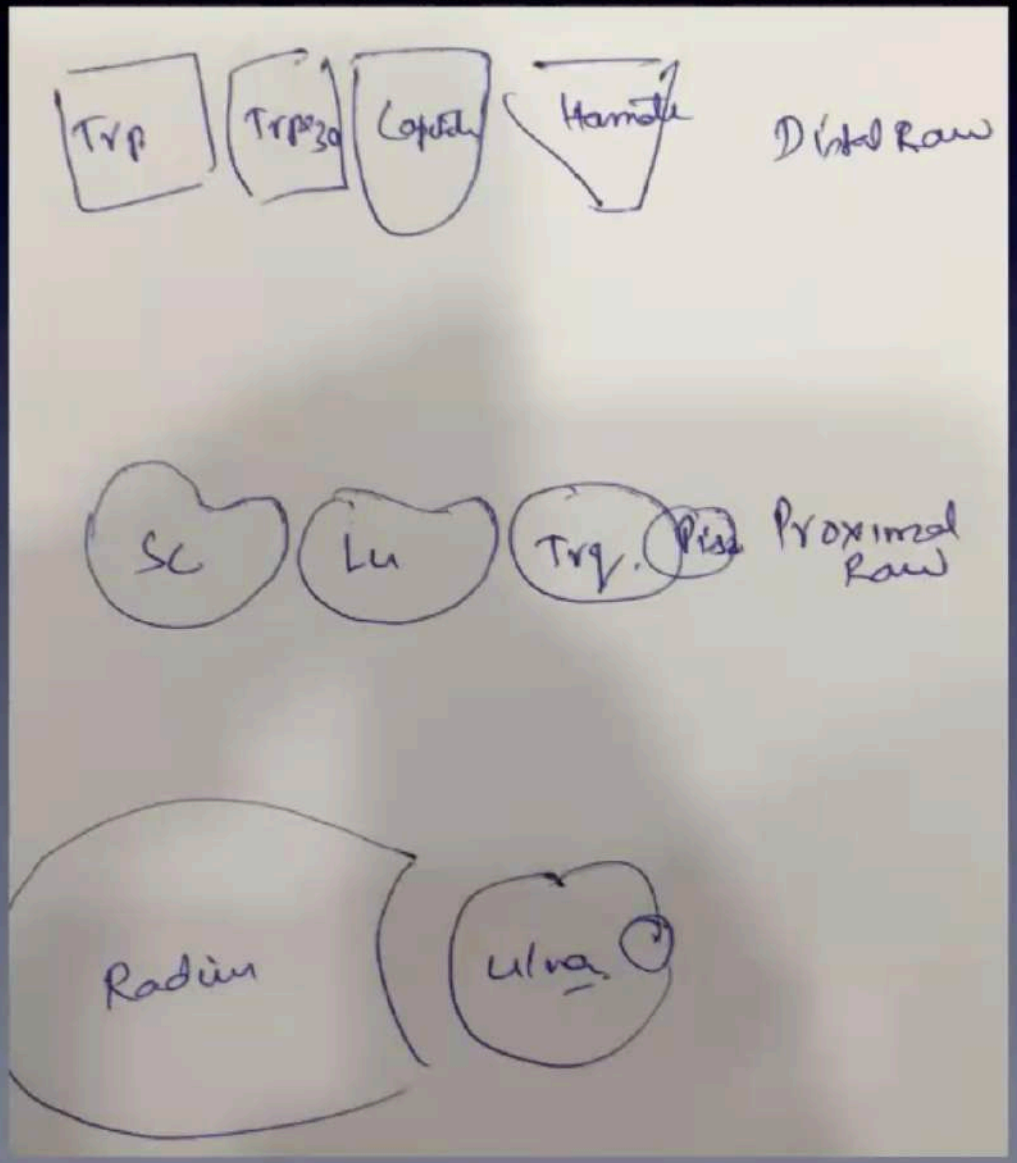
Origin of Extrinsic ligament from palmar aspect of Radius and Ulna



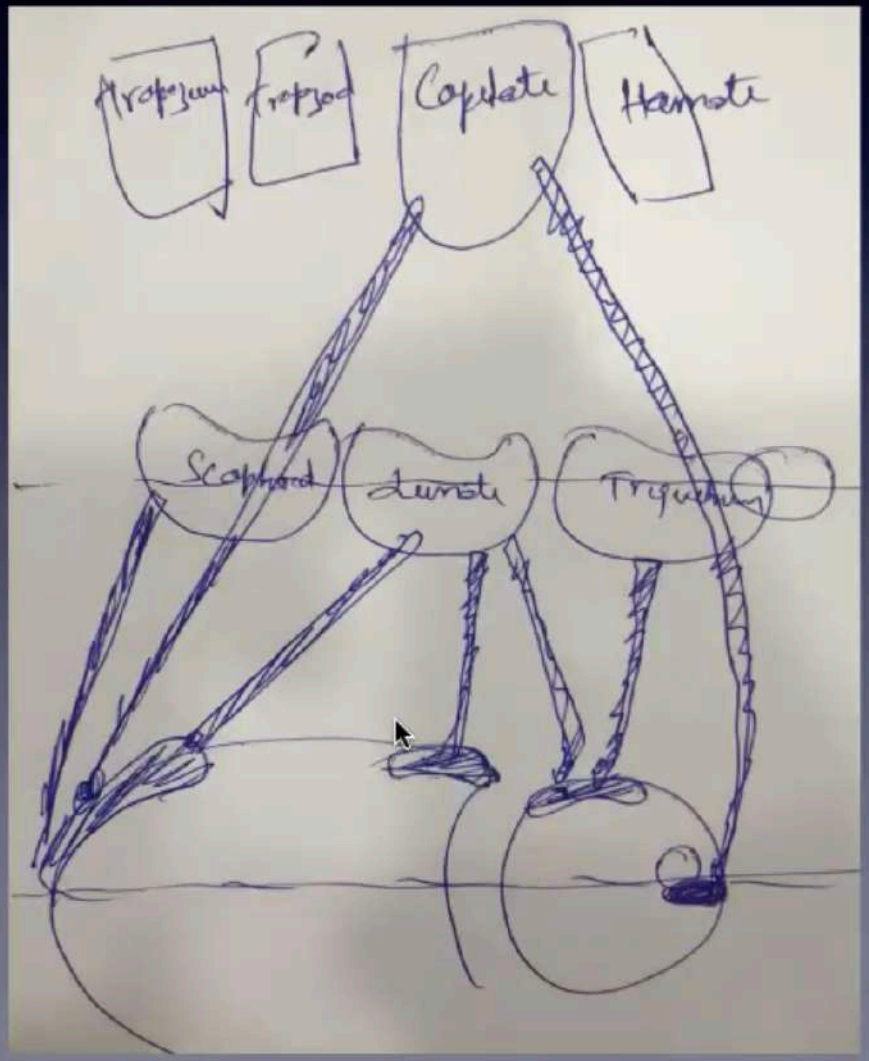
Origin of extrinsic ligament from dorsal rim of radius
Nothing from ulnar side



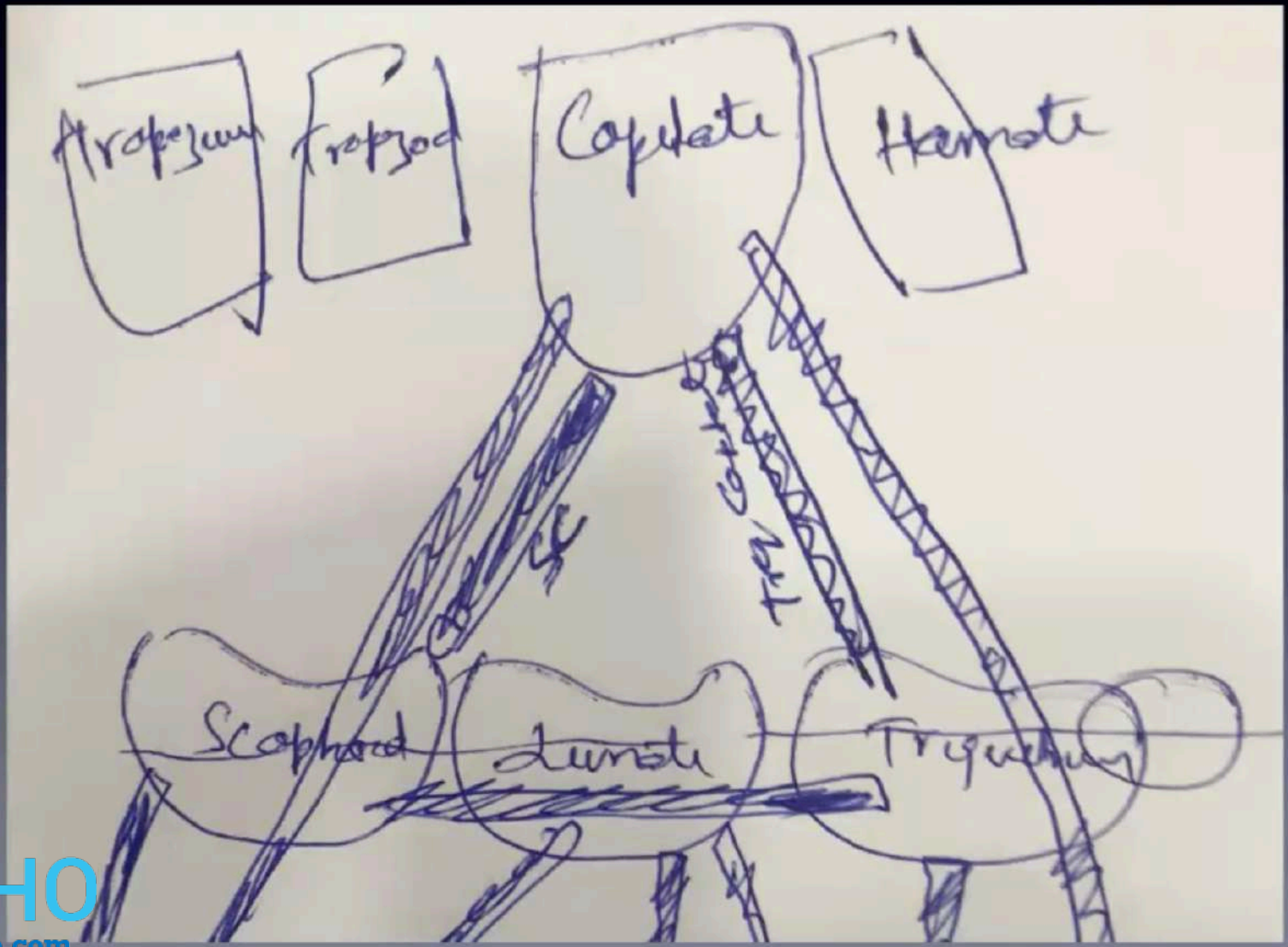
Relation of ligaments on proximal and distal row



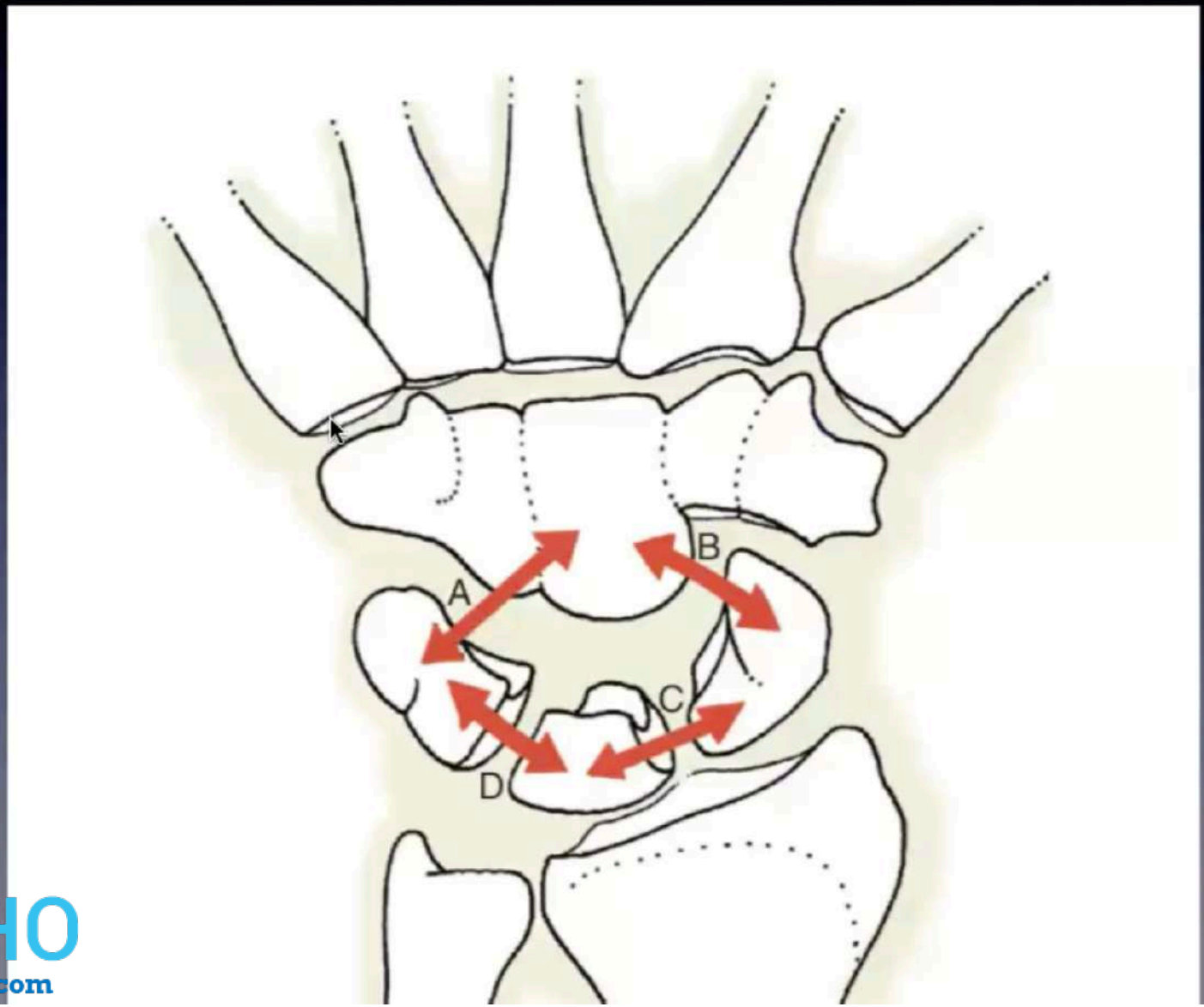
Extrinsic ligament insertion on Proximal and Distal row



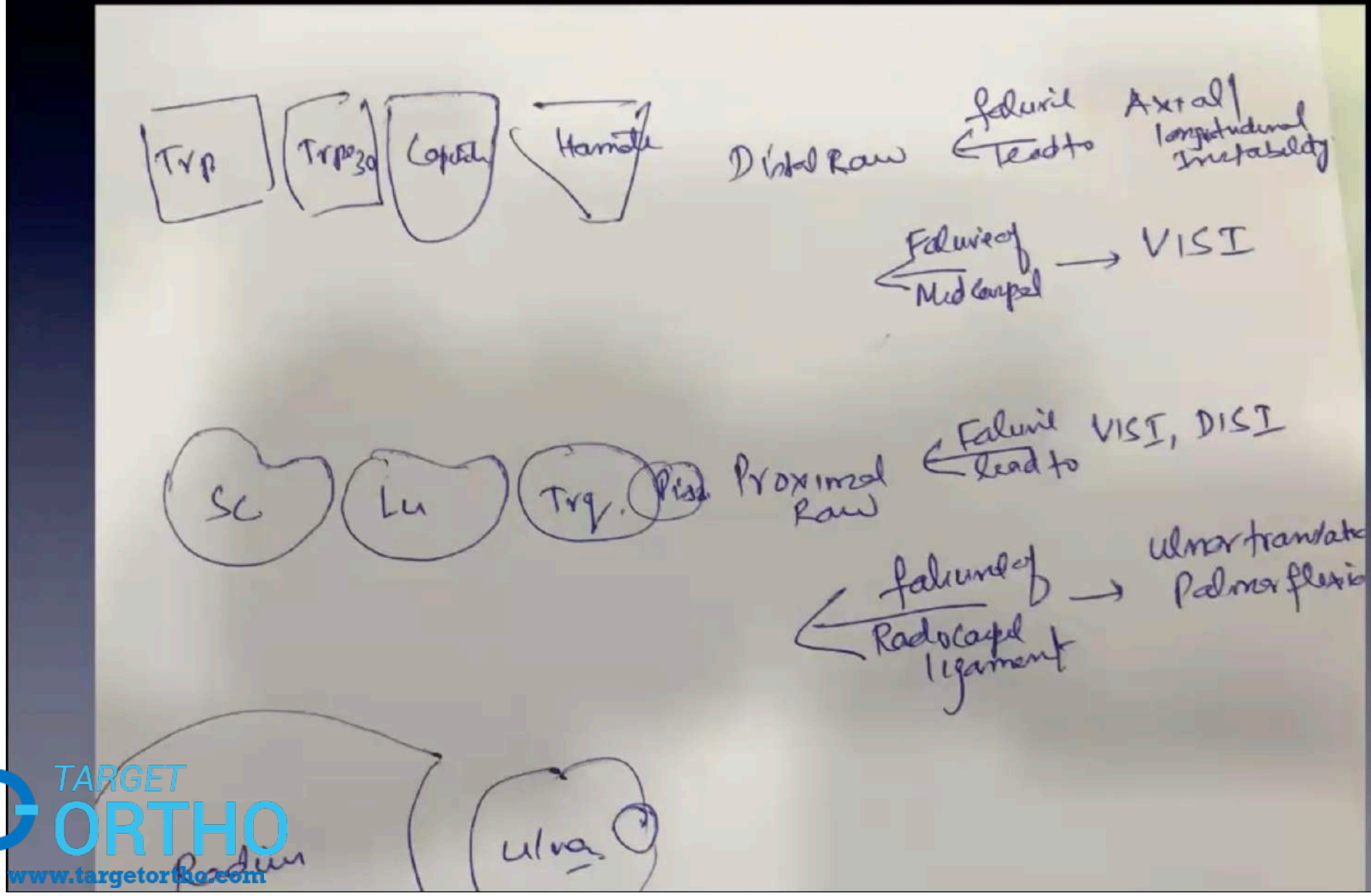
Origin of Intrinsic ligament from proximal row



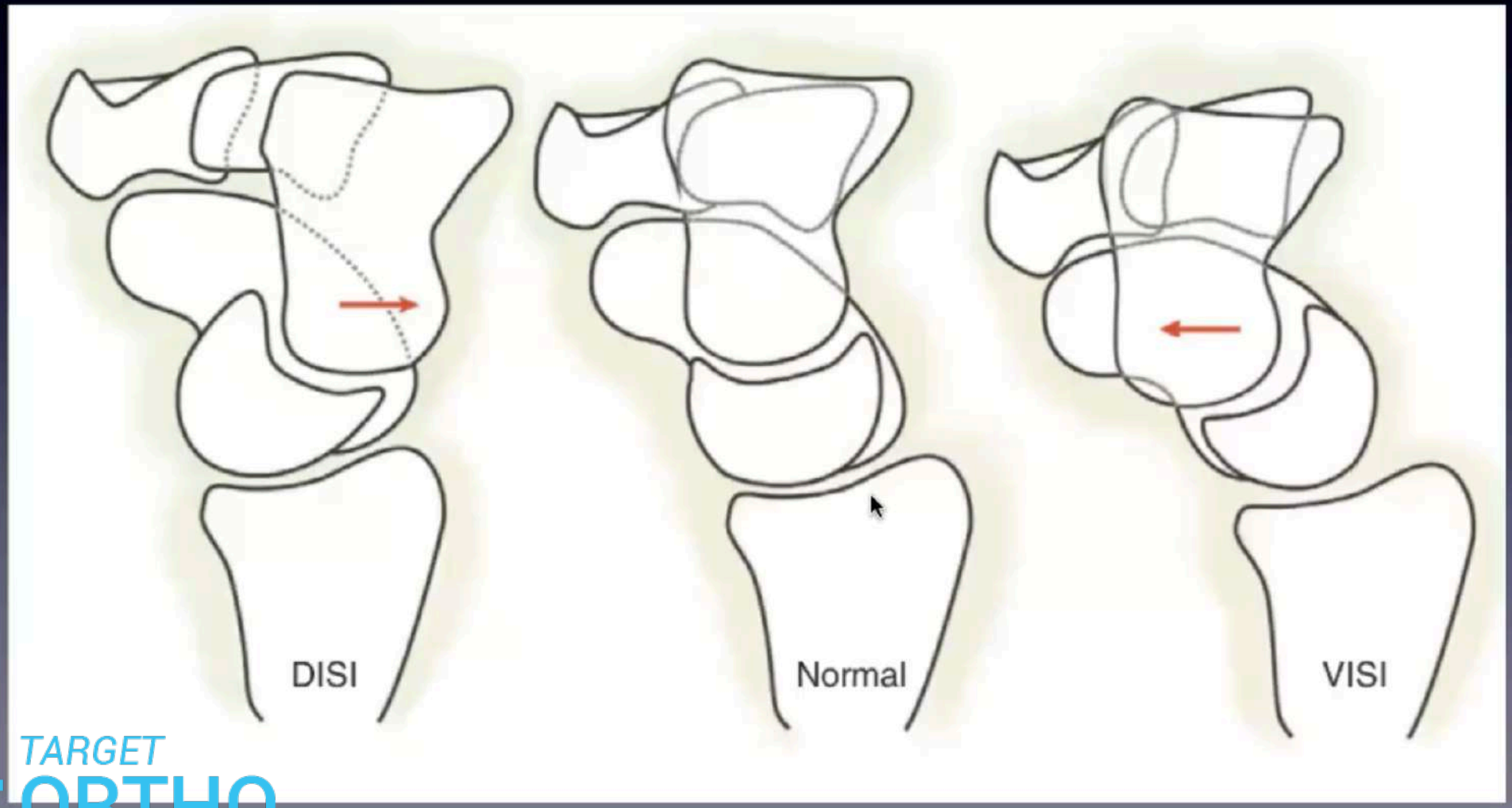
Anatomy - **Ring Concept** Carpal stability



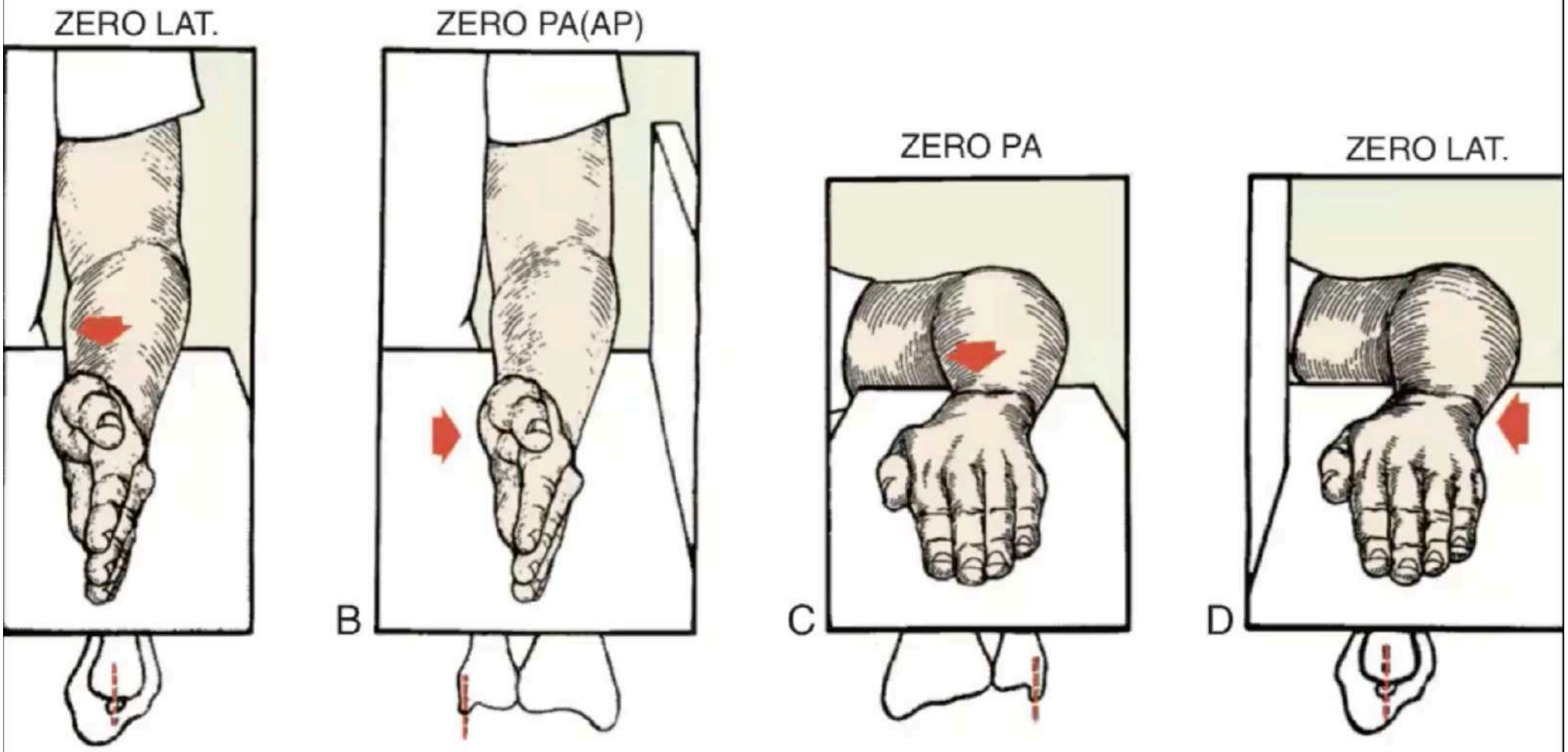
Mechanism of Radioiocarpal, Mid carpal Proximal and Distal row stability



Stabilising mechanism of wrist - Faliure leads to VISI, DISI



X - ray view



Xray
AP view with clinch Fist

- Correct position of wrist in neutral position
- is evaluated by
- looking at 3 rd cmc joint space is in clear profile

.

PA view with 10 degree angulation from ulna towards radius

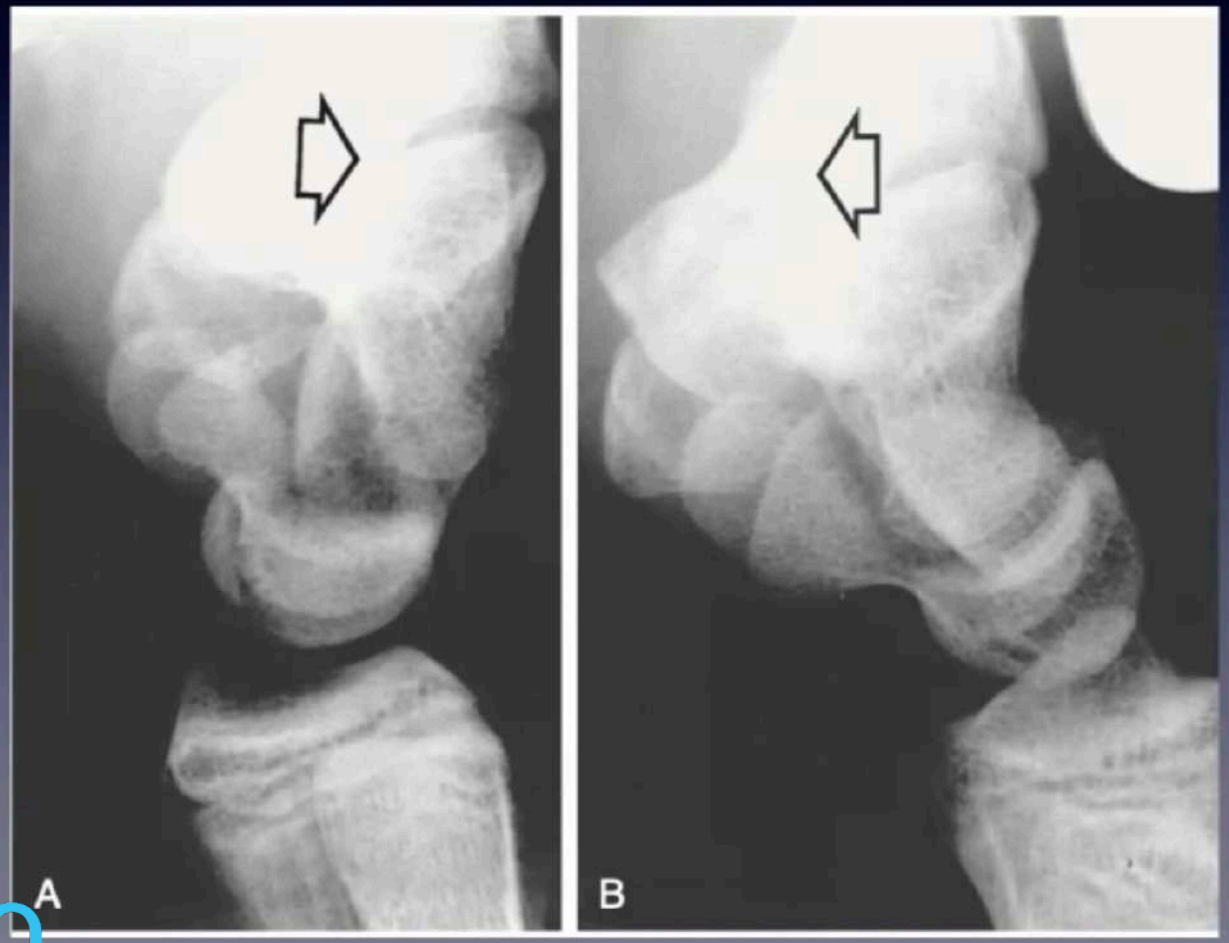
- Measure Mid portion of scapholunate interval

Static motion view

- PA and AP view in Radial deviation and ulnar deviation
- Lateral view in Flexion and extension view

Stress view

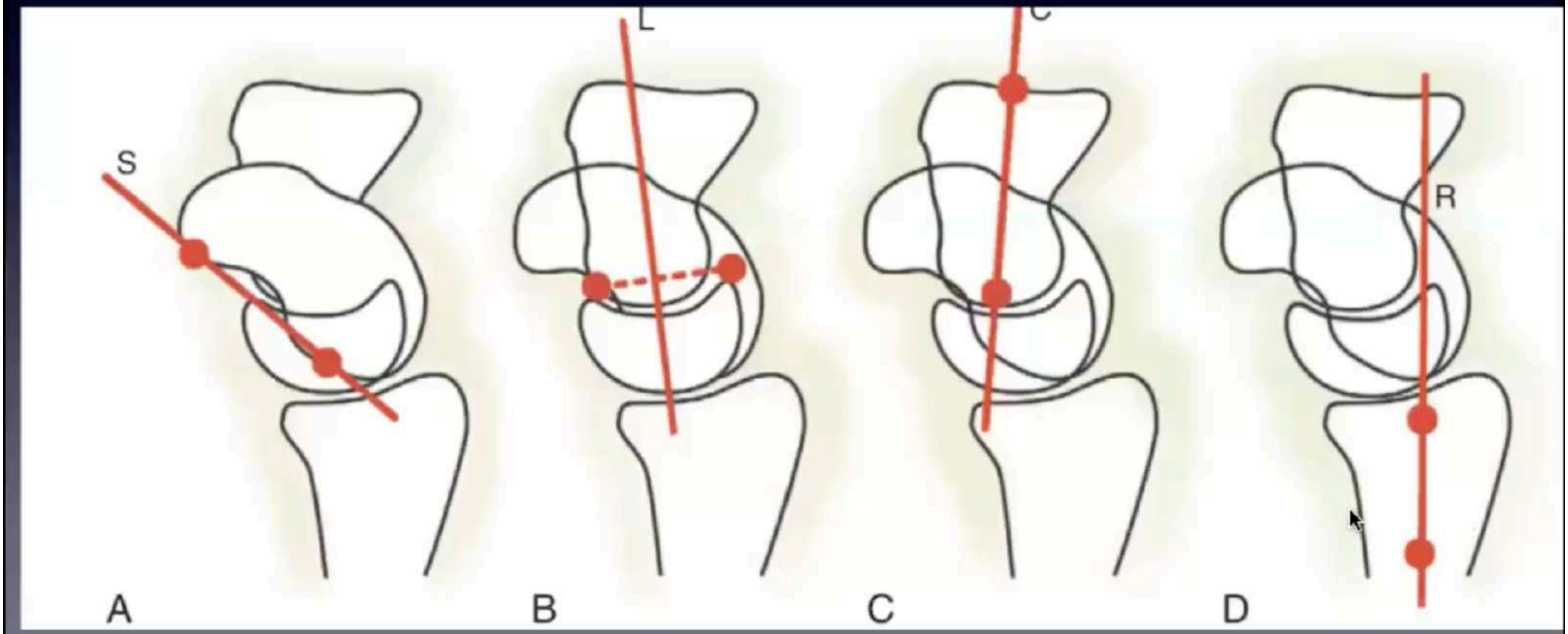
- Drawer test - Volar or dorsal force son distal row to identify mid carpal instability



Measurement of carpal alignment

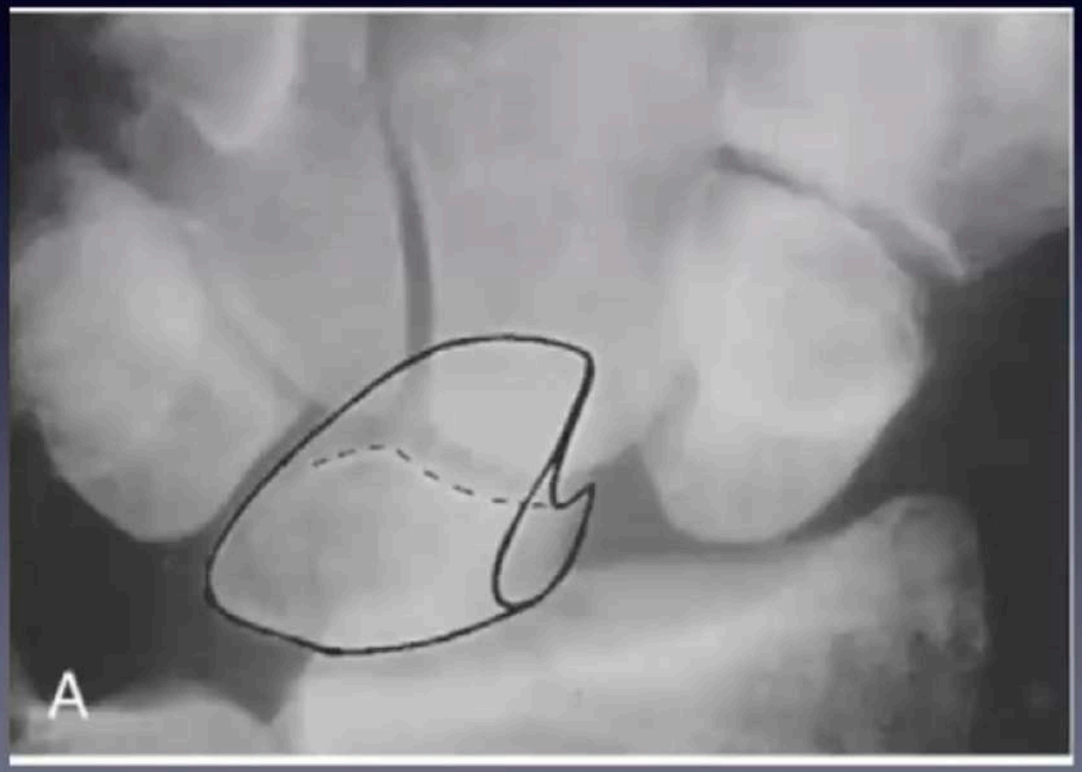
- Capitolunate , scapholunate , radiolunate angles
- Ulnar variance
- Carpal height ratio - determine progression of carpal collapse

Axis of carpal bones

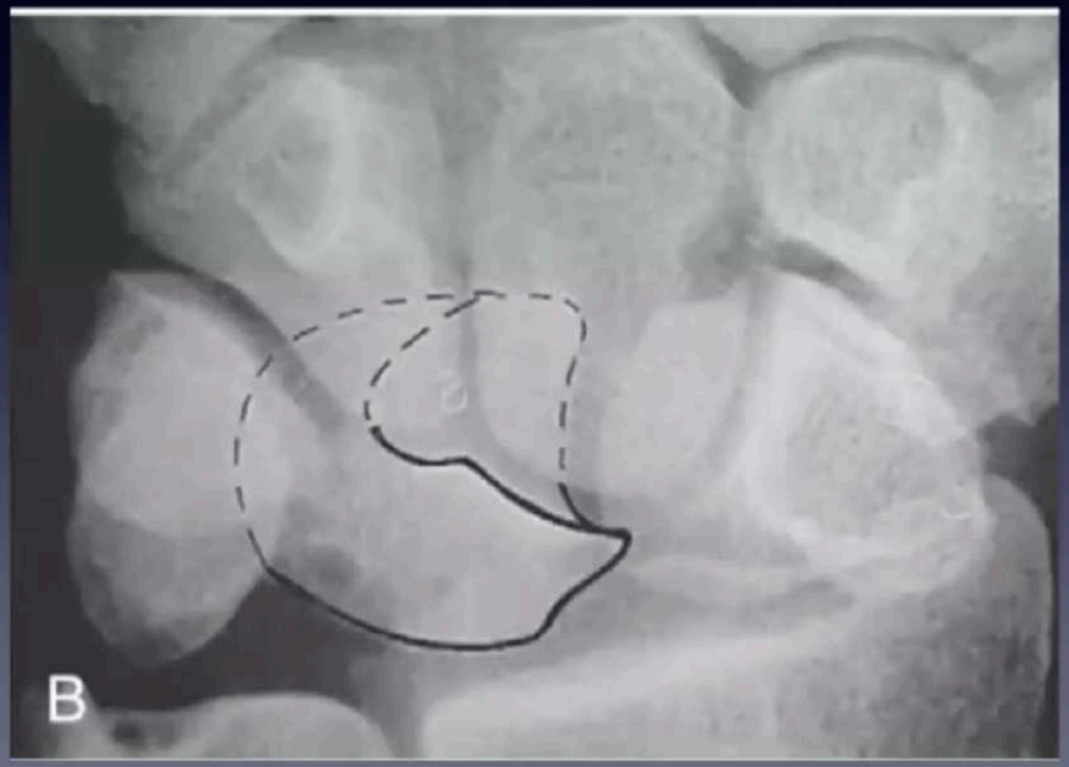


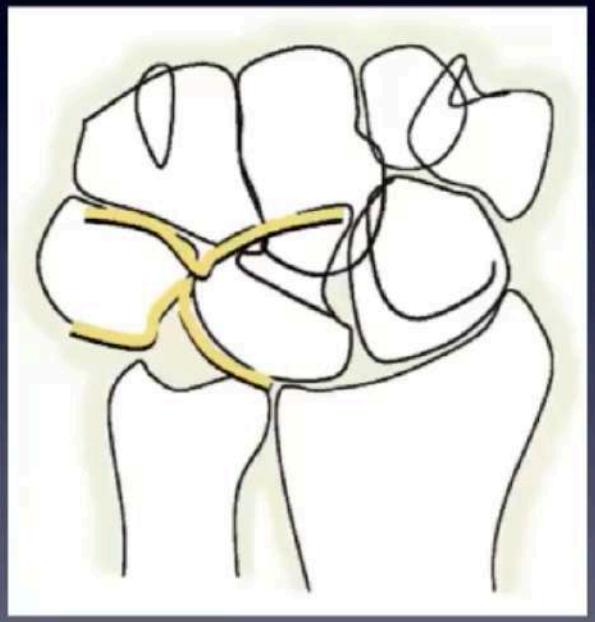
Oblique oriented oval configuration with prominent wedge shaped ulnar corner pointing towards medial aspect of wrist

DISI



Moon like face or "C" shaped Lunate in **VISI**





Isoscellous triangle
Minor palmar lunate rotation
Dorsal Perilunate dislocation

Lesser arc = pure ligamentous
Greater arc = with fracture

What else we need to know for management of carpal instability ?

6 features of Carpal Instability

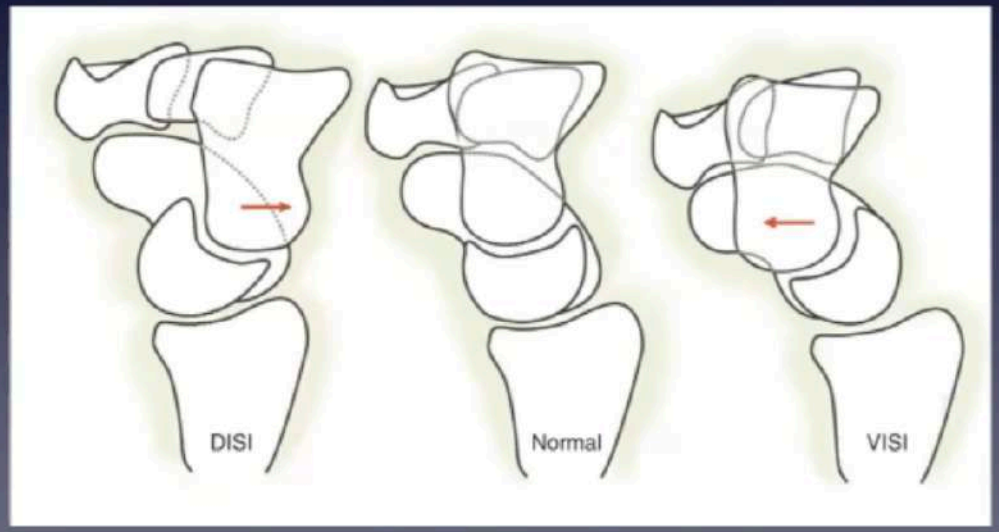
- Chronicity - Acute , Subacute[1 - 6 week], Chronic

> is not the time from injury itself that counts, but the fact that time implies a progressive loss of the healing potential of the damaged ligaments.

- Etiology - Traumatic / Inflammatory
- Location - Radiocarpal , Proximal Inter carpal, Midcarpal , Distal Inter carpal
-

6 features of Carpal Instability

- Severity - Predynamic / Dynamic / Static
- Direction - DISI / VISI / Ulnar, Radial, Dorsal Translation



- Pattern - CID, CIND, CIC, CIA

Severity - of instability

- **Pre dynamic** - partial tear and no malalignment under stress
- **Dynamic** -complete tear and malalignment under stress
- **Static** - complete tear with permanent alteration of malalignment

CI- Dissociative [No dislocation]

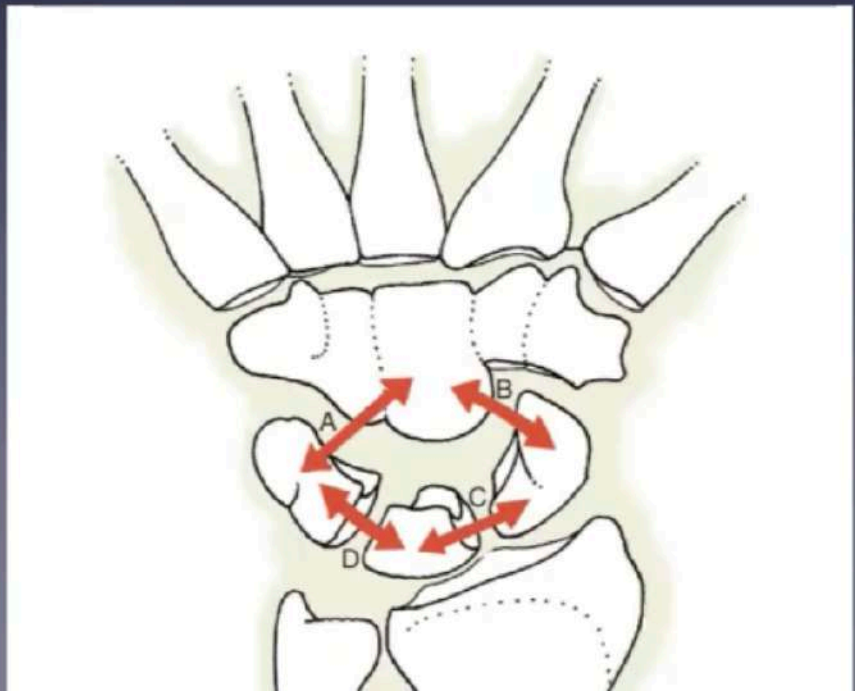
Malfunction of joint between bone of same row

Causes

SLD, LTD

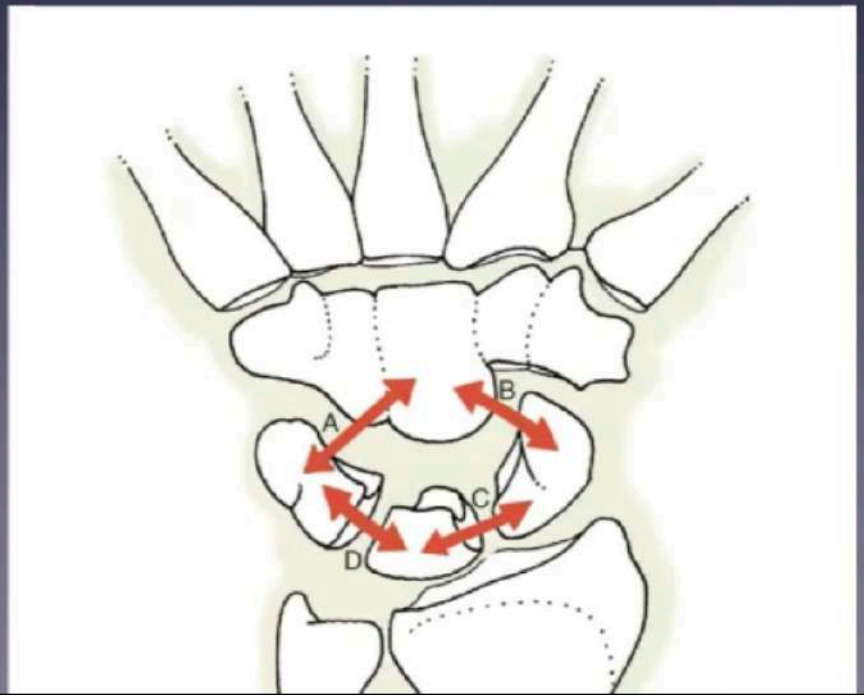
Unstable scaphoid fracture , Scaphoid fracture nonunion

Advanced Keinbock



CI- NonDissociative [Dislocation]

- Malfunction of joint between bone of different row
  Causes - radiocarpal , mid carpal
- **Laxity , madelung**
-



Carpal instability complex [CIC]

- **CICD +CICND**

1. Dorsal perilunate dislocations (lesser arc)
2. Dorsal perilunate fracture-dislocations (greater arc)
3. Palmar perilunate dislocations (lesser or greater arc)
4. Axial dislocations
5. Isolated carpal bone dislocations

Case 1
Kirodimal
57y/ Male

- Sustained right wrist injury following fall from bike
- Presented after one and half month
- Wrist stiffness
- Median nerve symptom

X- ray - Diagnosis -?

- Correct view
- Overlapping carpal bones
- Scaphoid ring sign present
- Lunate is missing

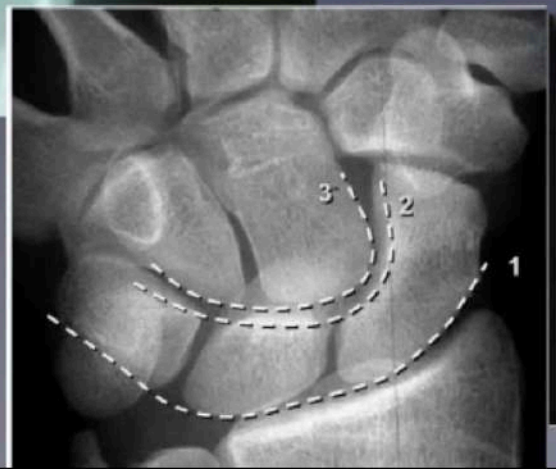
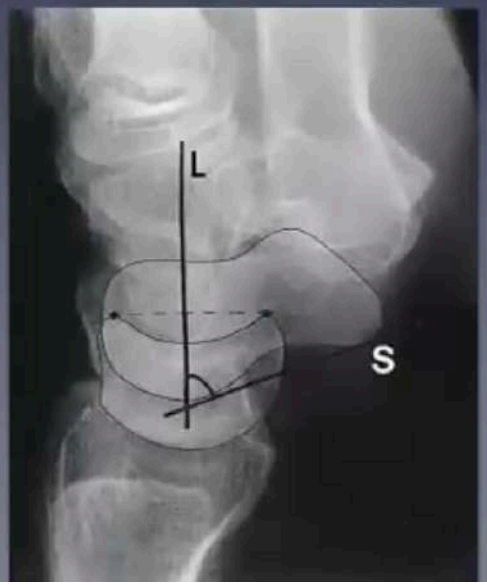


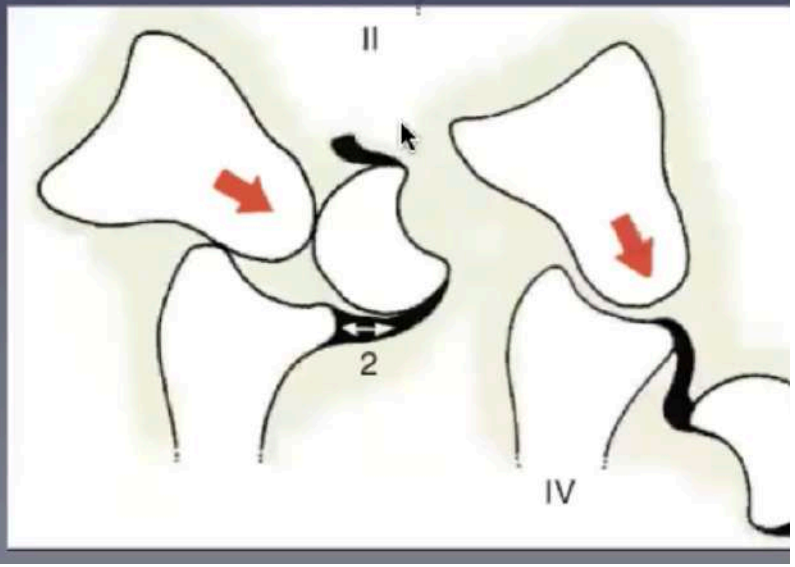
Figure 15.11 The scapholunate space is most clearly shown in a posteroanterior view with the tube angled 10 degrees from the ulnar side.[125] The gap is to be measured in its mid-portion, the landmark being the middle of the flat medial facet of the scaphoid (arrows).

X- ray - Diagnosis -?

Lunate rotated 90 degree out of radius

Capitate dorsal to lunate bone





Lesser / Greater arc injury

6 features - Lesser arc injury

- Subacute
- post traumatic
- Radoiocarpal, Proximal Inter carpal, Mid carpal,
- Static
- palmar lunate dislocation
- CIC

Plan

- Closed reduction and cast
- Closed reduction percutaneous k wire
- External wrist distractor yes / NO , ? Week
- Open reduction and internal fixation
- ORIF + Ligament reconstruction

Traction view under Anesthesia

- Check for Joint space and alignment
-

Surgical approach

- First Dorsal
- First Volar

Surgical approach

- Dorsal lazy 'S' shaped 6 cm incision centered on lister tubercle
- Extensor retinaculum opened along EPL ,
- Expose 2nd and 4 th compartment
- Elective posterior interosseous nerve neurectomy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Tips

- Reduce the lunate under direct vision by pushing it between capitate and radius
- Ligament reconstruction / ligament repair
-
-

Treatment
Scapholunate Dissociation

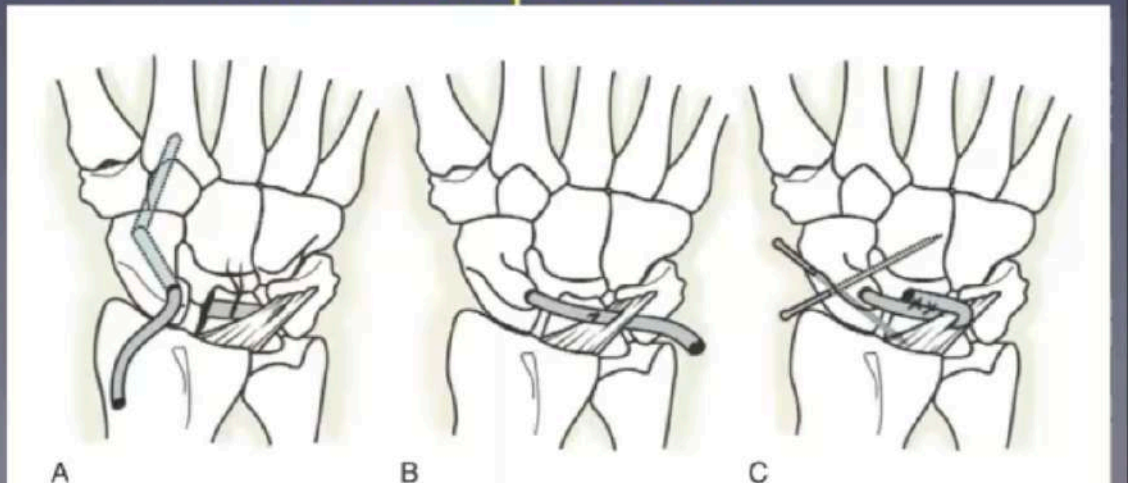
- Stage I [ocult SLD] - conservative
- **Stage II** - Complete injury repairable - **ligament repair + dorsal capsulodesis**
- **Stage III- Dynamic SLD -DISI - Three ligament tenodesis**
- **Stage IV- Reducible static SLD - Three ligament tenodesis**
- Stage V -irreducible without loss - radoiocarpal fusion + excision of distal portion of scaphoid
- Stage VI-[SLD + SLAC radoiocarpal and mid carpal arthritis]- scaphoid excision + mid carpal fusion [capito lunate triquetrum four corner fusion]

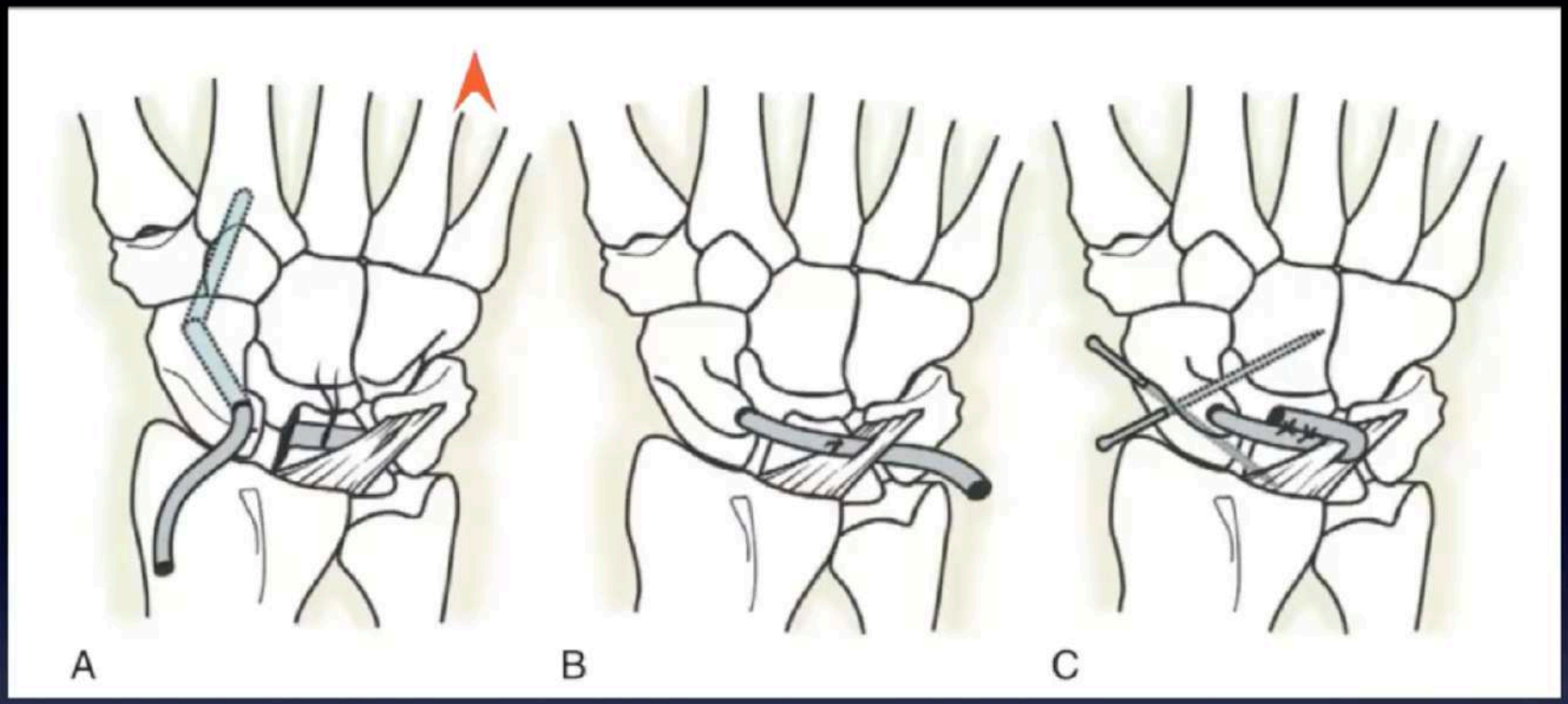
Modified Brunelli Three ligament Tenodesis

- Distally based 8 cm split FCR tendon is harvested
- 2.7 mm drill hole from dorsal SL site to palmar tuberosity
- Retrive split FCR tendon into dorsum of scaphoid

Modified Brunelli Three ligament Tenodesis

- Transverse Trough made in dorsal lunate for FCR tendon
- Suture anchor in lunate to compress tendon
- Correct tension is created by making loop of tendon across distal portion of Radiotriquetrum ligament





- While tensioning the tendon using RT ligament as pulley , SL and SC joint is transfixed by 1.5mm k wire

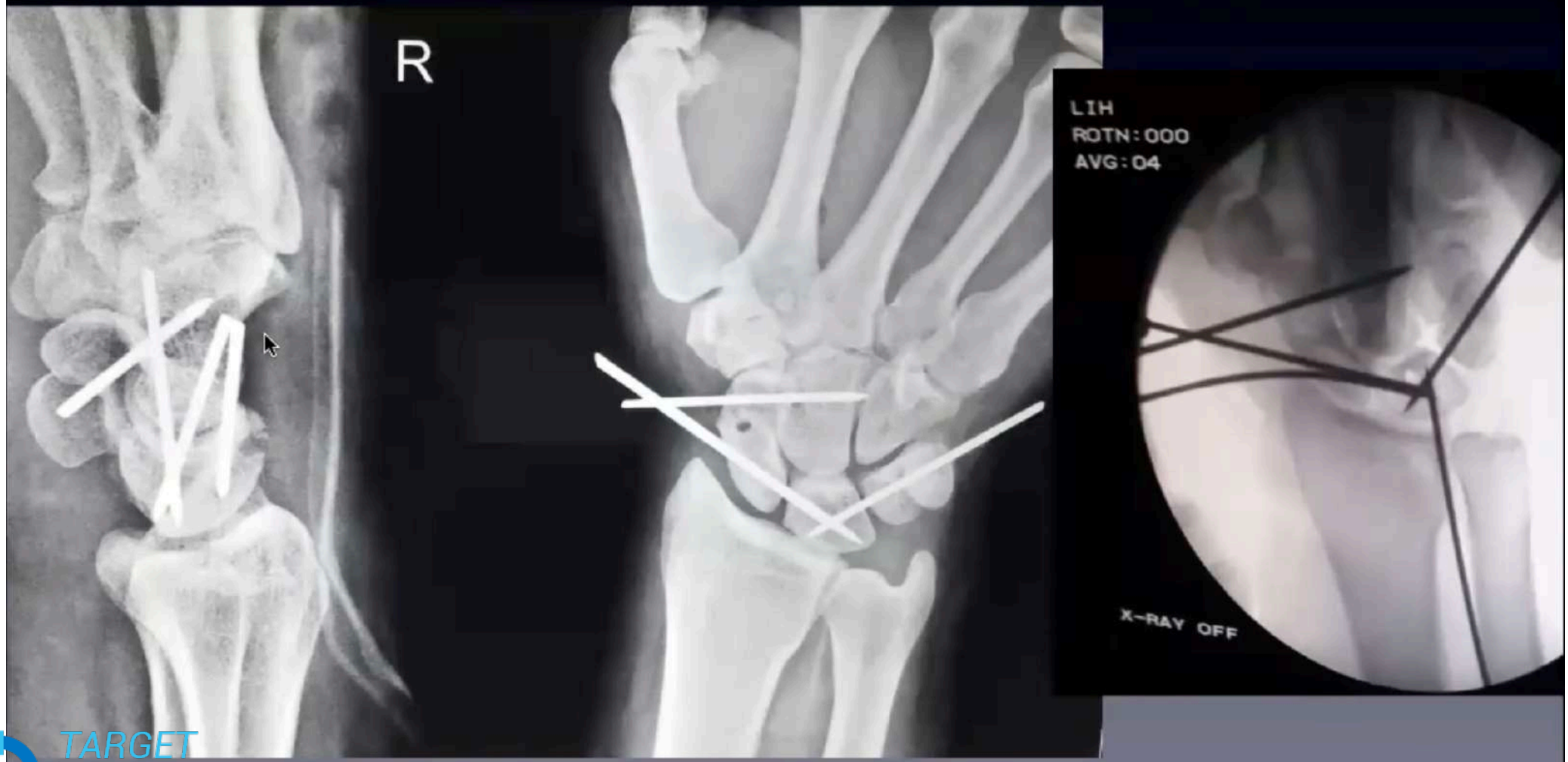
- without releasing the tendon tension - suture anchor is used to compress at dorsal lunate .

Post op regime

- At 2 weeks thumb spica and suture removed
- At 8 weeks k wire and cast removed
- At 8 week Detachable wrist splint to allow wrist mobilisation exercise begin

Skin closure

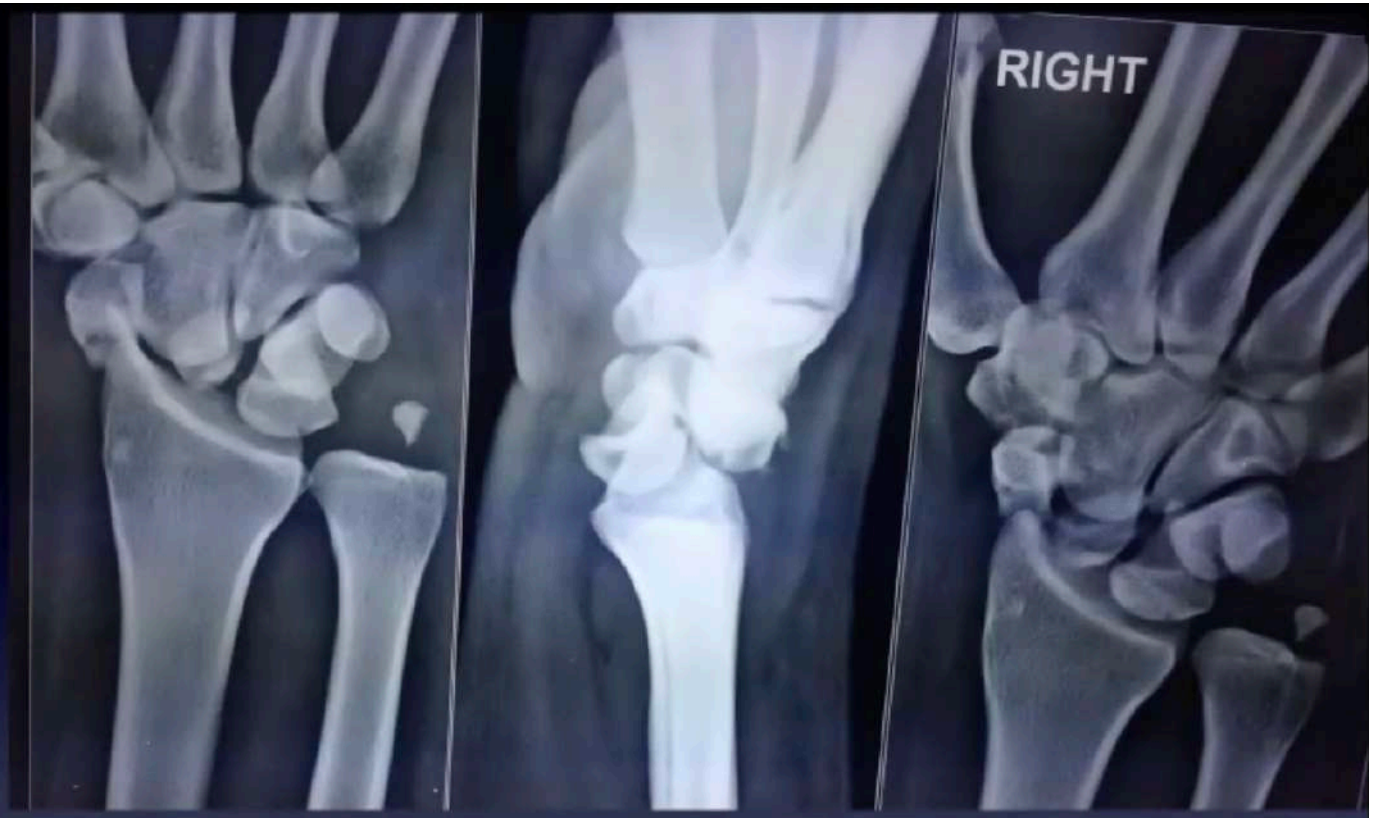
Post op



2 year follow up

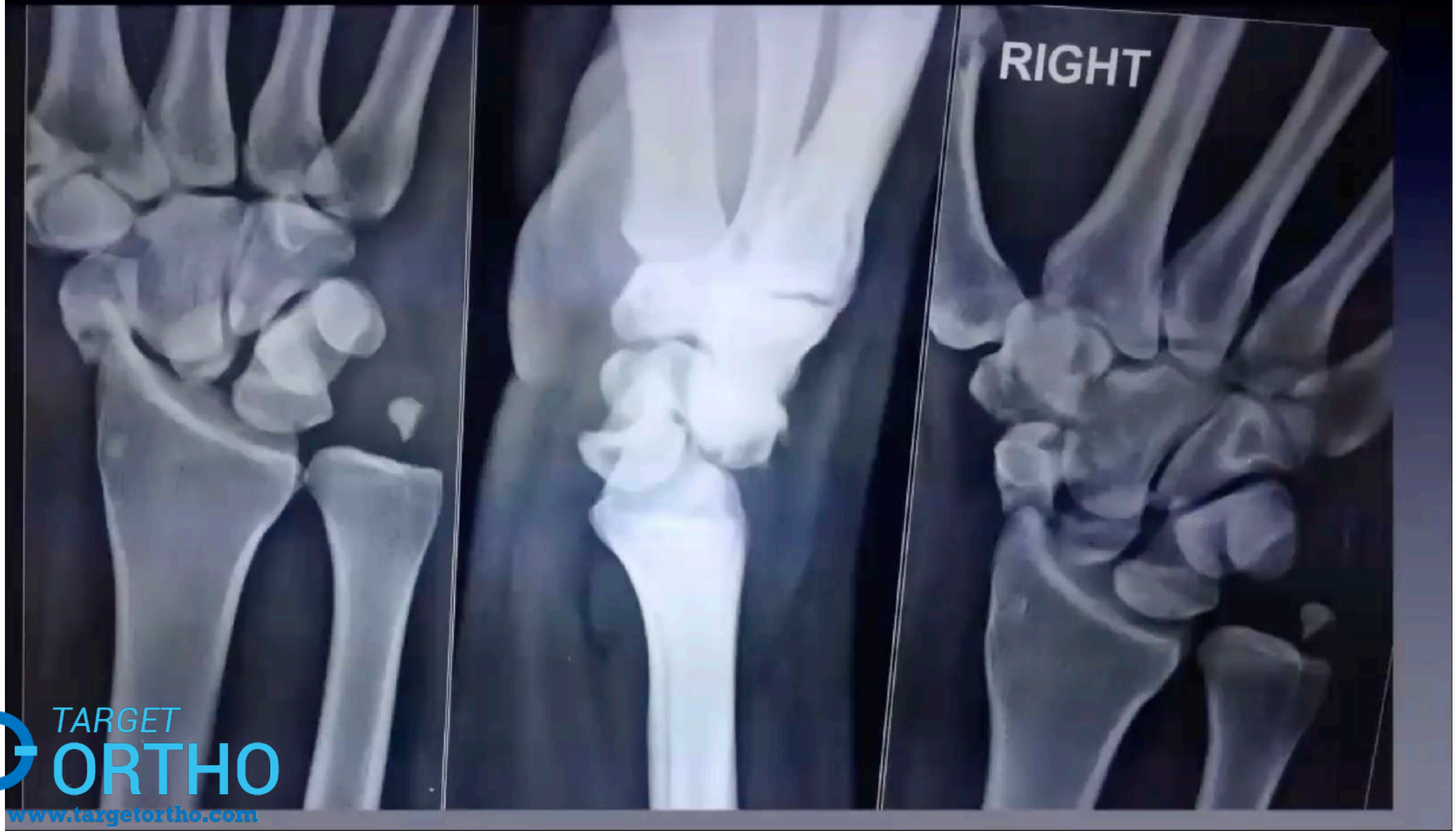
2 year follow up

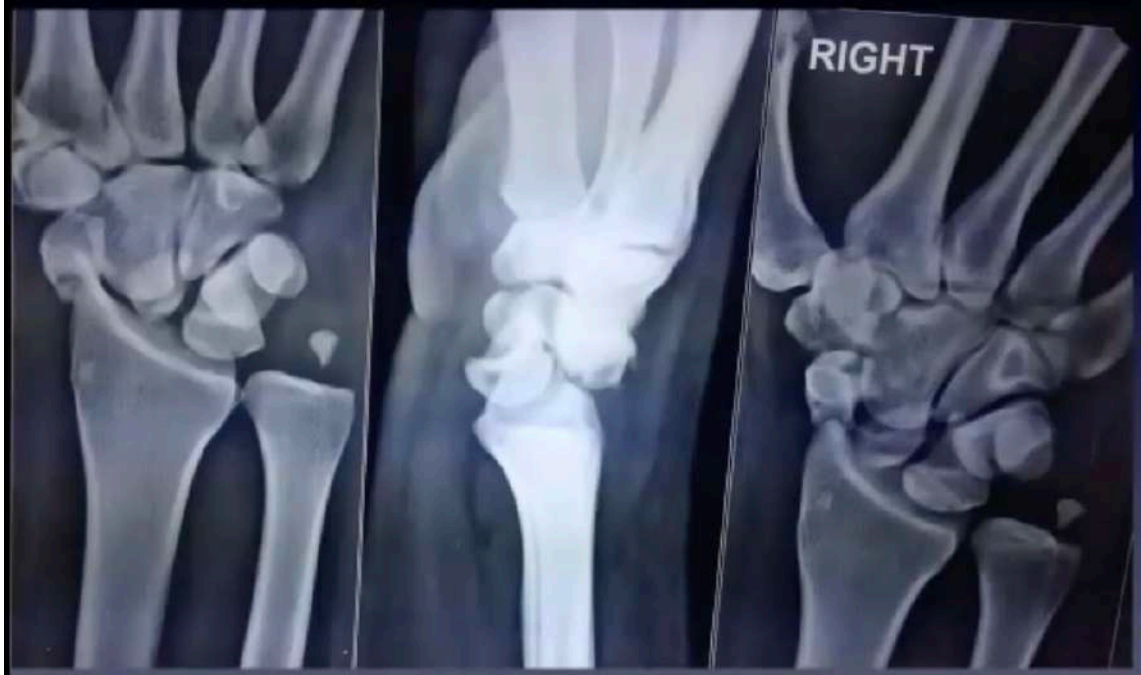
Case 2



- Shyamsundar 35y/male
- Motor vehicle injury
- Presented 10 day later
- With right side wrist swelling / pain

Treat me





- Waist scaphoid fracture
- Ulnar styloid fracture
- Dorsal dislocation of capitate
-

6 features - Greater arc

- Acute
- Post traumatic - trans scaphoid , trans ulnar styloid
- Radio carpal , mid carpal
- Static
- Dorsal
- CIC

Transscaphoid Trans ulnar styloid dorsal perilunate dislocation

Plan

- Closed reduction + Cast immobilization
- Closed reduction + Percutaneous fixation
- Open reduction + Internal fixation

Palmar approach

- Remove the interposed soft tissue between scaphoid fracture site
- Bone graft to address the palmar comminution of scaphoid fracture
- Repair the anterior capsular rent

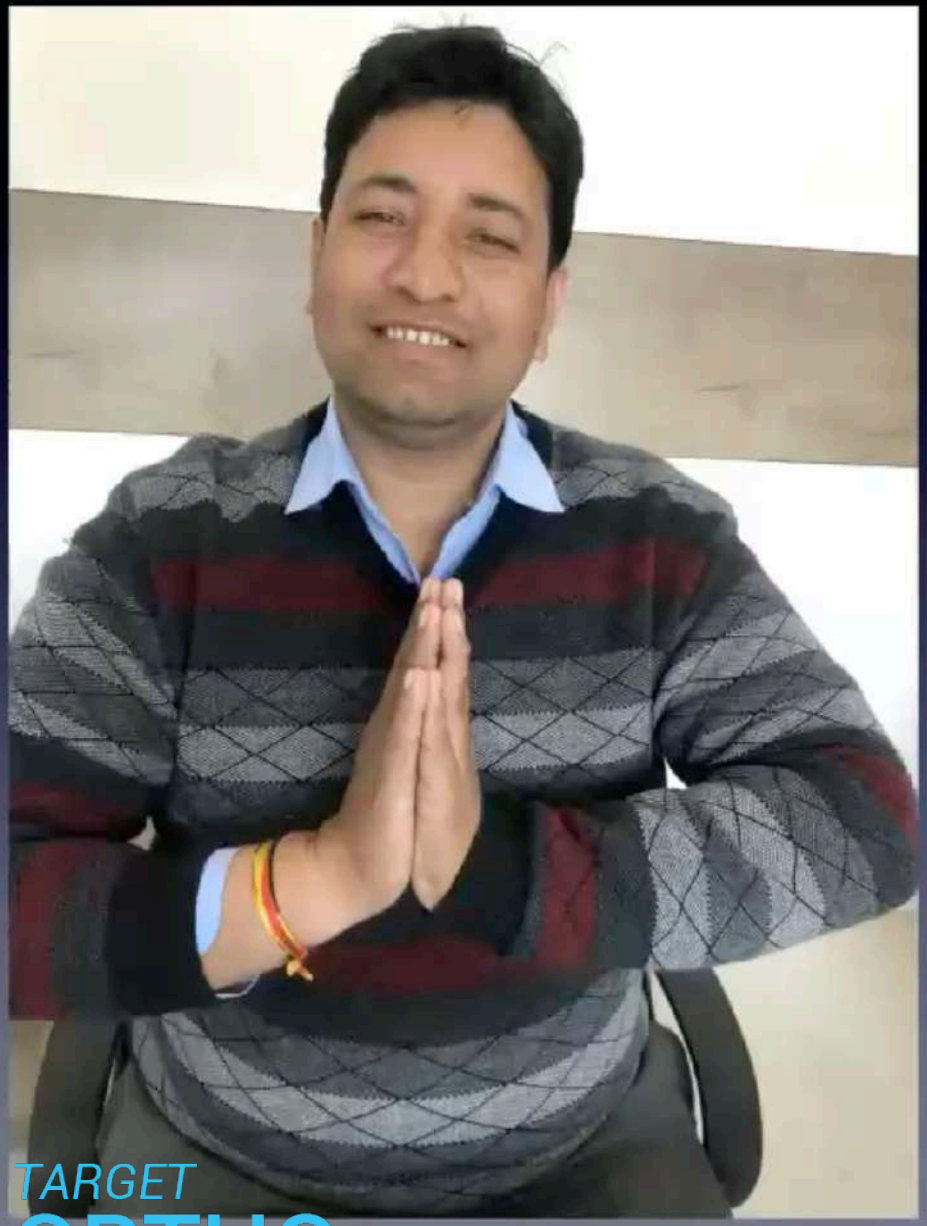
Scaphoid fixation ?

- Headless compression screw
- K wire

Screw fixation

- Simple treatment and rehabilitation because motion can began before complete healing of scaphoid fracture .

Post op



Case 3

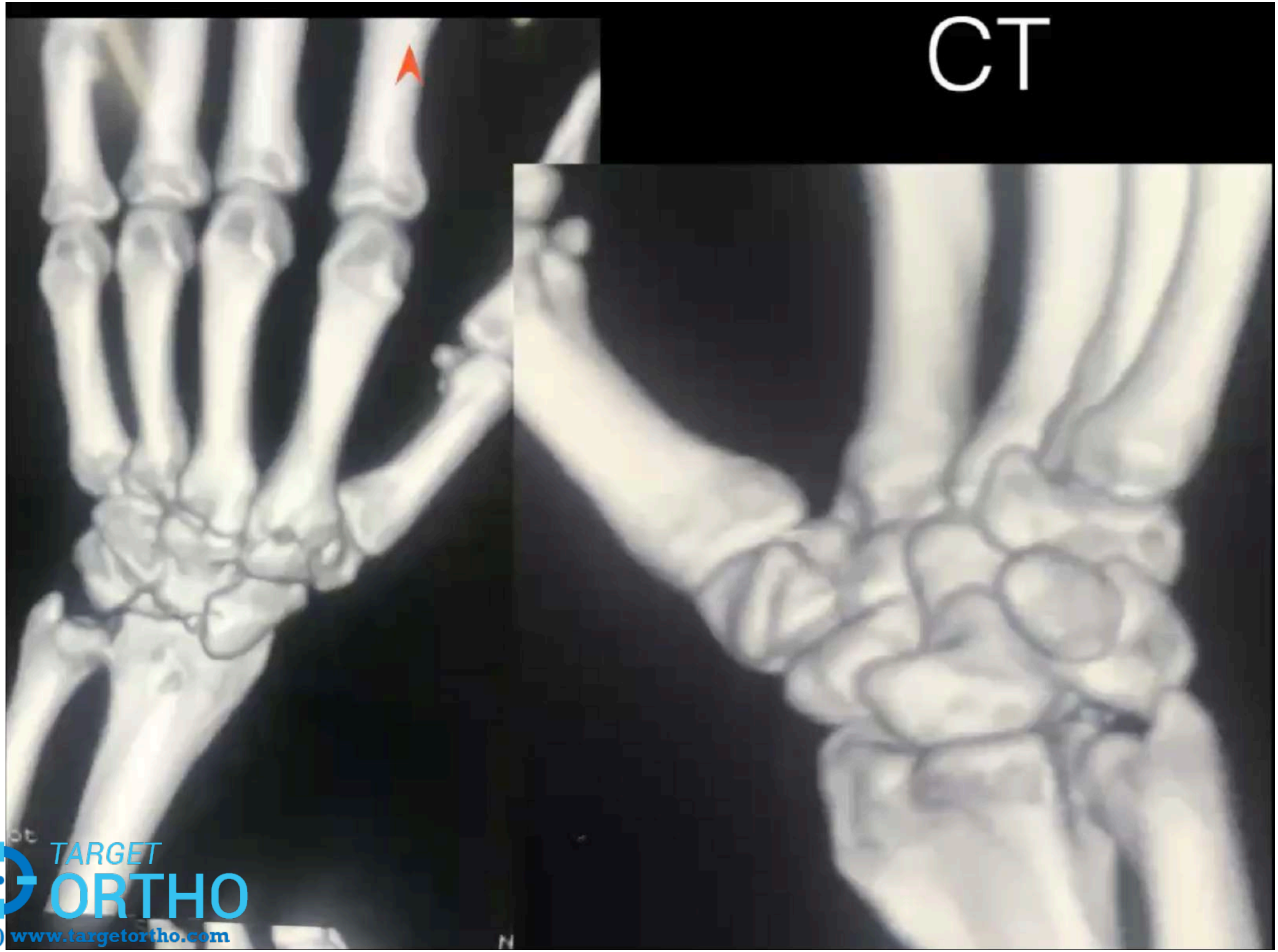
- Neema ram 40y/male
- Sustained wrist injury
- Presented 2 days from injury

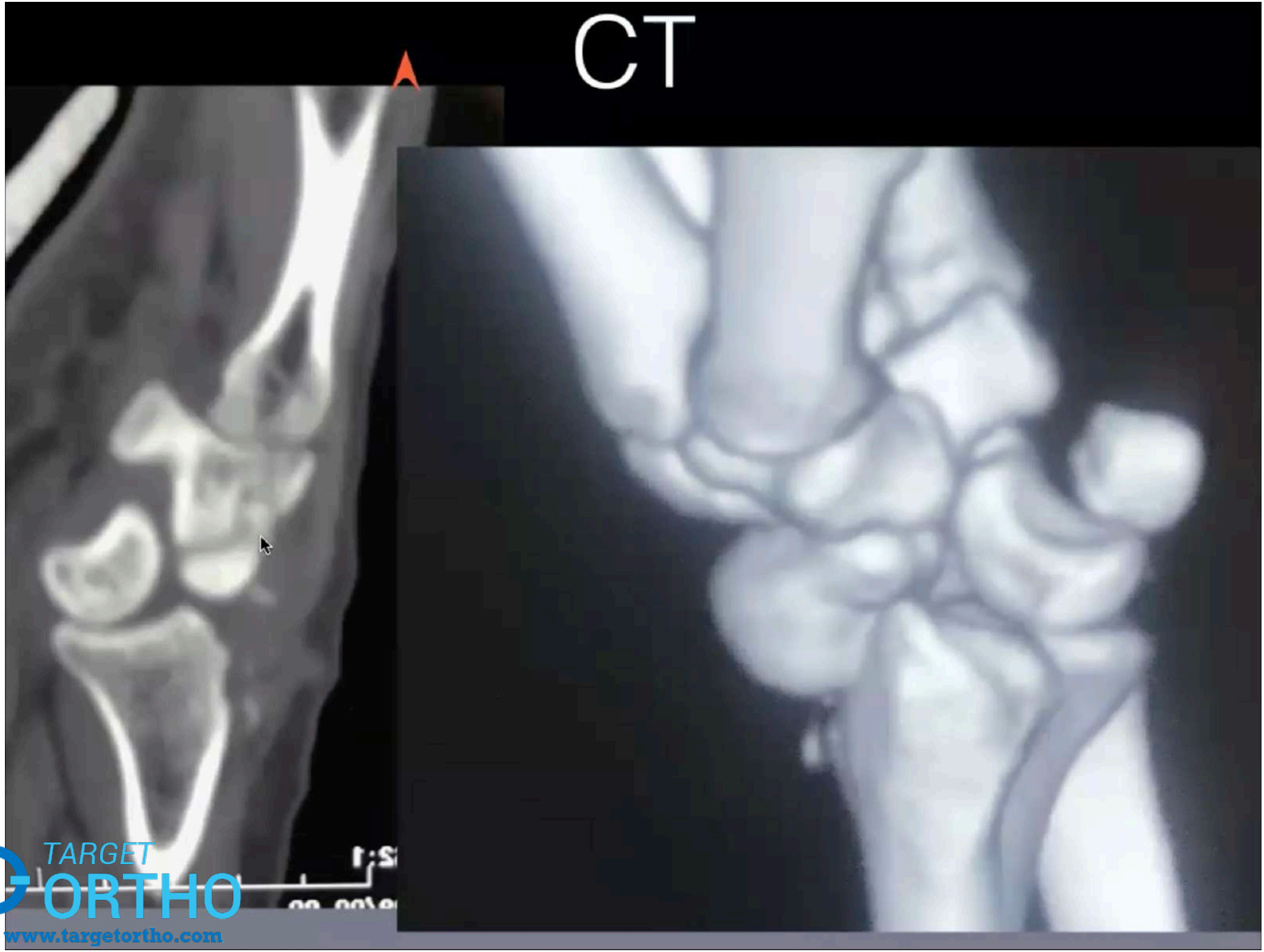
?????

- Overlapping of carpal bones , lunate moon shape
- Lunate in radial fossa
- No fracture seen

Any investigation required

- CT
- MRI





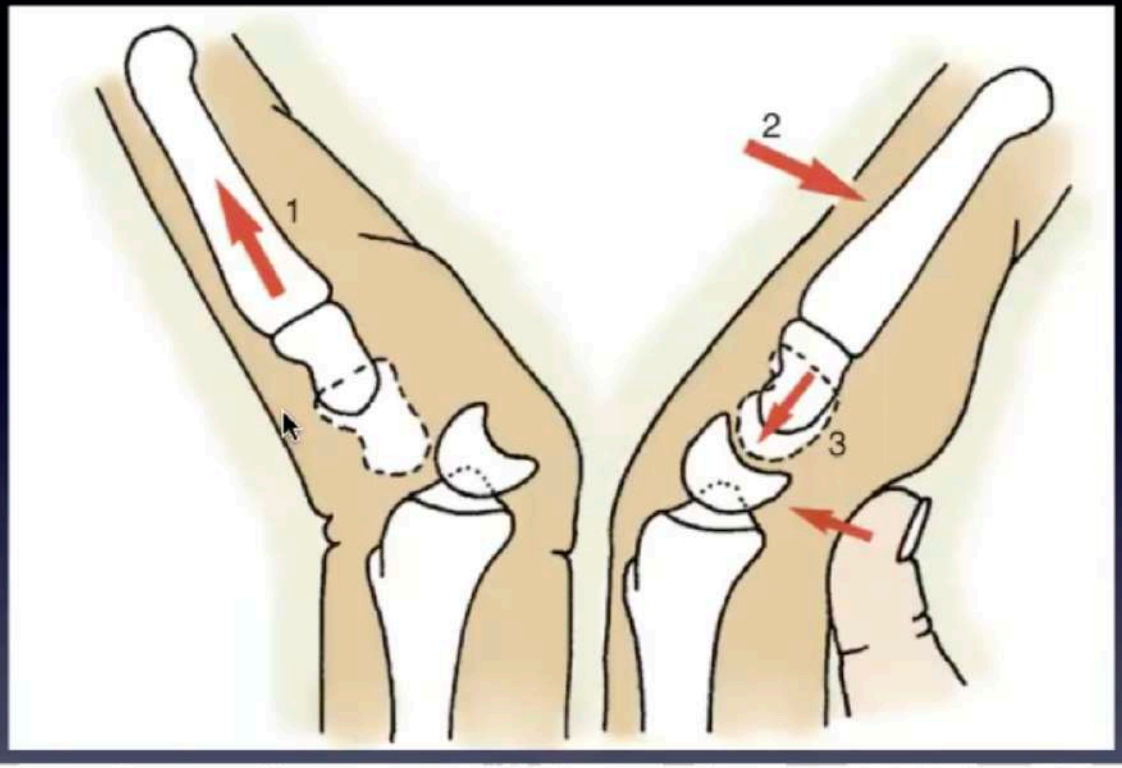
6 features - lesser arc injury

- Acute
- Post traumatic
- Radoiocarpal, proximal row, mid carpal
- Static
- Dorsal translation
- CIC

Dorsal Perilunate Dislocation
Lesser arc injury
Plan

- Closed reduction + Cast immobilization
- Closed reduction + Percutaneous K wire fixation
- Open reduction + Internal fixation
- ORIF + Ligament reconstruction

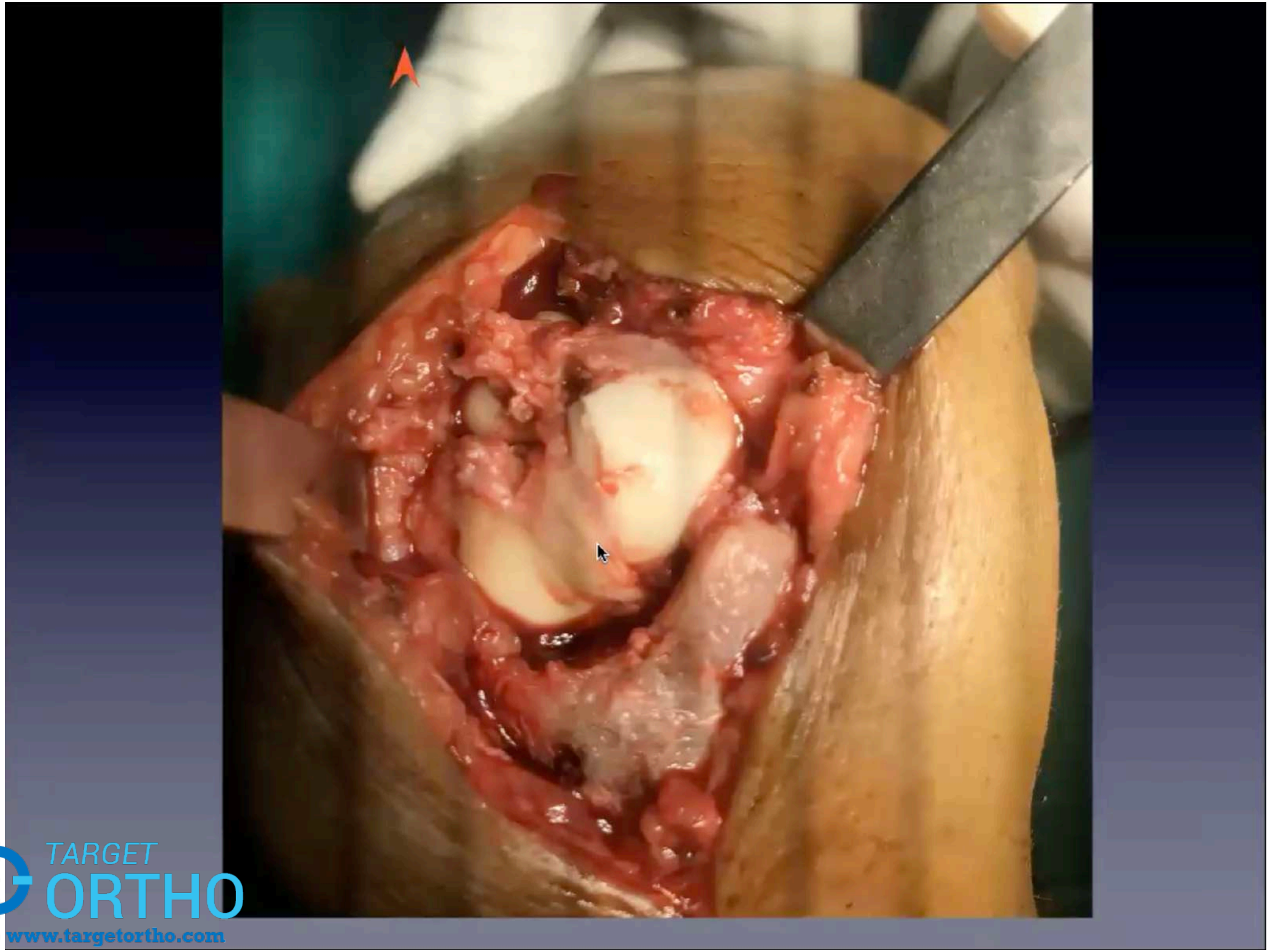
Tavernier's method



reduction of dorsal perilunate dislocations. With the wrist slightly extended, gentle manual traction is applied (*1*). Without releasing such traction, and while the lunate is stabilized palmarly by the surgeon's thumb, the wrist is flexed, until a snap occurs (*2*). This indicates that the proximal pole of the capitate has overcome the dorsal horn of the lunate. At this point, traction is released, and the wrist is brought back to neutral (*3*).

Approach - why

- Volar
- Dorsal



Treatment
Scapholunate dissociation

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- **Stage II - ligament repair + dorsal capsulodesis**
- **Stage III- Dynamic SLD -DISI - Three ligament tenodesis**
- **Stage IV- Reducible static SLD - Three ligament tenodesis**
- Stage V -irreducible without loss - radoiocarpal fusion + excision of distal portion of scaphoid
- Stage VI-[SLD + SLAC radoiocarpal and mid carpal arthritis]- scaphoid excision + mid carpal fusion [capito lunate triquetrum four corner fusion]

Post op

6 months follow up

Case 4

- Navratan 35y / male
- Motar vehicle injury
- 2 weeks from injury
- Wrist pain /swelling

??????

- Radial styloid fracture
- Scaphoid signet ring ,
- Lunate [DISI]
- Scapho lunate gap
- Ulnar styloid fracture

Plan

- Closed reduction + Cast immobilization
- Closed reduction + Percutaneous fixation
- Open reduction + Internal fixation
- ORIF + Ligament reconstruction

Post op

One half year follow up


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Take Home Message

- **Delay in Diagnosis and Treatment worsen the result**
- **All Perilunate dislocation should be treated as early as possible .**
- To decompress the median nerve at carpal tunnel
- To release the tension on the vascular supply of displaced carpal bone
- **Controlled Hand Physiotherapy under vision and frequent follow up for first 3 months is key for optimal outcome .**