*The Ulnar Side of the Wrist!

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*Aim

1. Review anatomy & biomechanics of the ulnar side of the wrist
2. Explore the patho-mechanics following trauma to the wrist
3. Explore special tests to aid diagnosis
4. Brief review of therapy treatments

Non-traumatic wrist pain accounts for 58 per 10,000 referrals from 1° care per year.

Financial cost to 2° care:

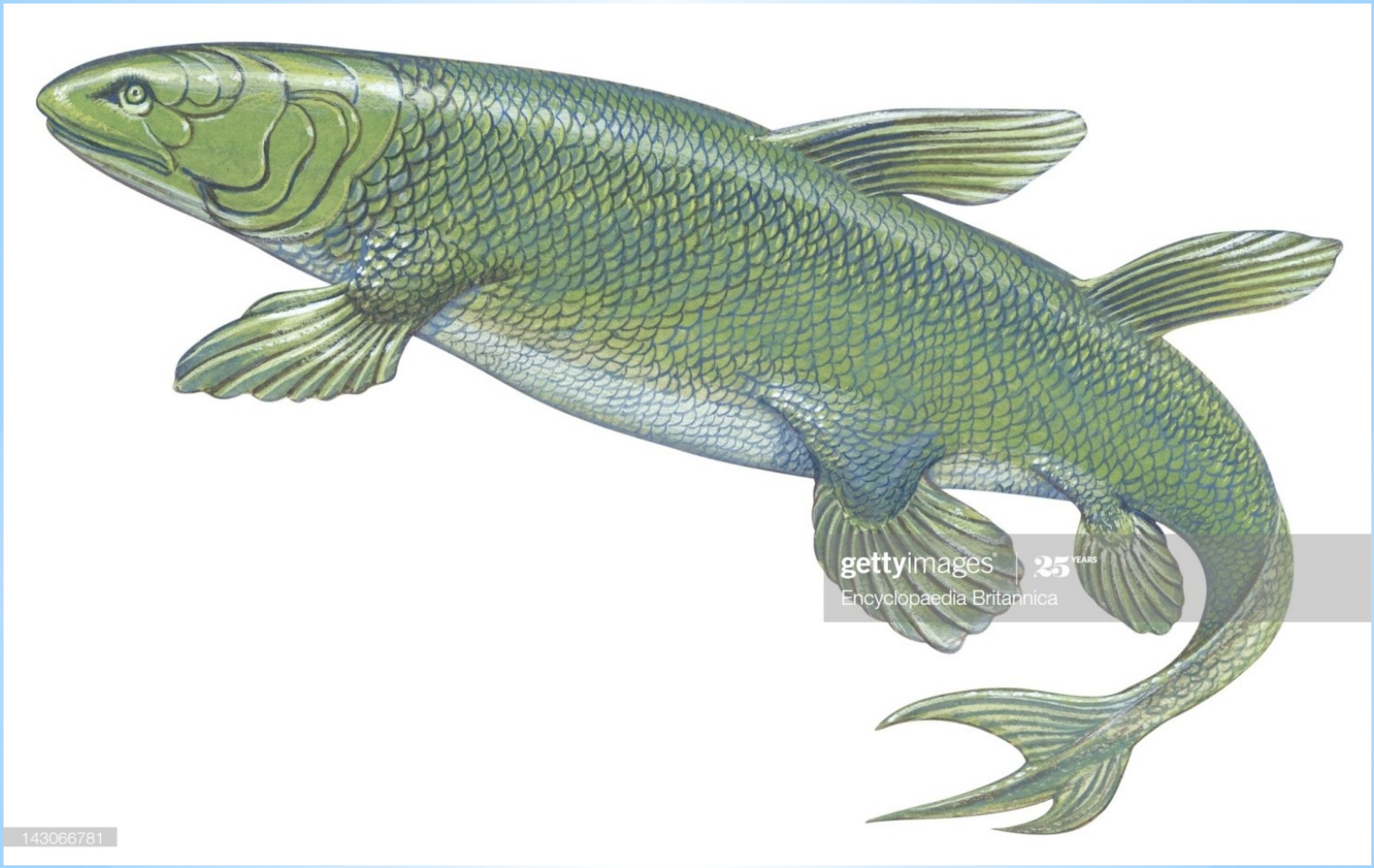
- Number of referrals
- Investigations
- Treatment: Conservative & surgical
- Follow-up appointments

Ulna sided wrist patients unlikely to be discharged within a year of start of referral.
27% likely to require surgery Ref: Dean, BJF et al, Rheum. Advances in practice 7 July 2020

Management led by patient preference & clinical experience rather than evidence based information

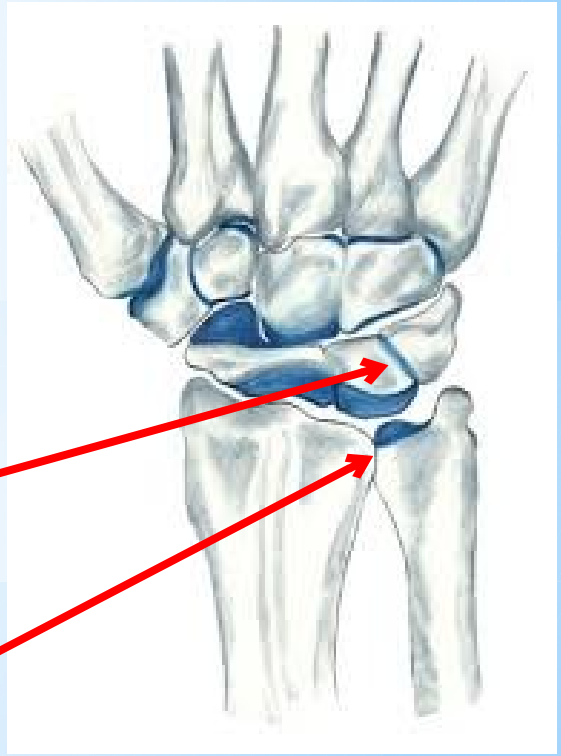
Ref: Robba et al. JHS(Eur) 2019

Crossopterygia: Primitive lobe-finned fish



*Ulnar Side of the Wrist

2 main areas:
Lunotriquetral Joint (LT)
Distal Radioulnar Joint (DRUJ)



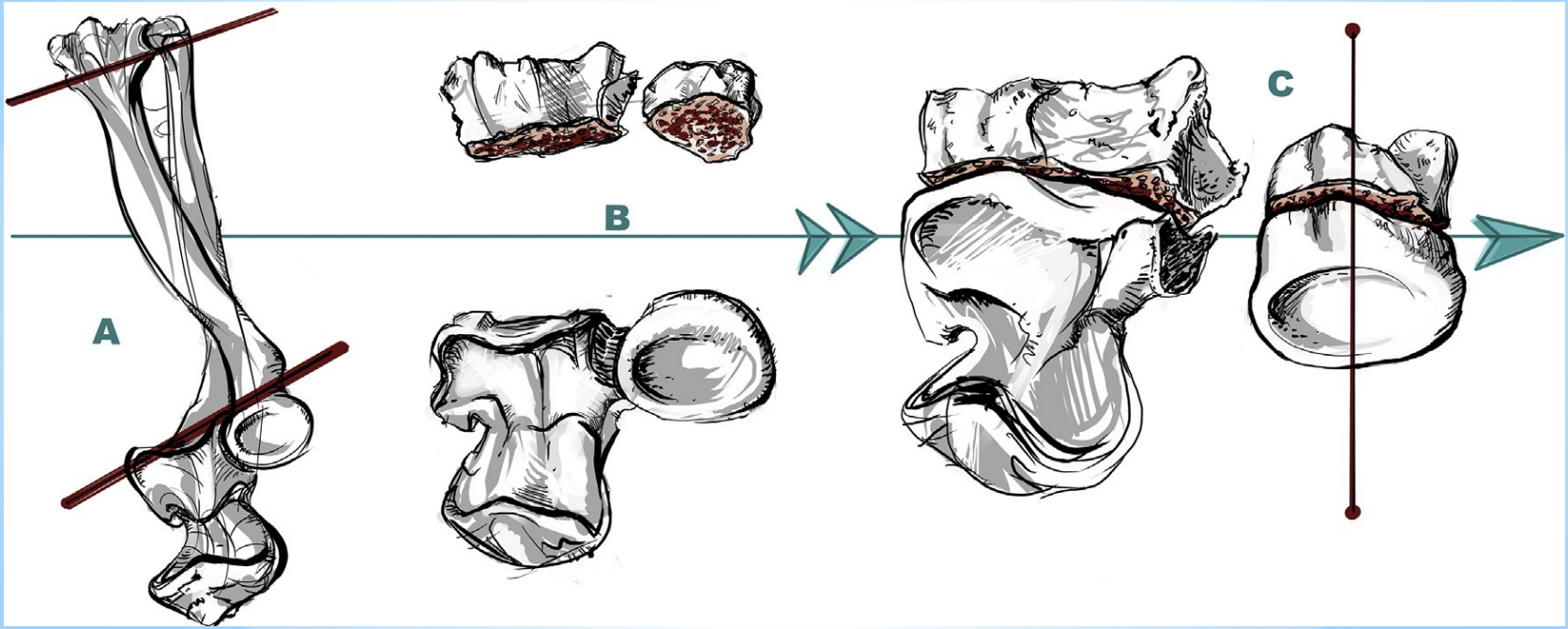
Lunotriquetral Joint

Distal Radioulnar Joint

* Radioulnar Joints

Asymmetrical; Bi-condylar joint

2 convex articulations
2 concave articulations



112 E. Altman / Journal of Hand Therapy 29 (2016) 111e122

*Distal Radioulnar Joint

Anatomy:

Trochoid joint

Formed by:

Concave Sigmoid notch of Distal Radius

Convex seat of Ulnar Head

3 Planes of movement:

Longitudinal

AP-PA translation Rotation

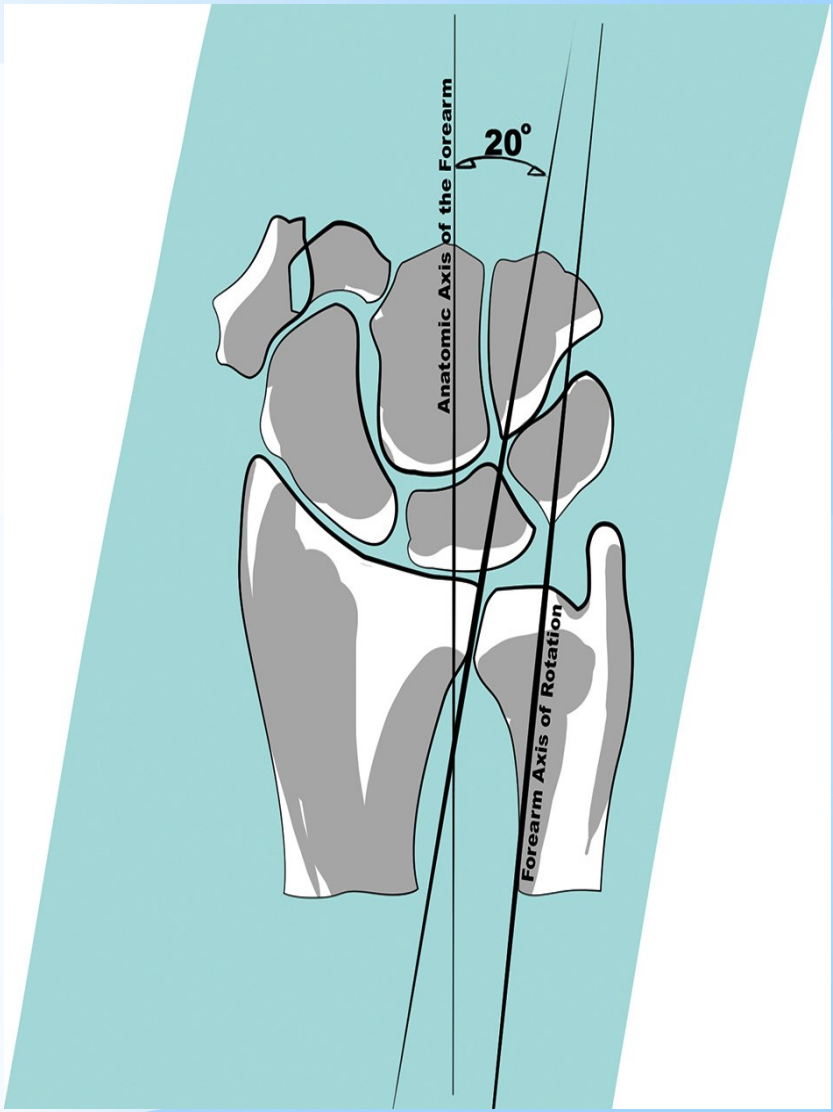
Axis of Rotation:

Centre of Radial Head

Fovea origin Ulna Head:

Supination – Proximal palmar

Pronation - Distal Dorsal



*Biomechanics of DRU Joint

TENSEGRITY:

"Synergy of tension & compression forces. Tension and compression are inseparable and coordinate functions of structural systems…{that} are mechanically stable not because of strength of individual members but because of the way the entire structure distributes and balances mechanical stresses"

Hagert,E; Hagert,CG Understanding stability of the distal radioulnar joint through the understanding of its anatomy. *Hand Clinic* 2010;26:459-466

*Distal Radioulnar Joint

Osseous: Sigmoid notch ; Distal Radius; Ulna; Ulnar Carpus

Soft Tissue:

Triangular Fibrocartilage Complex (TFCC) includes:

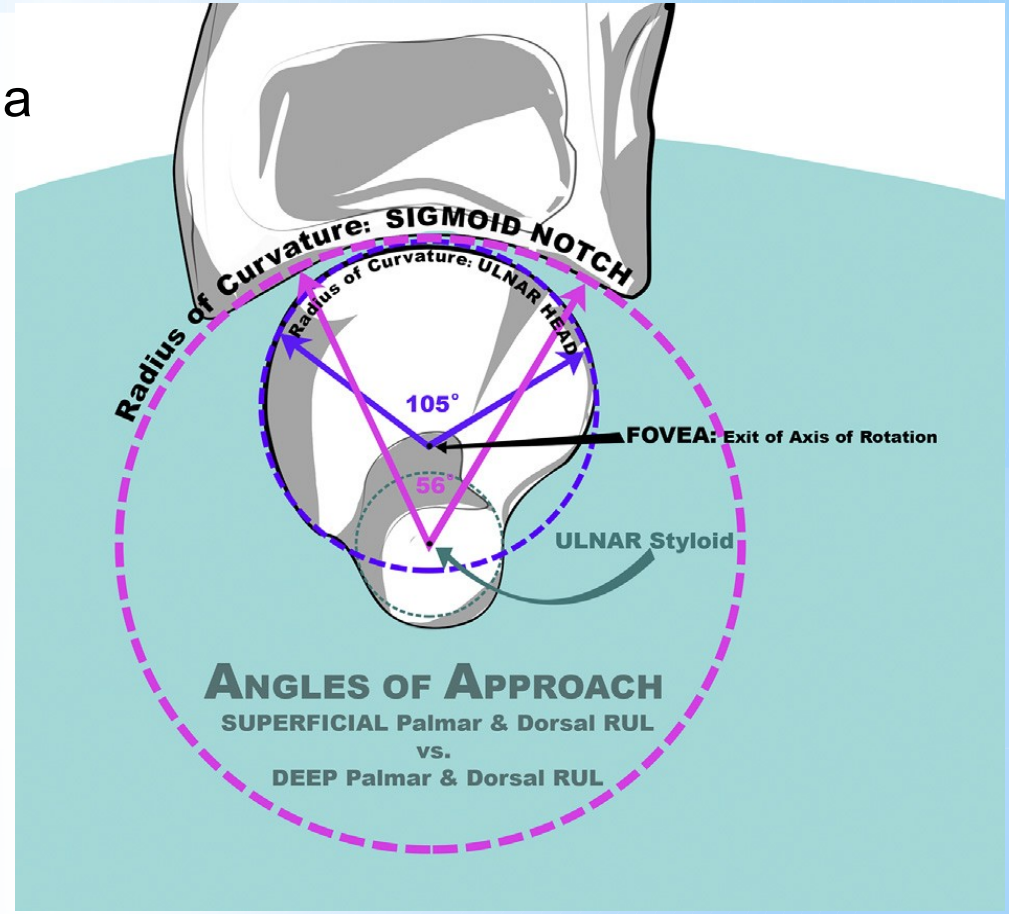
1. Triangular Fibrocartilage (TFC)
2. Meniscal Homologue
3. Ulnotriquetral,Ulnolunate,Ulnocapitate ligts (Ulno-carpal ligament complex)
4. ECU & sub-sheath
5. Dorsal & Palmar Radioulnar ligaments (DRUL & PRUL)
6. Pronator Quadratus (PQ)
7. Interosseous membrane (IOM): Distal (DIOM) Distal Oblique Bundle (DOB)
8. Capsule

*Distal Radioulnar Joint

Sigmoid Notch:
Radius curve **TWICE** as big as Ulna Head.

Ulna Styloid:
Insertion for **SUPERFICIAL** fibres of DRU & PRU ligaments

Ulna Fovea:
Well vascularized.
Insertion for **DEEP** fibres of DRU & PRU ligaments



Triangularfibrocartilagenous Complex

“Iceberg Concept”

Tip: Distal component
Submerged: Proximal component

DISTAL component:

* UCLC
* Superficial DRU ligaments.
* Disc (Triangular Fibrocartilage – TFC).

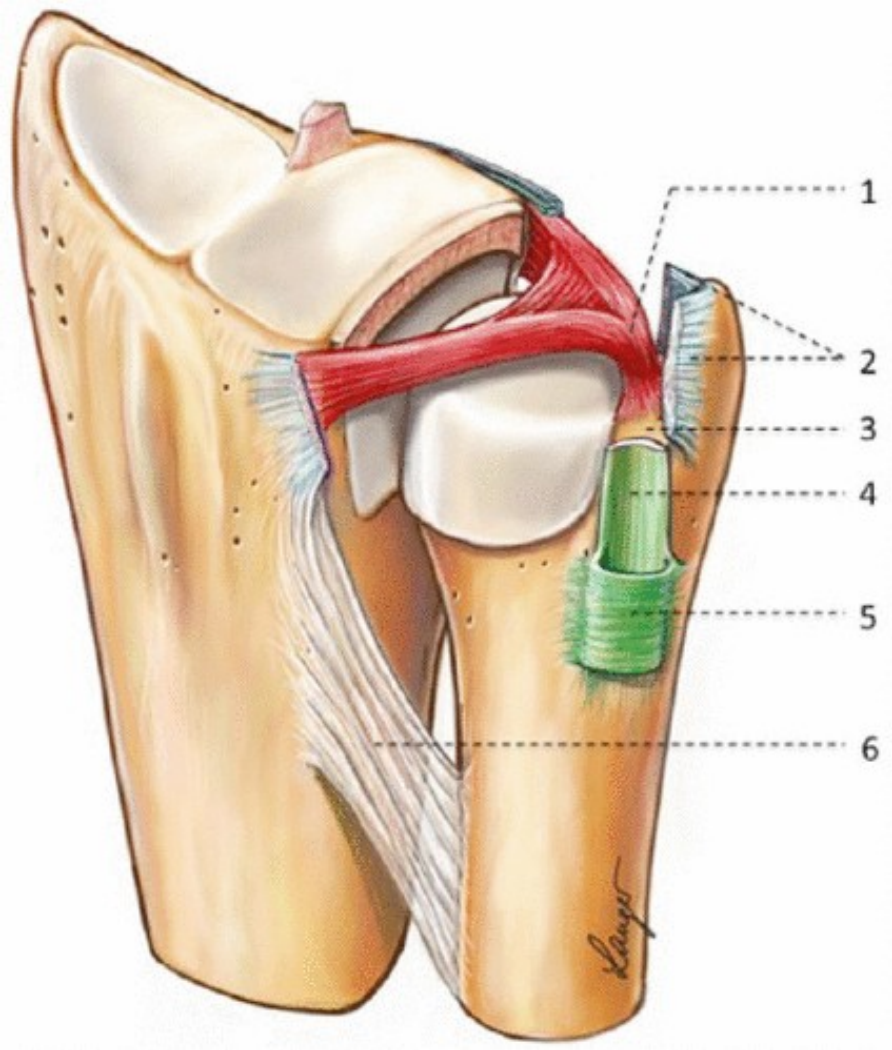
Function: Suspend Ulnar carpus; Shock absorber; Load transmission

PROXIMAL component:

* Deep ligament

Function: Stabilizer of DRUJ & Ulnar carpus

* Soft Tissue Structures - Dorsal



1. Attachment of Deep Fibres of RUL

2.Attachment of Superficial fibres of RUL

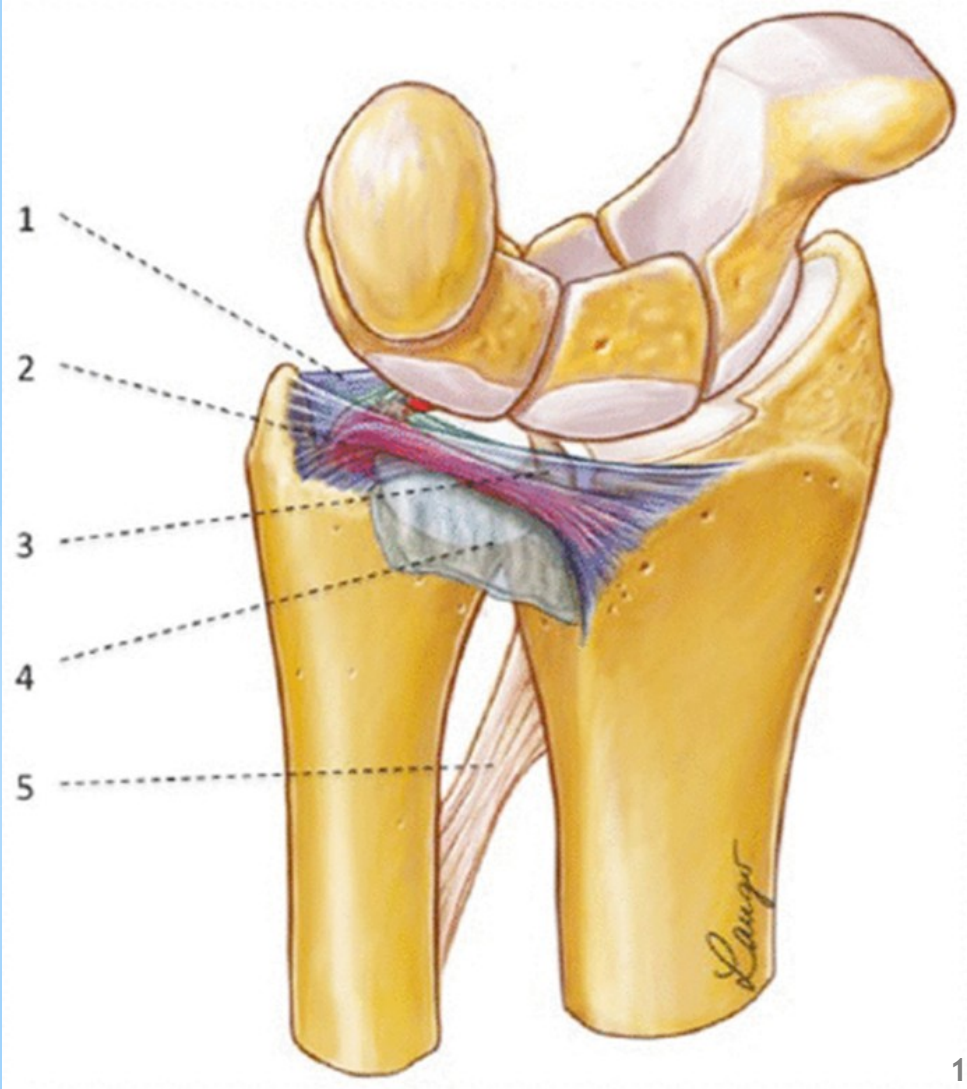
3. Pre-styloid area of Fovea

4. ECU tendon sheath & periosteum

5. Extensor retinaculum of ECU

6. Distal Oblique Bundle of IOM

* Soft Tissue Structures - Palmar



1. Dorsal Radioulnar ligament
2. Attachment of DEEP fibres
3. Palmar Radioulnar ligament
4. Palmar capsule of DRU joint
5. Distal Oblique Bundle

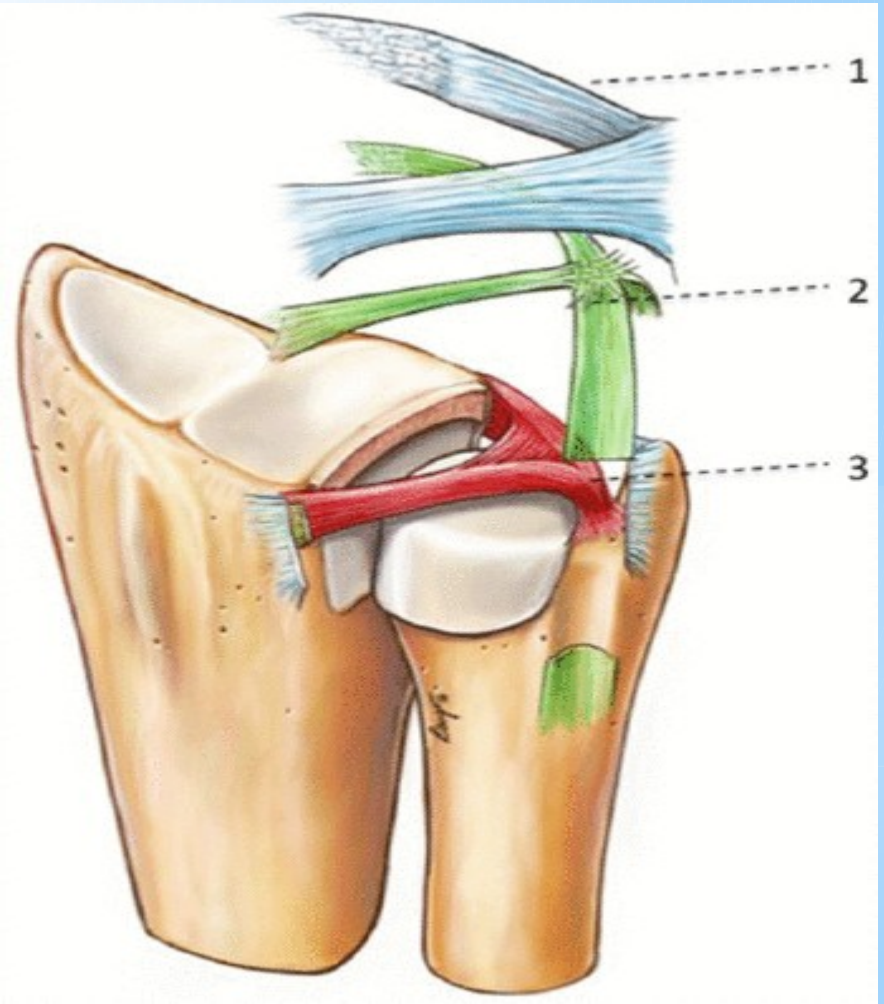
*TFCC: Radioulnar Ligaments

3 layers of TFCC:

1st Dorsal and Palmar Radioulnar ligaments (Superficial fibres)

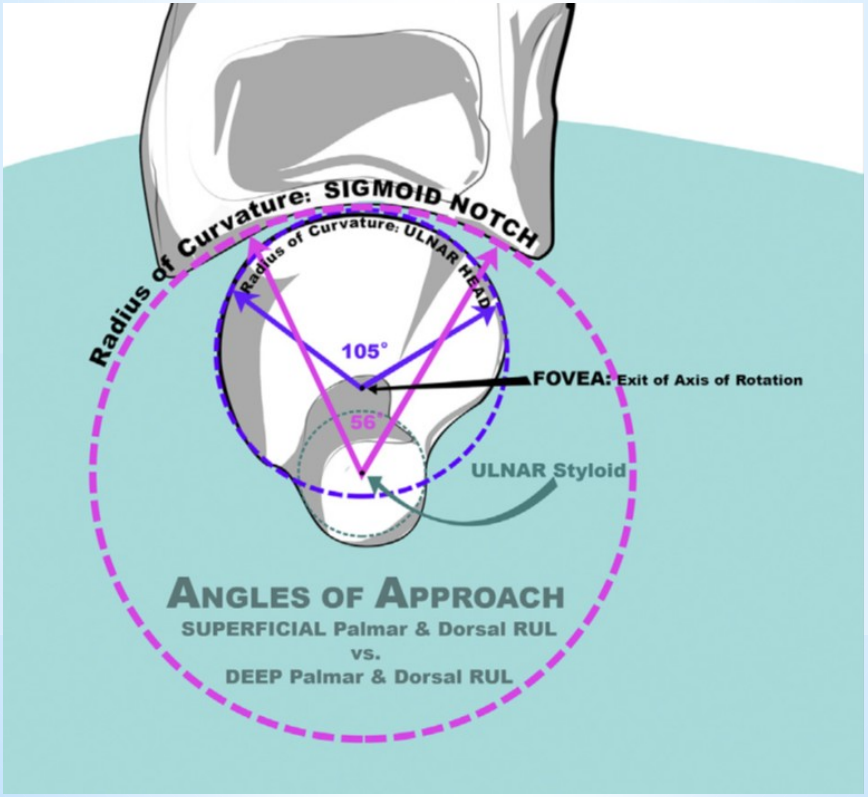
2nd Radio-palmar fibres to the periosteum & ECU tendon sheath
Radio-dorsal fibres to the palmar area of the ulna styloid

3rd The deep fibre system



* Paradox of Al Ekenstam & Schuind

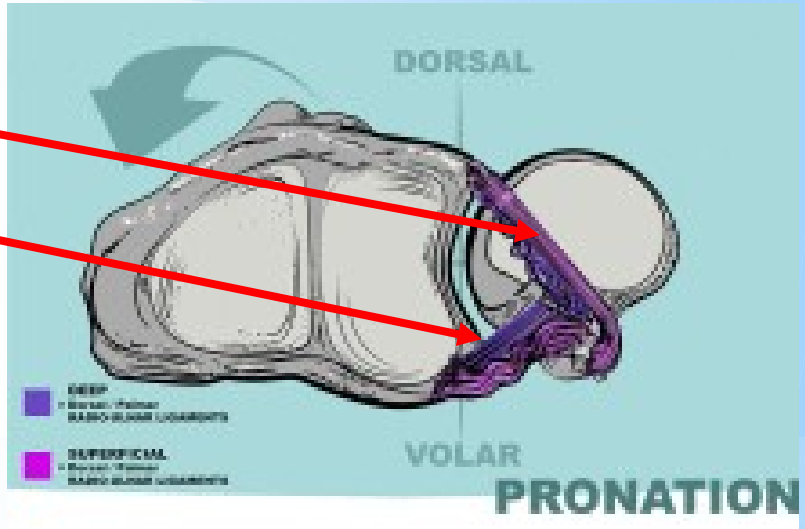
Which part of the Distal Radioulnar Ligament Stabilises the Joint?



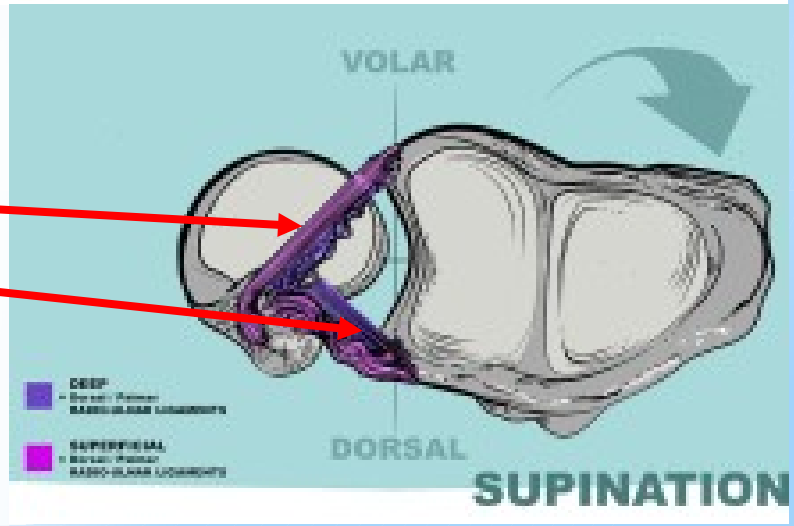
Altman,E et al (2016) *JHT*
Haugdtvedt et al (2017) JHS

* Pronated & Supinated DRU Joint

PRONATION:
DORSAL superficial fibres
PALMAR deep fibres
tighten.



SUPINATION:
PALMAR superficial fibres
DORSAL deep fibres
tighten.

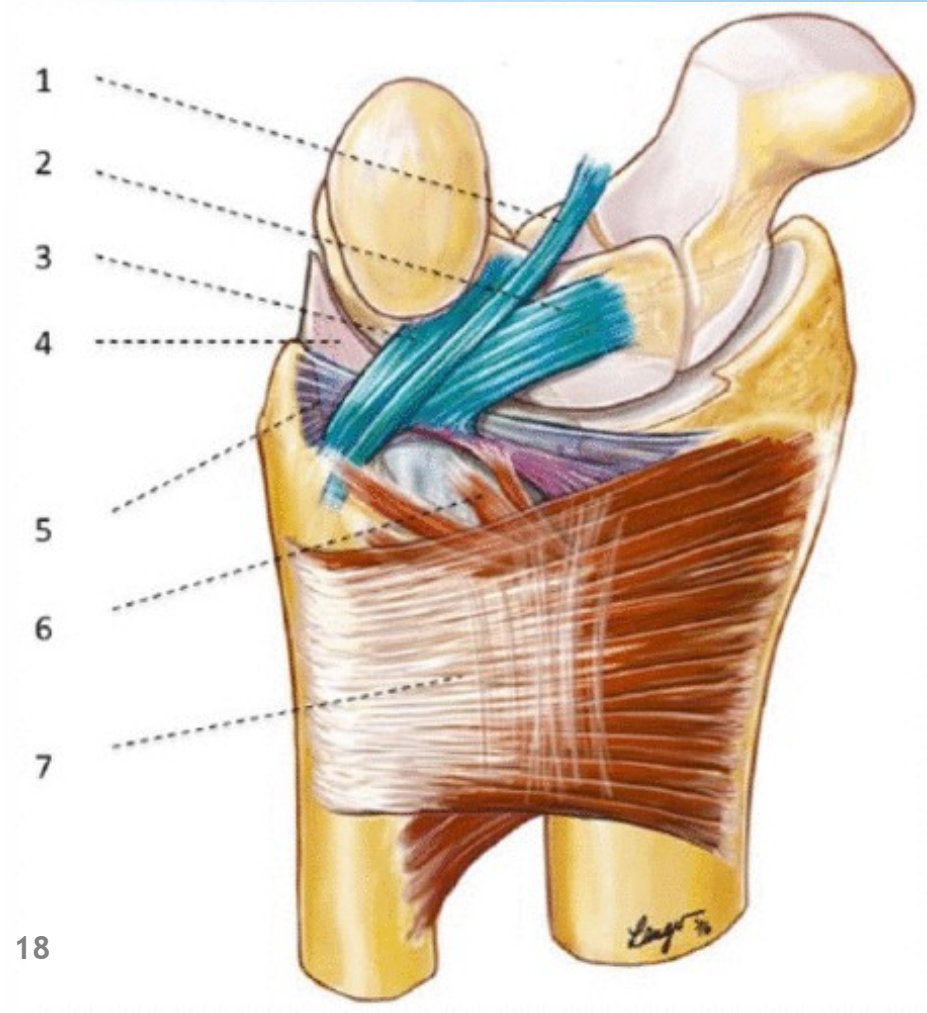


*Ulno-carpal ligt Complex (UCUL)

1. Ulnocapitate Ligament
2. Ulnolunate Ligament
3. Ulnotriquetral ligament

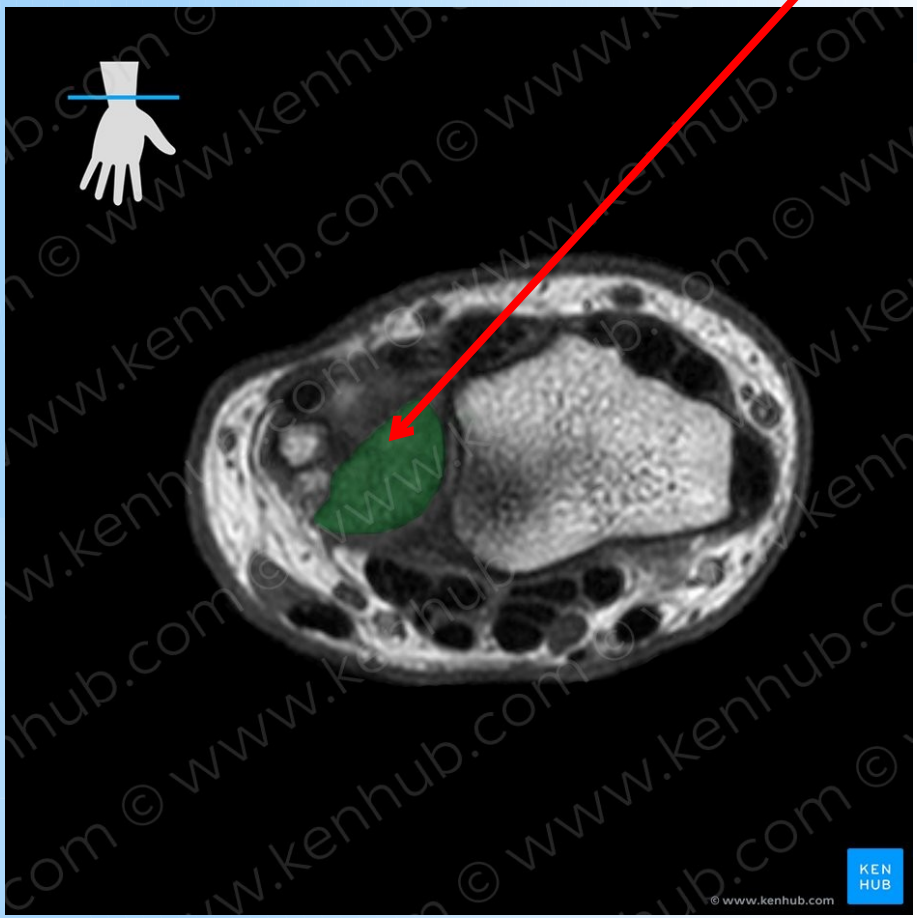
FUNCTION:

- Suspends ulnar carpus
- Shock absorber
- Transmits load



4. TFC
5. Proximal Radioulnar Ligament
6. Deep part of PQ
7. Superficial part of PQ

* TFC



- Fibrocartilage
- Vascular on ulnar aspect, otherwise avascular

Palmar Classification:

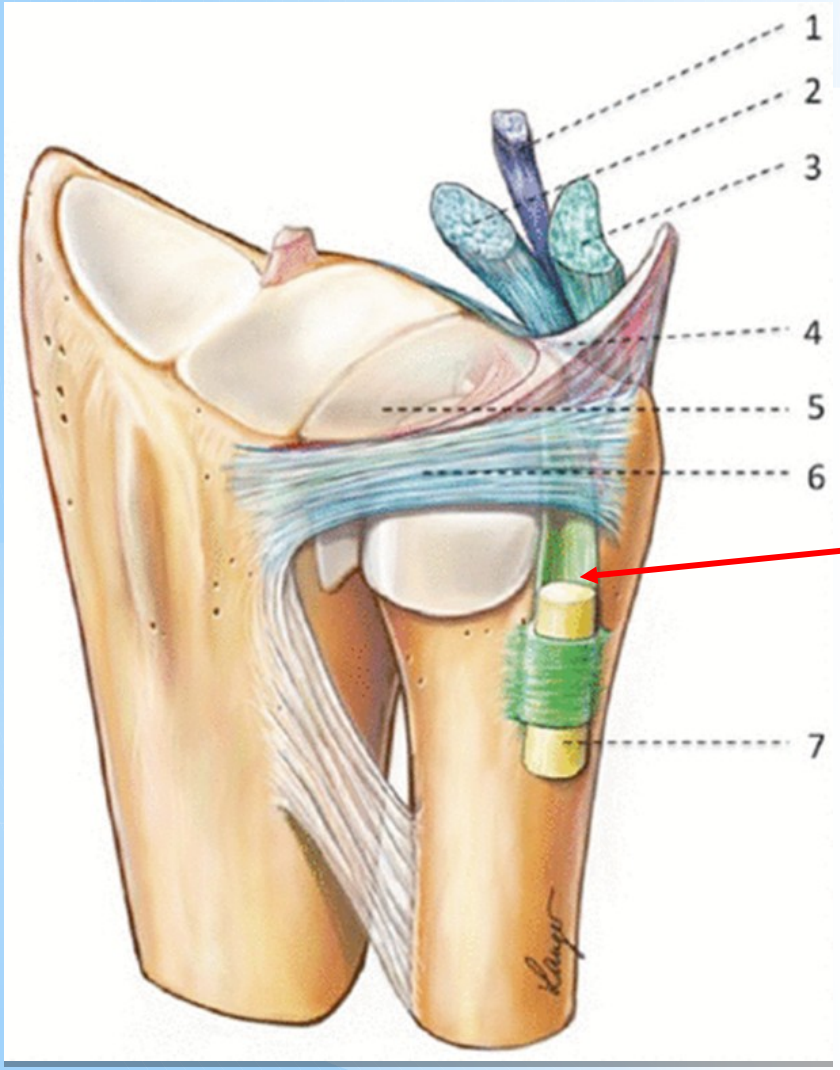
Class 1 Traumatic

Class 2 Degenerative

*Palmar Classification

Type		Where?	Stable/ Unstable	Treatment
1A	Avascular	Central disc (TFC)	Stable	Debride
1B	Vascular	Ulnar attachement TFC	Stable	Repair
1C		Ulnatriquetral/Ulnalunate ligaments detached	**Unstable**	Reattach
1D	Avascular	Radial attachement (TFC)	**Stable?**	Reattach/Debride
2A		Perforation		Conservative
2B		2A + chondromalacia		Conservative
2C		Full thickness perforation		Conservative
2D		2a,b,c with Lunotriquetral Interosseous ligament tear		Ulna shortening
2E		2D + arthritis		Joint replacement

*ECU & ECU Sub-sheath



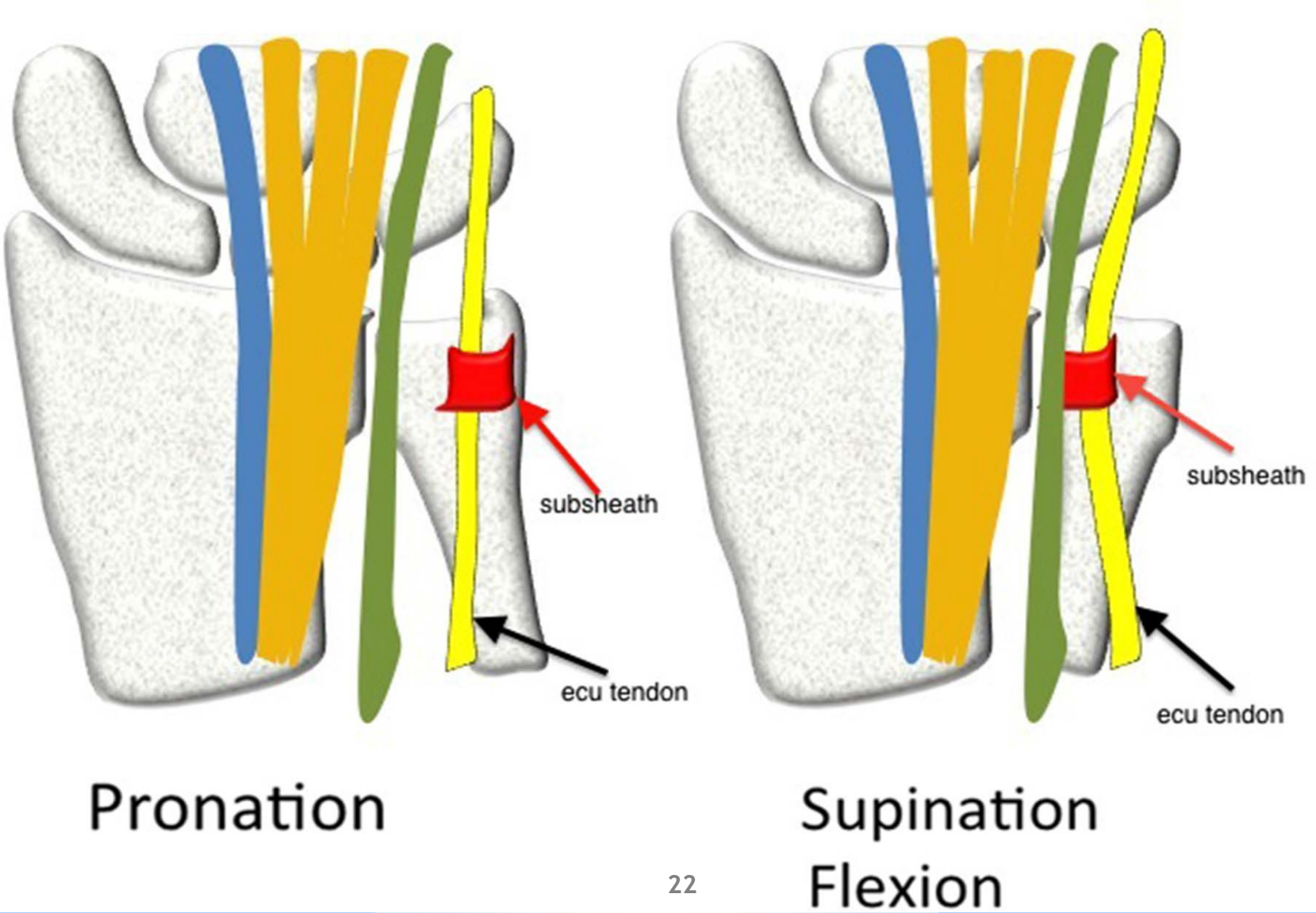
1,2,3 UCLC complex
4. Meniscus Homologue
5. TFC
6. Dorsal Radioulnar ligaments

ECU sheath – Stabilizes DRU joint in neutral rotation.

7.ECU Tendon

FUNCTION:
Dynamic stabilizer in supination & forearm rotation.

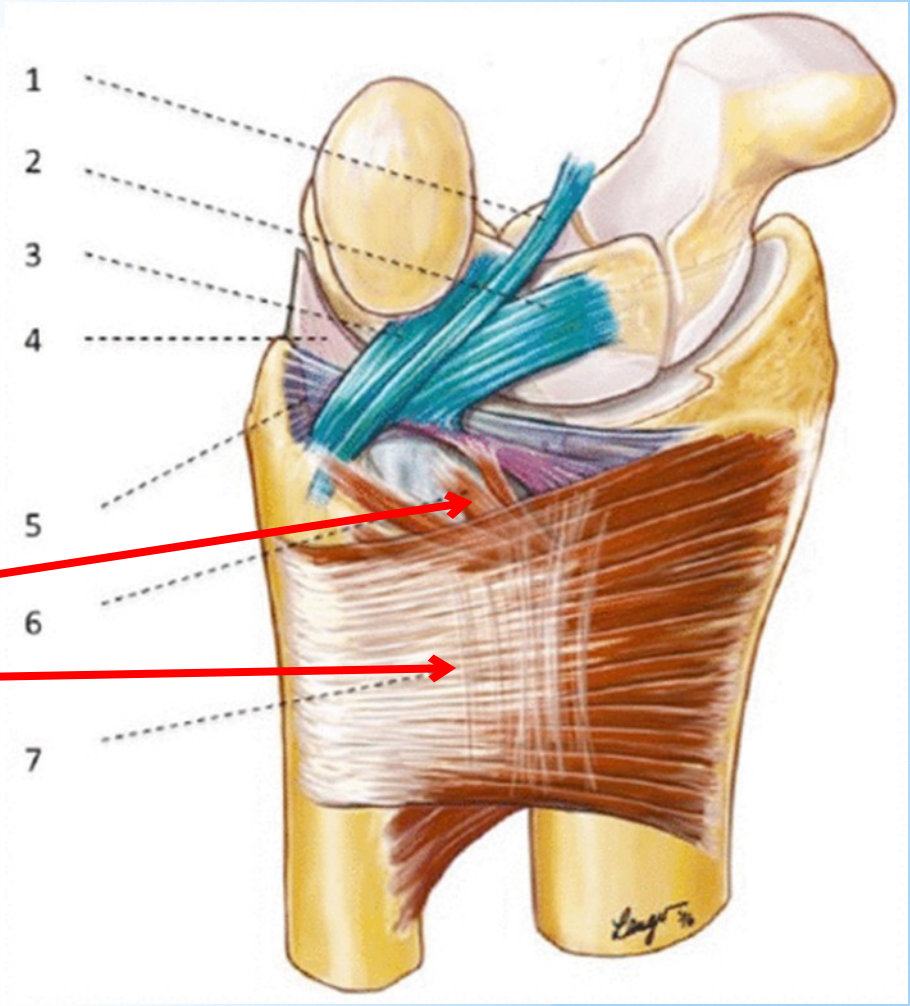
Position of ECU exiting Sub-Sheath



*ECU Sub-Sheath Tension

*Pronator Quadratus

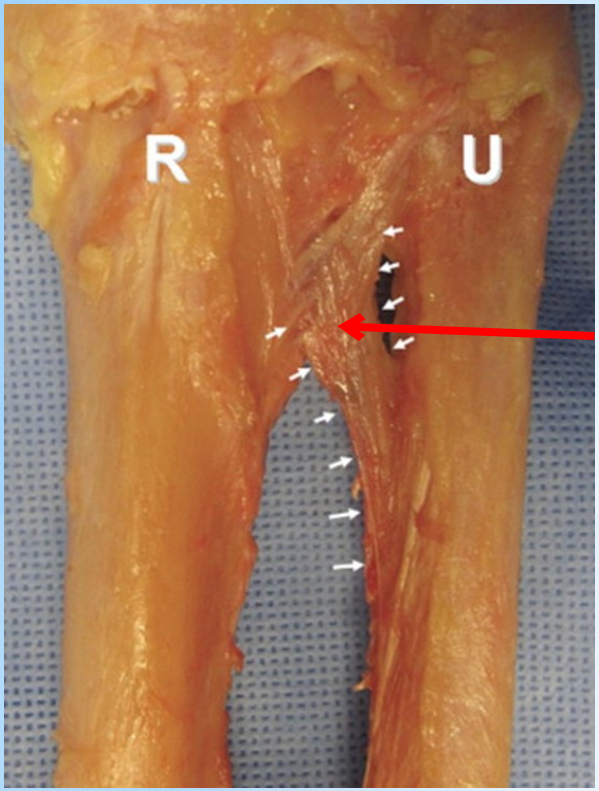
1.Ulnocapitate Ligament
2.Ulnolunate Ligament
3. Ulnotriquetral ligament
4. TFC
5. PRU ligts.



Pronator Quadratus:
6. Deep Head
7. Superficial Head

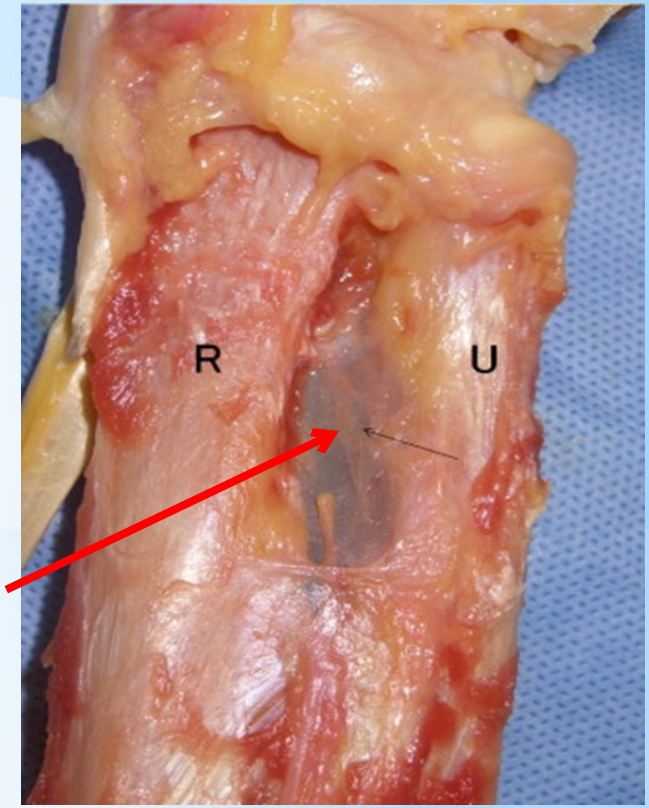
FUNCTION:
Dynamic stabilizer

*Interosseous Membrane



Distal oblique bundle (**DOB)**

Thin Distal Interosseous membrane **(DIOM)**
No DOB



Origin: Oblique from Ulna distally to Radius proximally.

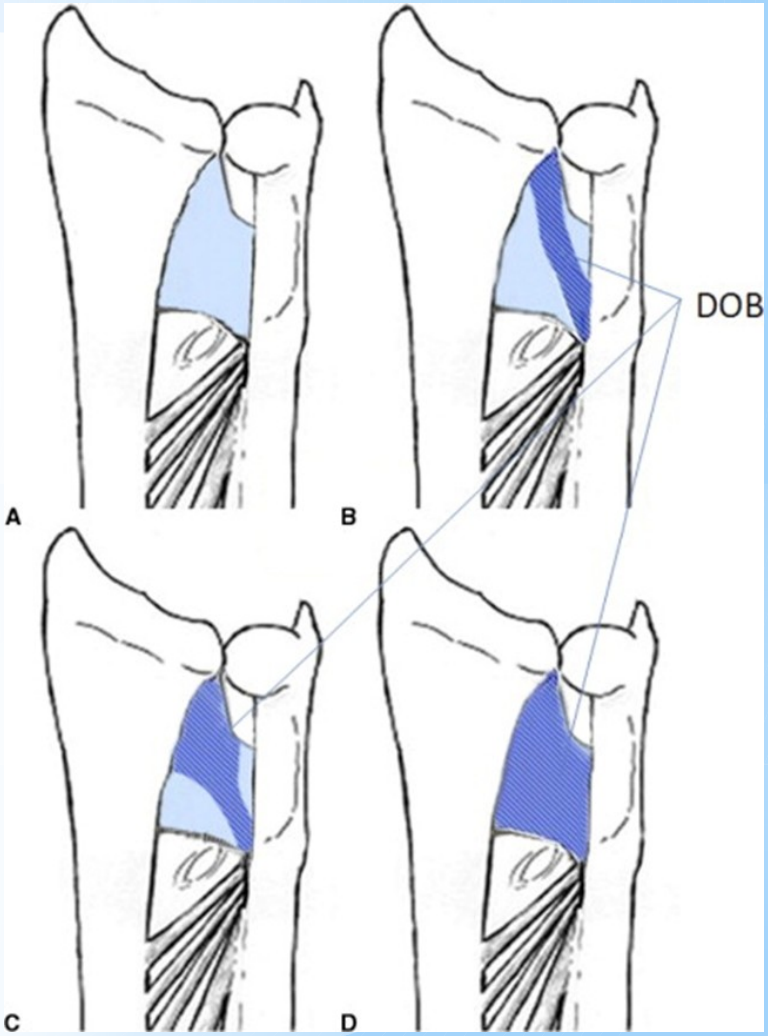
Radioulnar ligaments & Interosseous membrane known as the
INTERGRATED OSSEOLIGAMENTOUS SYSTEM

Function of Interosseous membrane:

- Transmits load from Radius distally to Ulna proximally
- Stabilizes DRU joint

Only 40% of patients will have a Distal Oblique Bundle (**DOB**)

*VARIATION OF DIOM



DIOM:

2° stabilizer of DRUJ if RU ligaments injured.

DOB:

Stabilizer in neutral rotation: provides volar and dorsal stability.

ISOMETRIC ACTION.

*Summary of Biomechanics

What happens when soft tissues are injured?

Does wrist position alter stability ?

	Neutral	Extension	Radial Deviation
Normal	7 mm	**5 mm**	**5 mm**
ECU cut	20 mm	21 mm	21 mm
Radioulnar ligaments injured	14 mm	12 mm	**10 mm**
Ulnocarpal ligament complex injured	7 mm	7 mm	6 mm

*Summary of Biomechanics

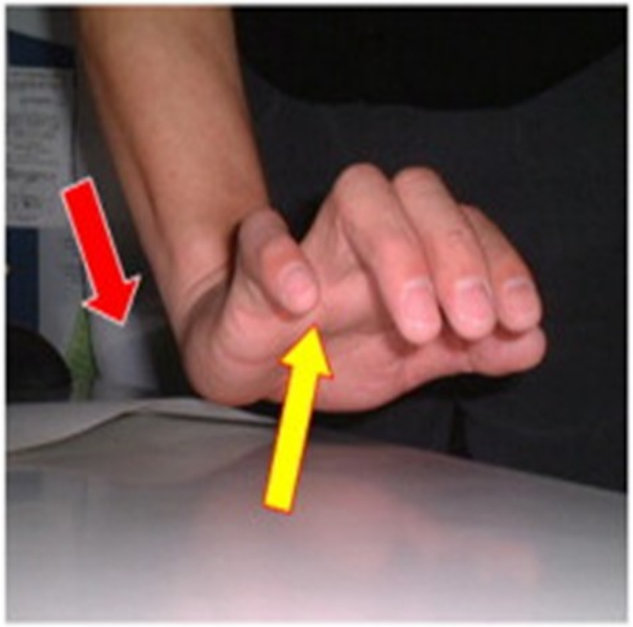
NORMAL DRU Joint:

40N Force Applied	Neutral Position	Supinated Position	Pronated Position
Translation	7 mm	**5 mm**	6 mm

TFCC & DOB injured ?

	Dorsal	Palmar
Normal	3 mm	4 mm
TFCC injured	10 mm	5 mm
Distal Oblique Bundle injured	23 mm	17 mm

*Patho-mechanics of a fall



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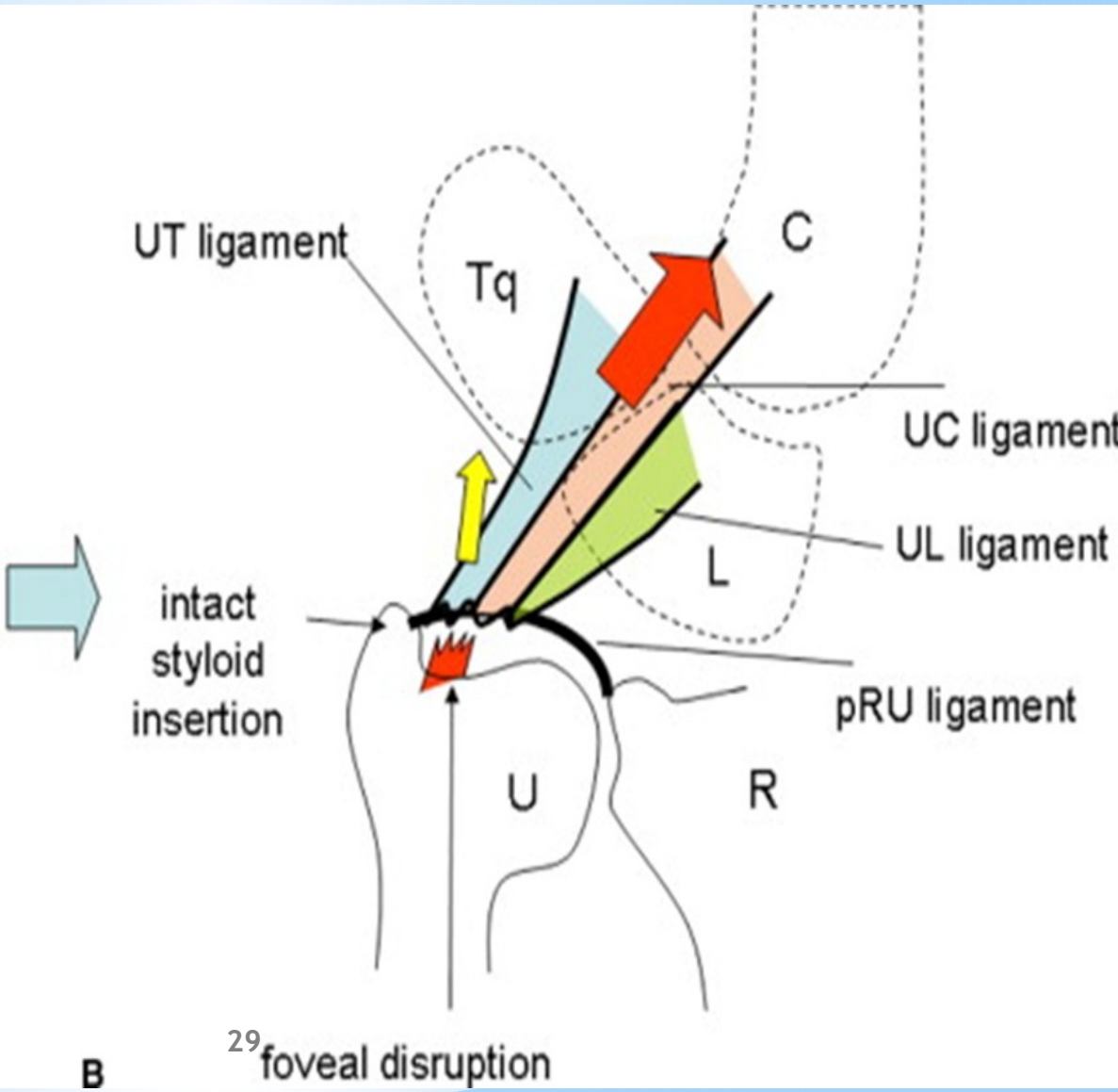


B

*ECU and a fall…..

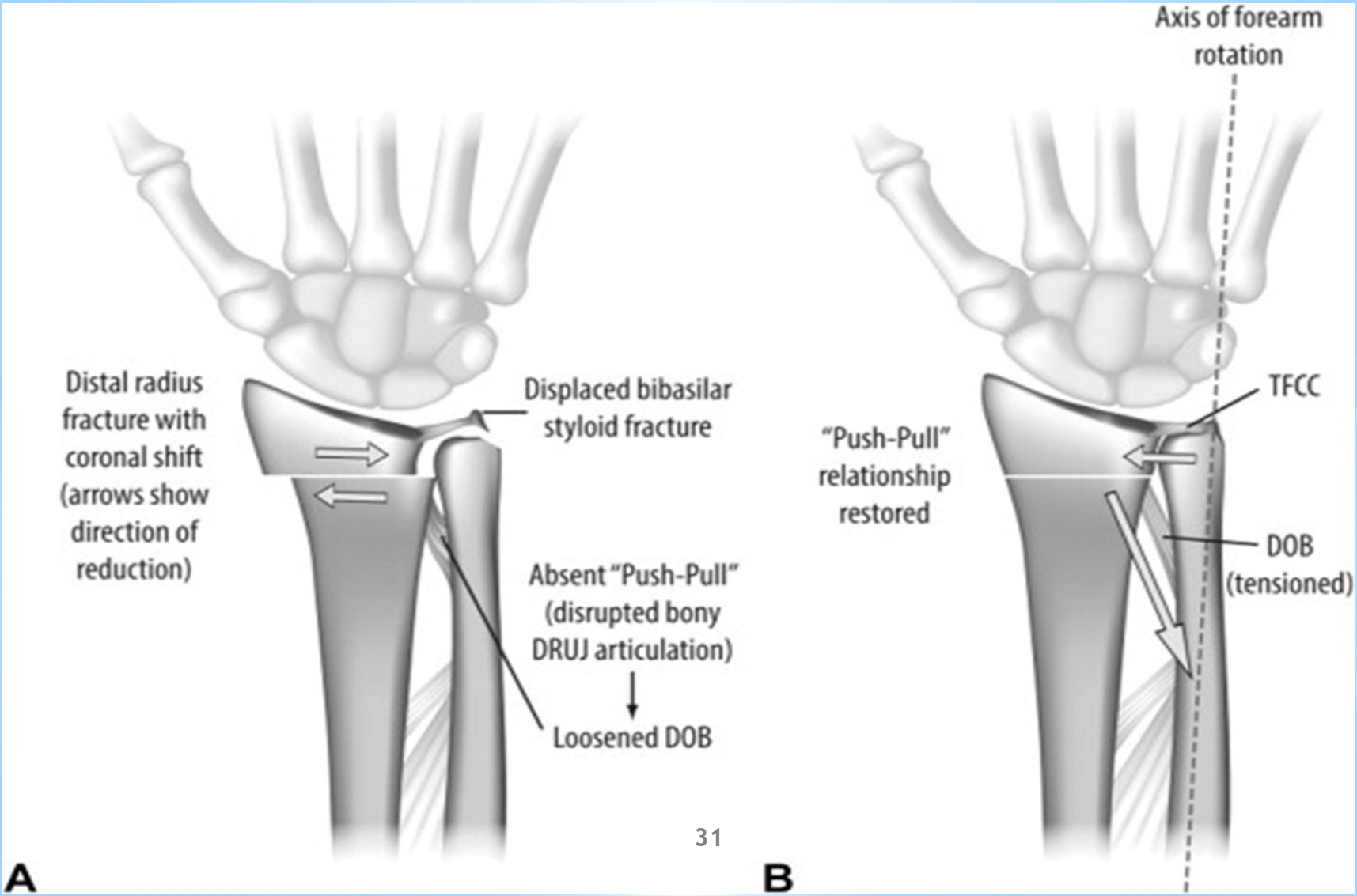
Activity: Fall onto the hand

1. Muscle activity increases suddenly
2. Shock waves transmit distal to proximal up towards the shoulder
3. ECU & FCU work to reduce the strength of the shock waves

Heavy load: Shock waves increase
Bone # more likely

Less load: Shock waves increase
Soft tissue injury likely

*# Distal Radius & Instability



*Special Tests & Diagnosis!

Can't see the wood for the trees……

*Lots……..

1. DRUJ Ballottement test
2. DRU joint compression
3. Dynamic Instability test
4. TFCC Stress test
5. TFCC Compression test
6. Press test
7. Ulna Fovea test
8. ECU Synergy test
9. Ice Cream “scoop”
10. LTIL fovea test
11. Shuck Test (TFCC toggle)
12. Supinated Test
13. Piano Key
14. Grind test etc…….!!!!!!!!

*Key tests???

1. Modified Ballottement
2. Shuck (Toggle) test
3. Ulna Fovea
4. TFCC Compression test
5. Grind test

6. ECU Synergy test
7. Cobra test

8. LTIL Fovea

- **MODIFIED BALLOTTEMENT:** +ve Pain +/- Increased movement

Forearm pronated
Fix the radiocarpal joint
Glide the Ulna AP-PA direction
Increased glide +/- Pain: Neutral = Radioulnar ligament injury
Radial deviation = Ulnocarpal ligament injury

- **SHUCK (Toggle) TEST:** +ve Pain at extreme e.o.r +/- Increased movement

Elbow on table
Fix radiocarpal joint: Test in Neutral
Rotate forearm **Full Supination:** Increased mvt = Injury **DEEP** dorsal fibres
Full Pronation : Increased mvt = Injury **DEEP** palmar fibres

- **ULNA FOVEA: +ve Pain**
  Palpate in Ulna fovea

- **TFCC +/- compression: +ve Pain**
  Ulna deviate wrist and glide ulna +/- axial compression through UC jt.

- **GRIND TEST: +ve Pain**
  Squeeze Radius and Ulna together

- **ECU SYNERGY TEST: +ve Pain with APL resistance**
  Elbow in table
  Therapist palpates ECU tendon
  Patient tries to palmar abduct thumb against resistance

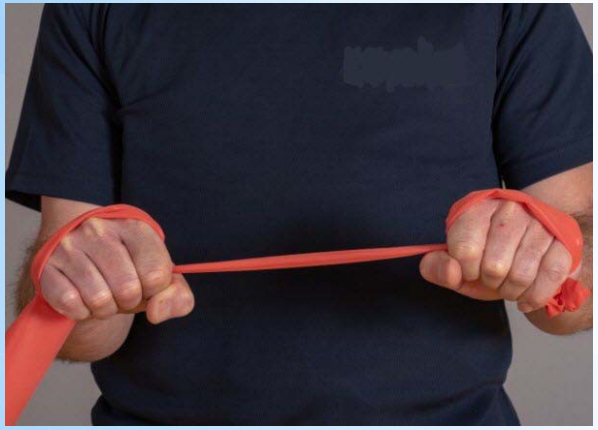
- **COBRA TEST: +ve Painful click as ECU subluxes**
  Elbow on table
  Patient flexes wrist fully
  Therapist palpates ECU tendon as patient supinates and pronates

- **LT FOVEA: +ve Pain**
  Palpate in LTIL fovea

*TREATMENT OPTIONS

Strengthening: ECU: UD & Extensor
PQ
Triceps, the Rhomboids, and the Lats

Avoid *bicep curls, push ups, pull ups, pull downs with the wrist supinated, and pectoralis (chest) strengthening*



ECU: Ulnar deviator

ECU: Extensor

NEVER USE DUMBELLS!

Wrist Widget:
https://www.wristwidget.com

Information for patients on self-management.
Stretches for cervical spine; shoulder, wrist.
Exercises for muscle imbalance in upper limb.

Information for medical professionals

Stabilizing exercise program in triangular fibrocartilage complex .

Ref: Bonhof-Jansen,EDJ; Kroon,GJ; Brink,SM; van Uchelen,JH (2019) Rehabilitation with a stabilizing exercise program in triangular fibrocartilage complex lesions with distal radioulnar joint instability: A pilot intervention study. *Hand Therapy,July 11.*
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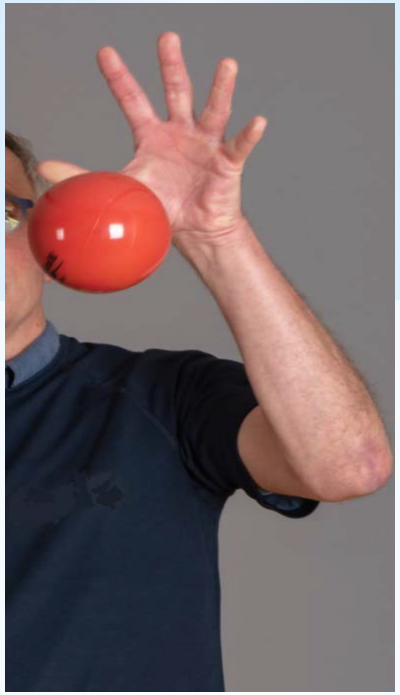
EXERCISE EXAMPLES…..

1

2

3



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5

6

THE END
THANK YOU FOR TAKING PART

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