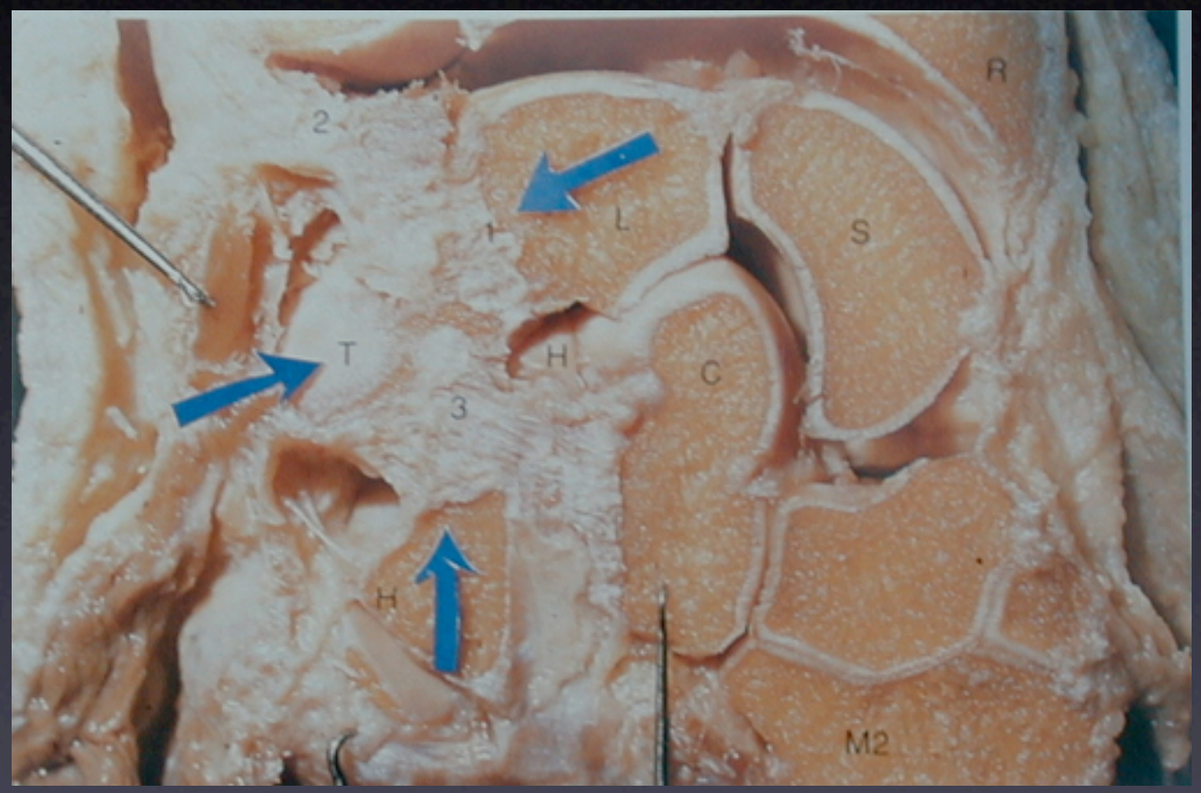
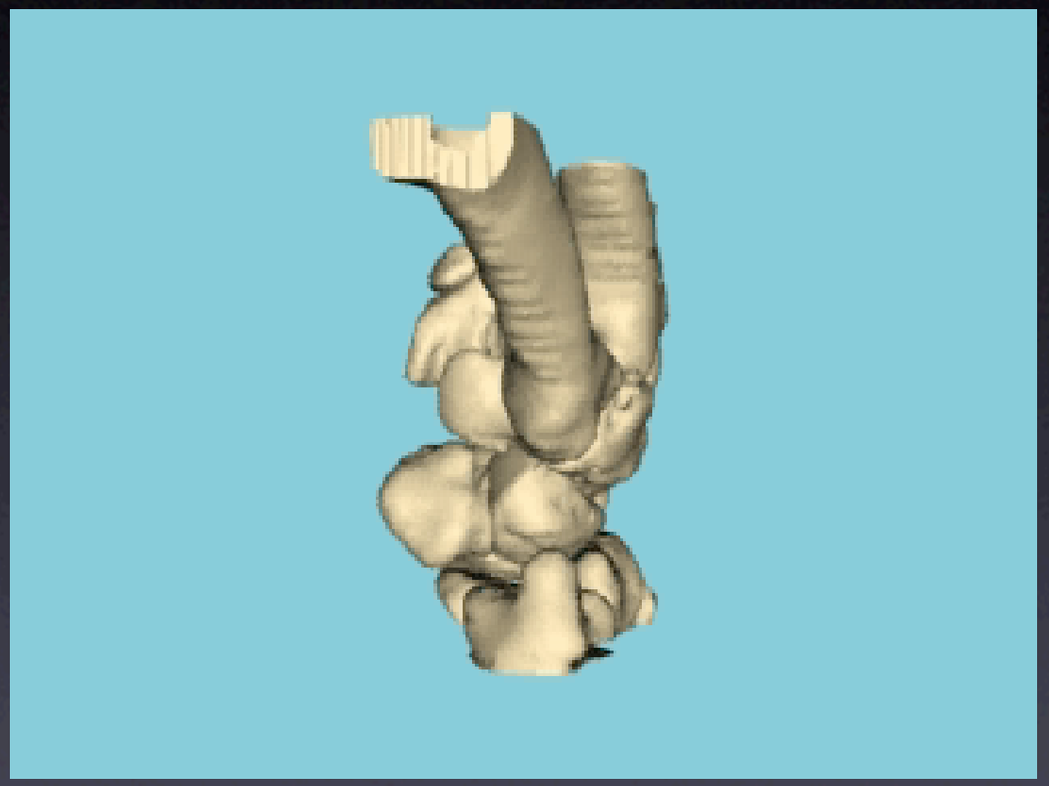
Wrist instability



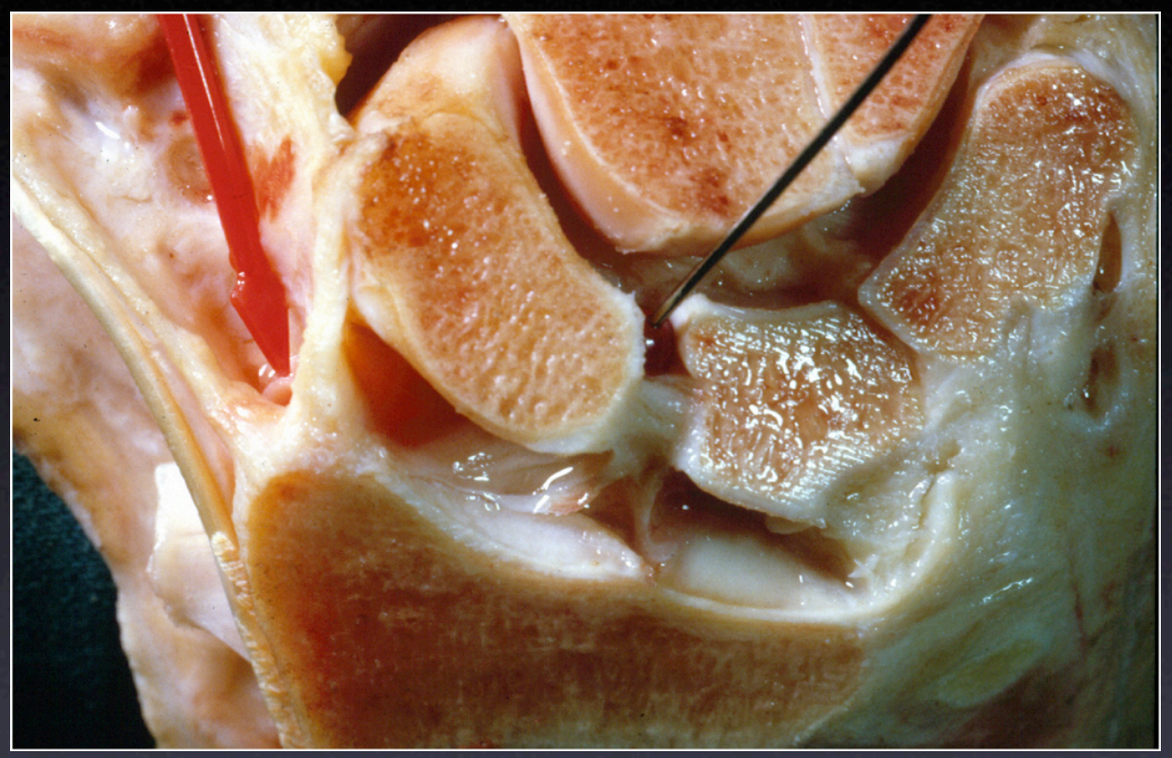


Christian Dumontier
Institut de la Main & hôpital saint-Antoine, Paris
(with courtesy of A. Pagliei & S. Kozin)

The radio-carpal joint

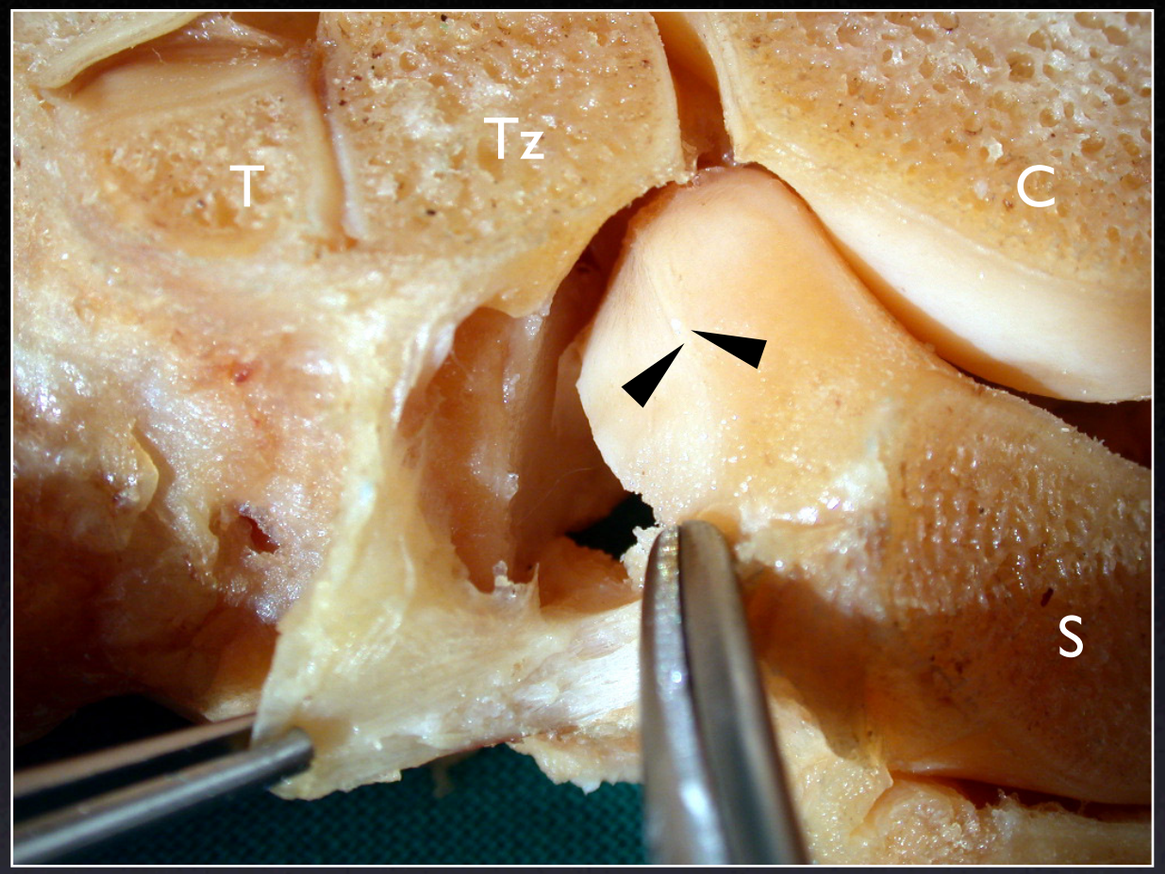
The first row

- Is devoid of any tendinous insertion
- Intercalary segment
- System with “variable” geometry

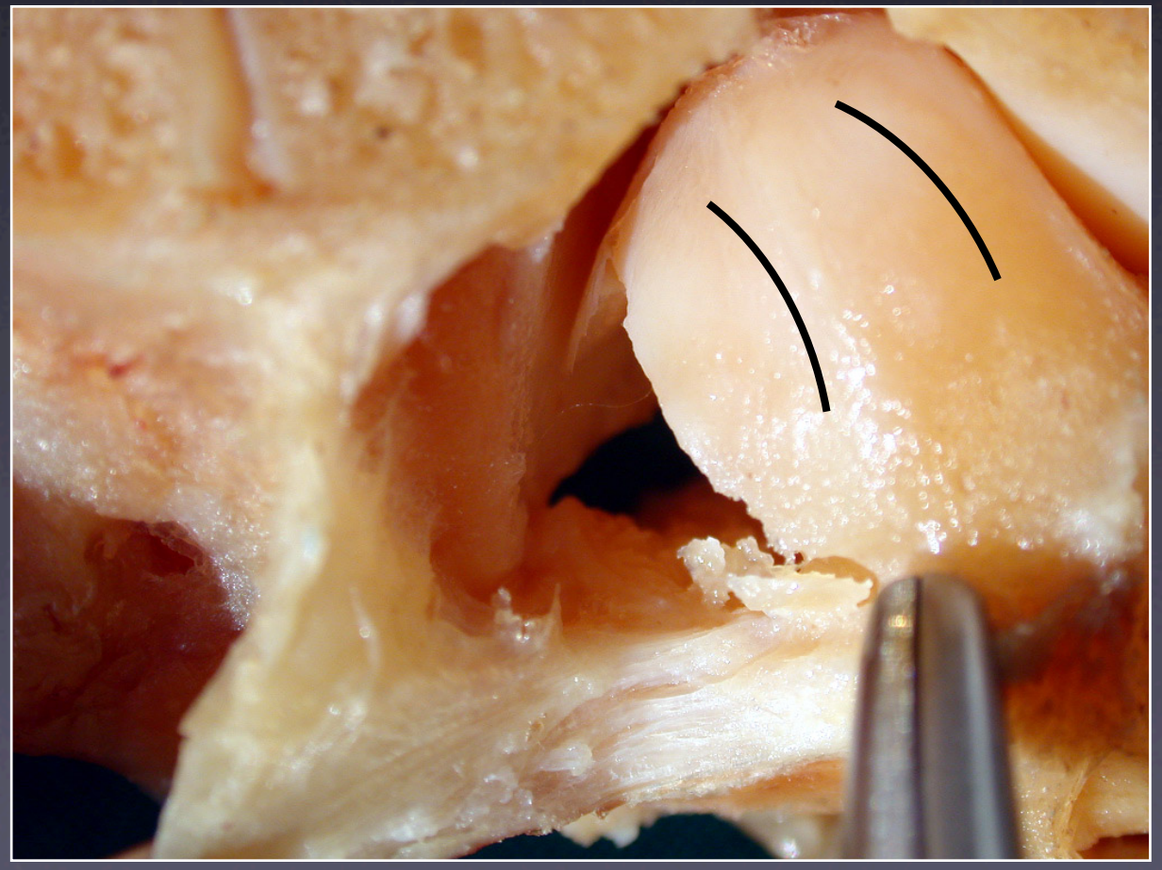


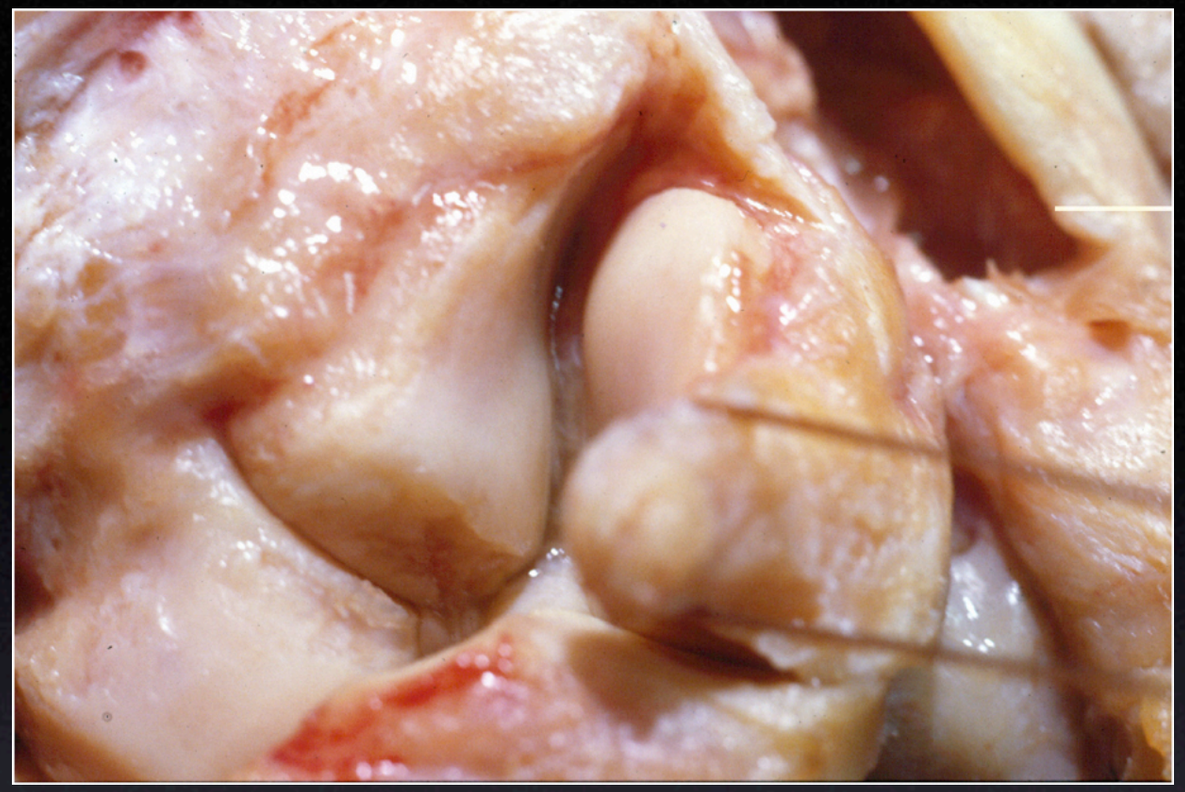
The midcarpal joint

3 different joints



- The STT joint allows for flexion/ extension of the scaphoid

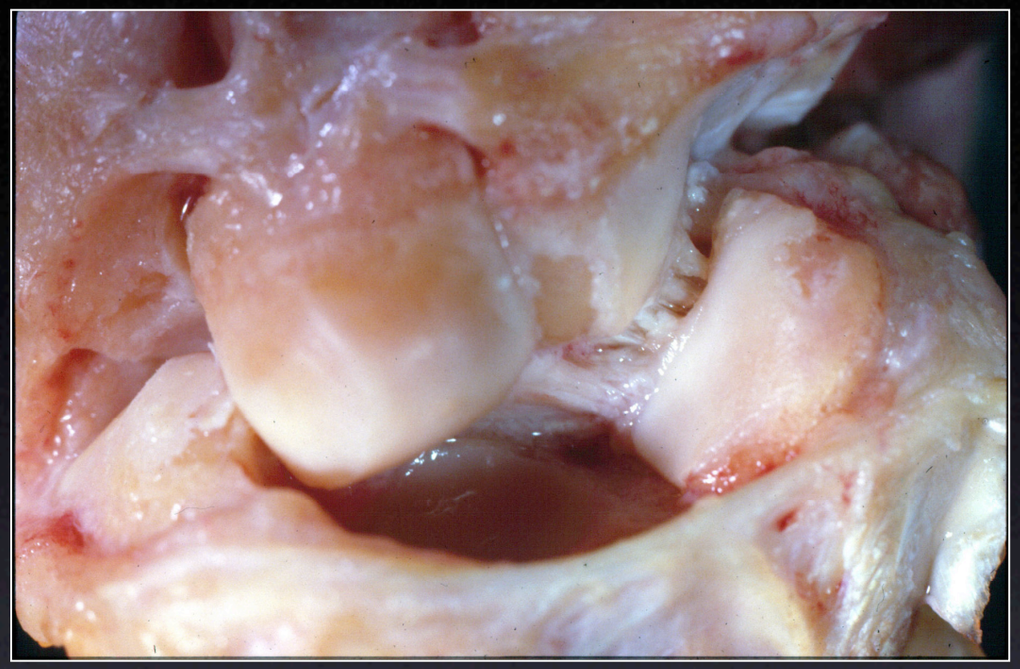




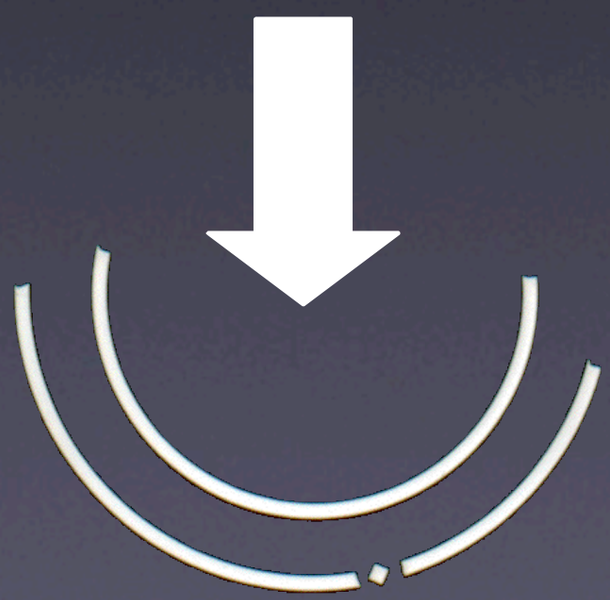
- The triquetro-hamate joint is helicoidal and allows for translation and rotation of the triquetrum on the hamate

- The capito-hamate is the central pivot of the wrist

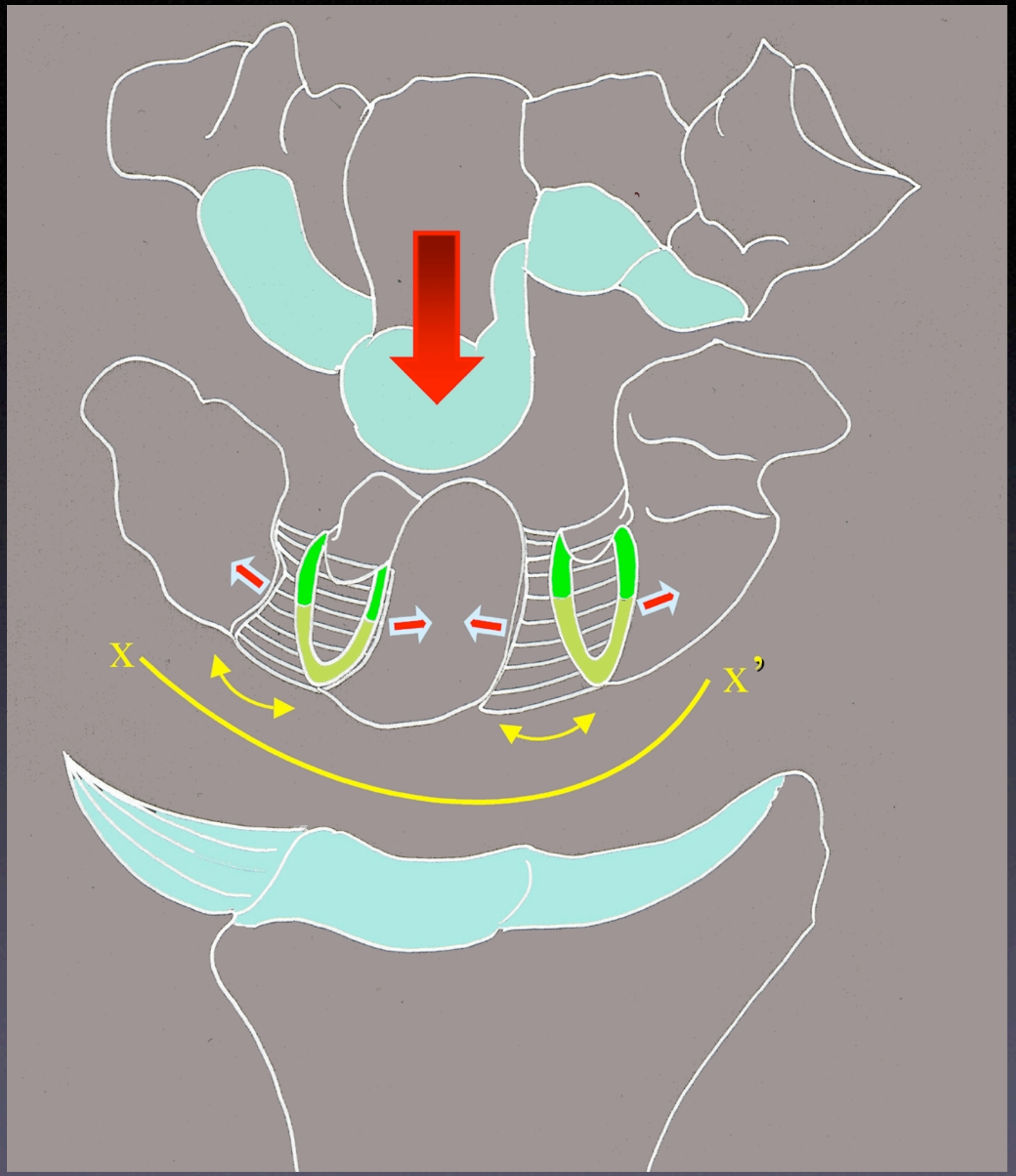
The first row forms an adaptable acetabulum



II -III



Interosseous ligaments serve as to stabilise the form of the first row



Wrist "instability"

- Ligamentous injuries
- Secondary to bony lesions (i.e. kienböck's, distal radius malunion,...)

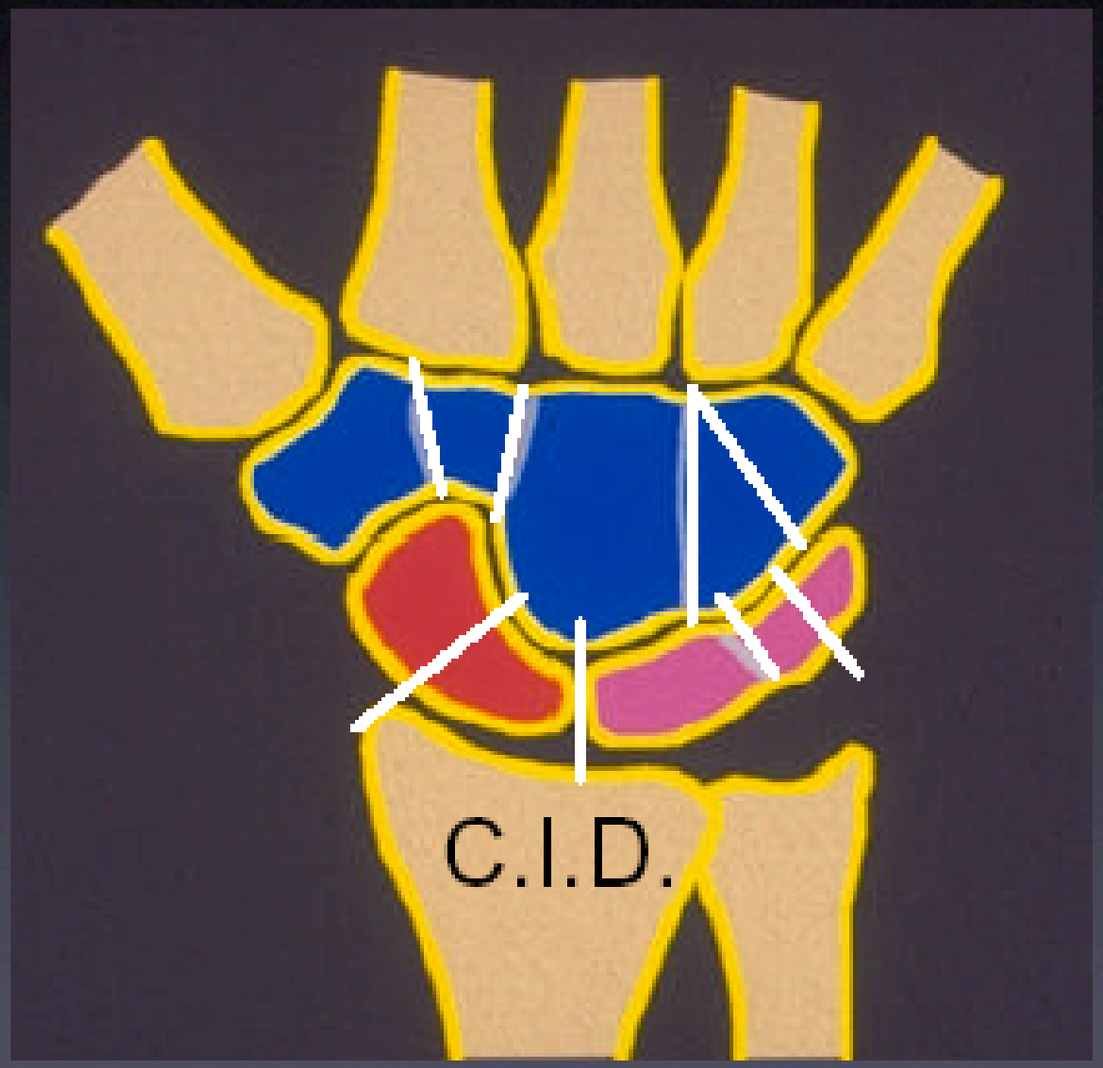
Classification according to localisation of the lesions

Instability I (Sprain)	Instability II (Subluxation)	Instability III (Dislocation)	Instability IV (Fx-Dislocation)
Radiocarpal			
Recurrent symptoms with variable clinical findings; assess by dynamic imaging only	CIND-VISI CIND-DISI Ulnar translation*	Dorsal* Palmar Ulnar	Dorsal Barton's* Palmar Barton's* Radial or ulnar styloid or fossa & carpal translation
Perilunate			
Recurrent symptoms with variable clinical findings; static imaging normal, cinefluoroscopic imaging can be diagnostic	CID-DISI (SLD)* CID-VISI (LT)	Perilunate	Transosseous PLD tS-pL* > others
Midcarpal			
Dynamic instability with variable clinical findings; static imaging normal, fluoroscopic imaging → midcarpal changes ± "catch-up clunk"	CIND-VISI* > DISI Triquetrohamate* Scaphotrapezium trapezoid DISI > VISI capitolunate	†	†
Axial			
†	†	†	Axial-ulnar or axial-radial (or both) fx dislocations
Carpometacarpal			
Recurrent symptoms of painful grip; variable clinical findings; CMC stress test (Linscheid) positive; static fingers; radiographs normal; + bone scan	CMC II & III; tomogram may confirm	CMC II & III Lateral or obliques +; tomogram confirms	CMC I, IV, V most common; special views (Roberts') confirm
Distal Radioulnar			
Recurrent symptoms with forearm rotation; clinical findings with rotation stress; normal or questionable imaging findings	Distal, dorsal, palmar, ulnar; axial computed tomogram confirms	Distal, dorsal, palmar, ulnar; lateral radiograph confirms	Dislocations associated with fx of distal ulna, ulnar styloid, & sigmoid notch

Classification according to the type of instability

Type, Site, & Name	Radiographic Pattern
I. CID	
1.1 Proximal carpal row CID	
a. Unstable scaphoid fracture	DISI
b. Scapholunate dissociation	DISI
c. Lunotriquetral dissociation	VISI
1.2 Distal carpal row CID	
a. AR disruption	RT PT
b. AU disruption	UT PT
c. Combined AR and AU disruption	
1.3 Combined proximal and distal CID	
II. CIND	
2.1 Radiocarpal CIND	
a. Palmar ligament rupture	DISI, UT of entire proximal carpal row UT with increased SL space; PT (actually is a CIC)
b. Dorsal ligament rupture	VISI, DT
c. After "radius malunion," Madelung's deformity, scaphoid malunion, lunate malunion (see "Adaptive carpus" below)	
2.2 Midcarpal CIND	
a. Ulnar MCI from palmar ligament damage	VISI
b. Radial MCI from palmar ligament damage	VISI
c. Combined UMCI & RMCI, palmar ligament damage	VISI
d. MCI from dorsal ligament damage	DISI
2.3 Combined radiocarpal-midcarpal CIND	
a. CLIP	VISI, DISI, alternating
b. Disruption of radial & central ligaments	UT with or without VISI or DISI
III. CIC	
a. Perilunate with radiocarpal instability	DISI & UT
b. Perilunate with axial instability	AxUI & UT
c. Radiocarpal with axial instability	AxRI & UT
d. Scapholunate dissociation with UT	DISI & UT
IV. "Adaptive carpus"	
a. Malposition of carpus with distal radius malunion	DISI or DT
b. Malposition of carpus with scaphoid nonunion	DISI
c. Malposition of carpus with lunate malunion	DISI or VISI
d. Malposition of carpus with Madelung's deformity	UT, DISI, PT

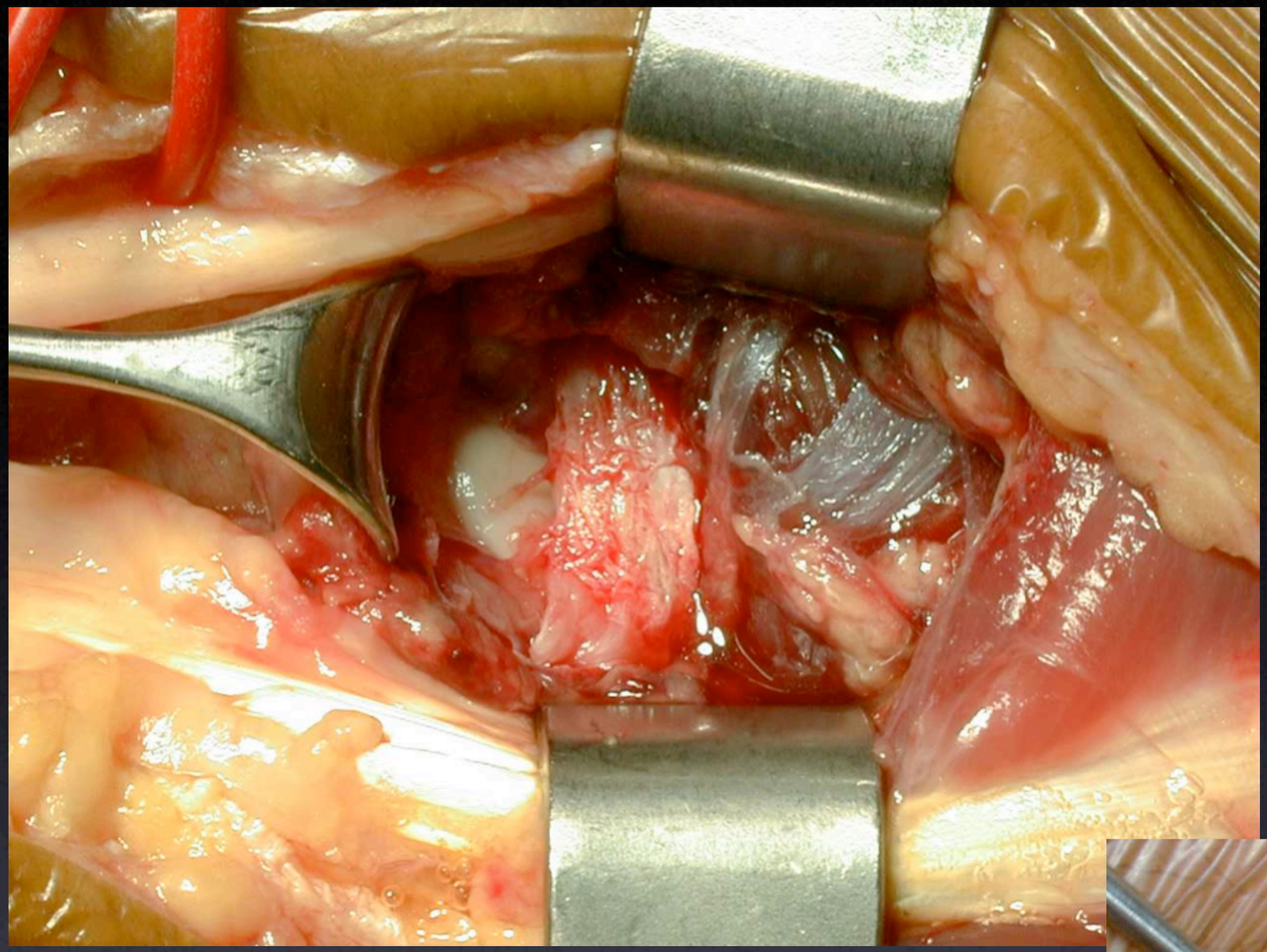
CID versus CIND



Complex types are the various associations

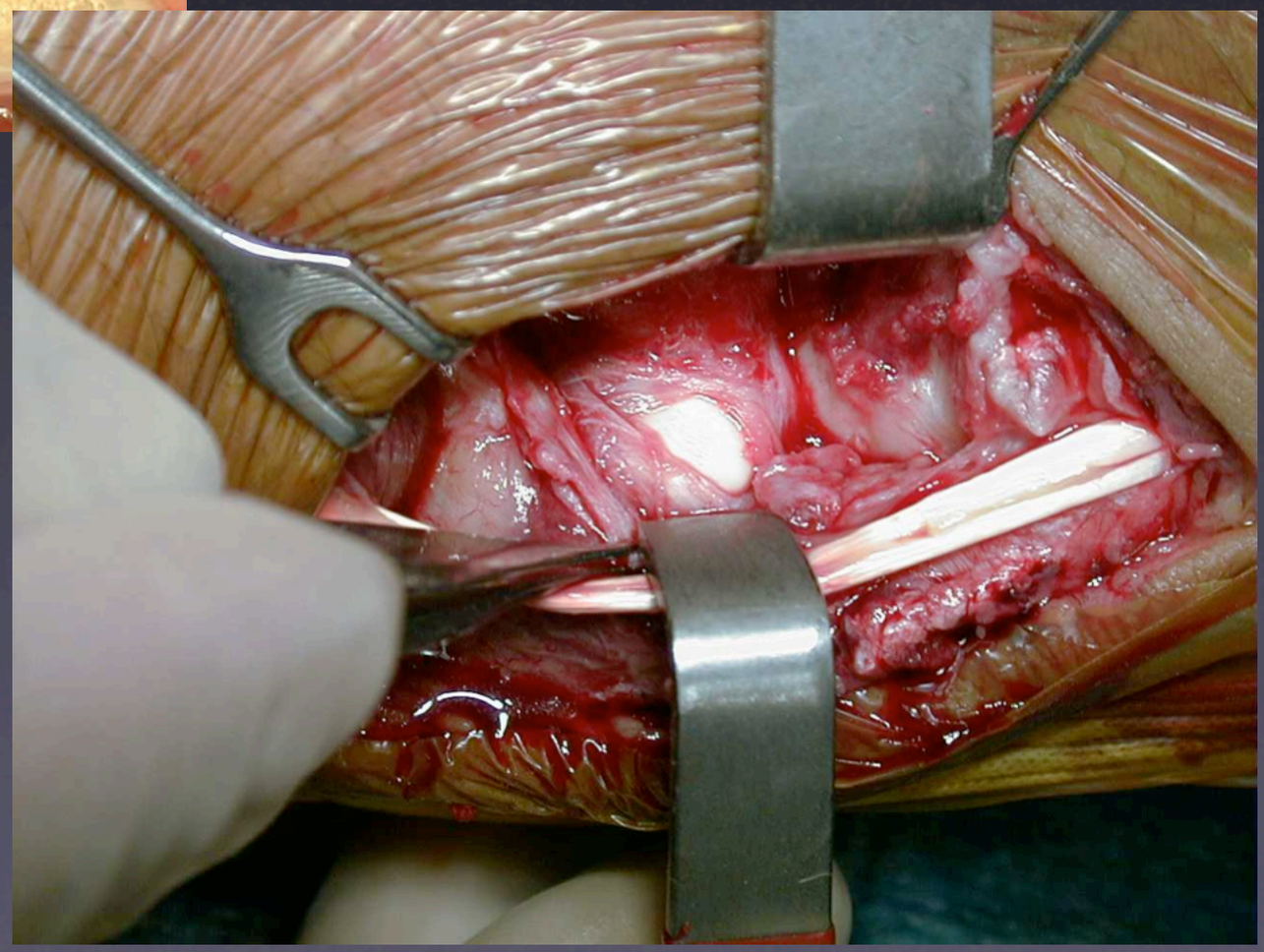
Radio-carpal instability

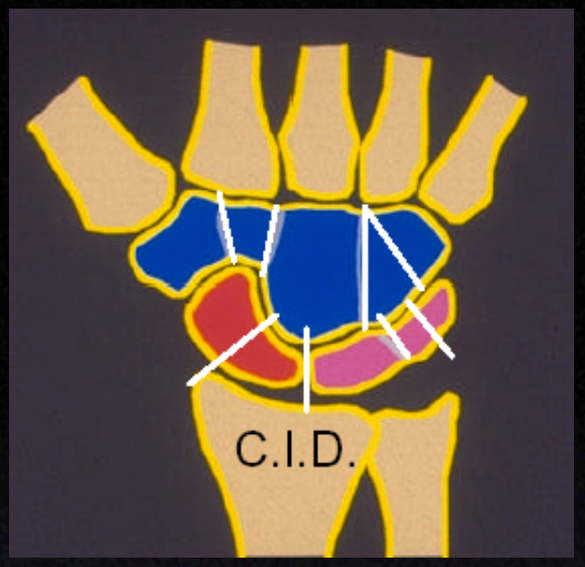
- CIND
- Very (very) rare
- Radio-carpal dislocation



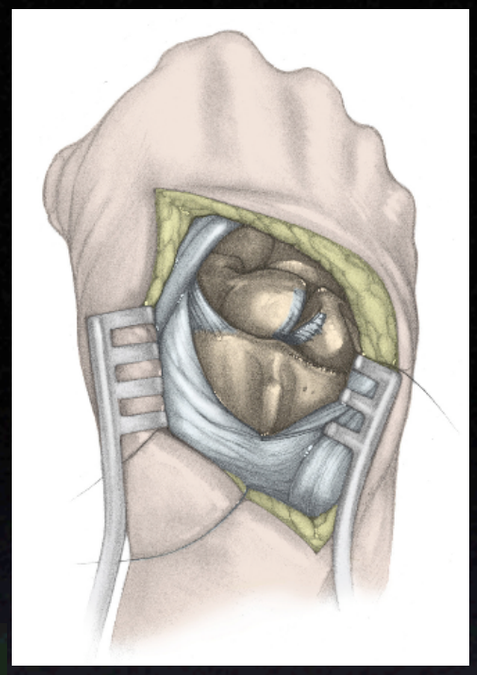
Surgical treatment is recommended

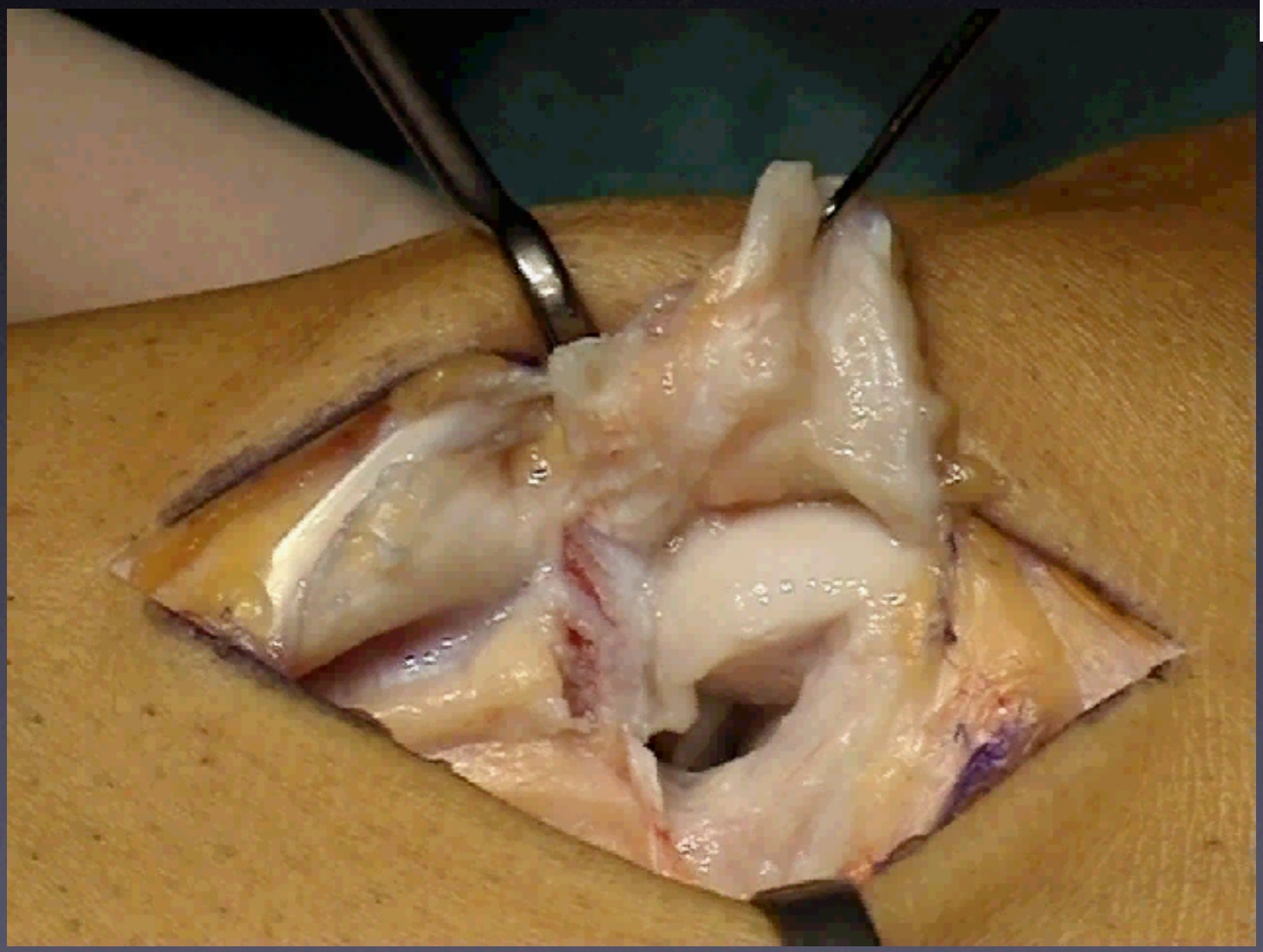
Dumontier et al., JBJS 2001



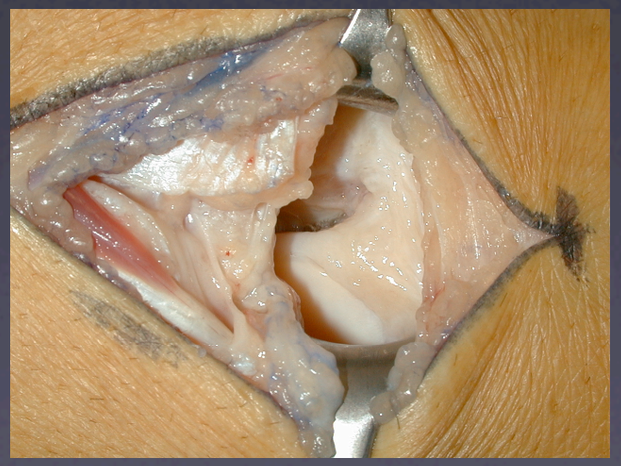


Proximal CID-Scapholunate





Continuum of lesions

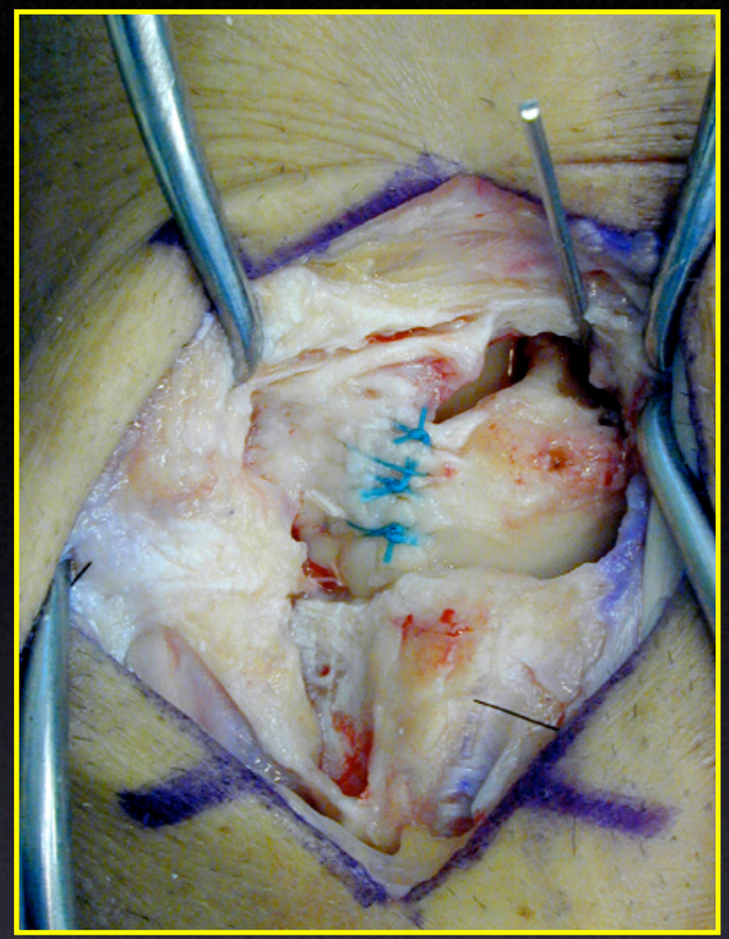


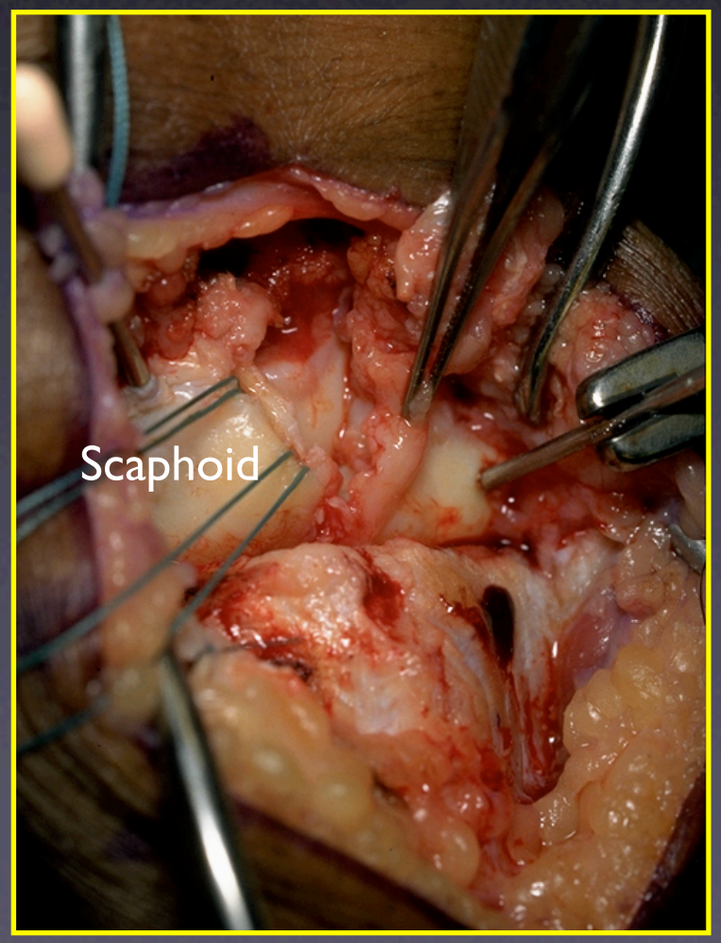
Scapho-lunate

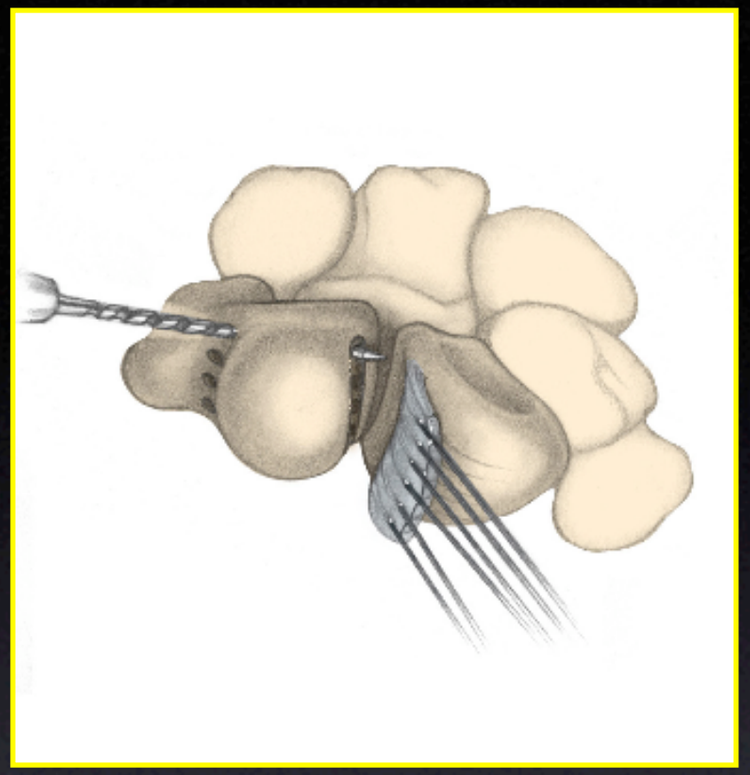
Stage	Occult	Dynamic	Scapholunate dissociation	DISI	SLAC
Injured lgts	Partial SLIL	Torn SLIL, partial palmar extrinsics	Complete SLIL, volar or dorsal extrinsics	SLIL+extrinsics +2ary lesions	idem
Xrays	normal	usually normal	SL gap > 3mm +/- SLΔ > 70°	SL gap > 3mm +/- SLΔ > 70°, RLΔ> 15°, CLΔ < 15°	I styloid DJD II RS DJD III CL DJD IV Pan-carpal
Stress Xrays	normal	abnormal	grossly abnormal	unnecessary	unnecessary

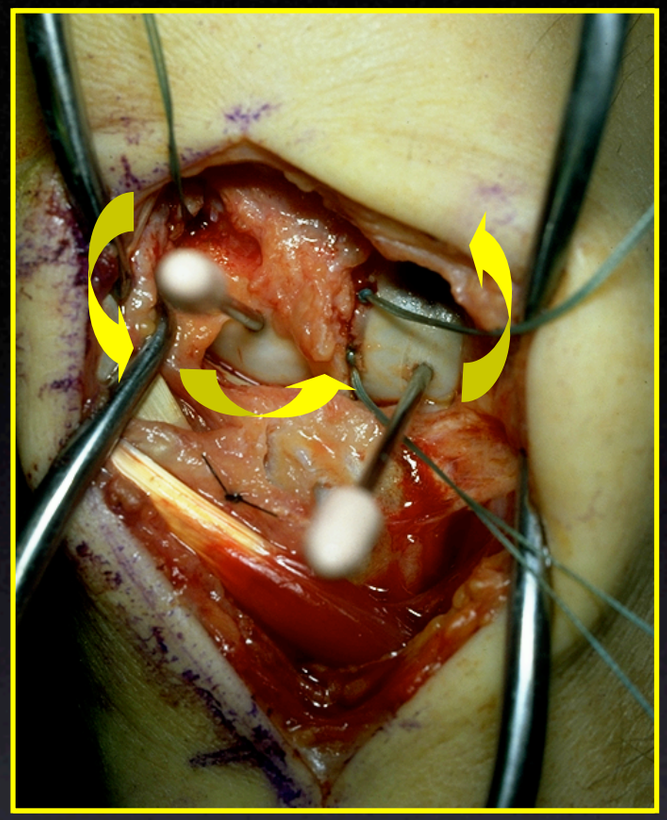
Direct repair

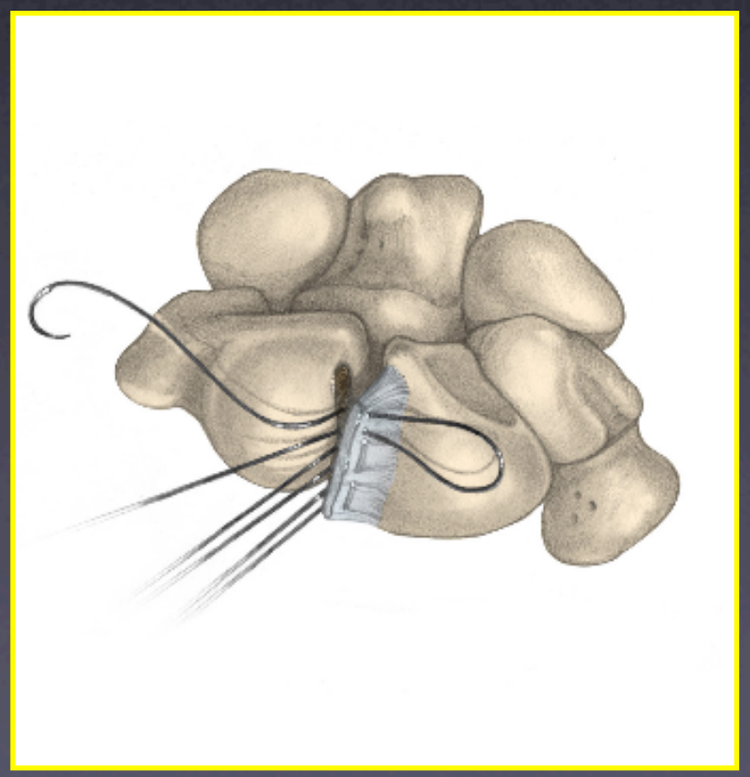
- Only the dorsal part of the SL ligament can heal

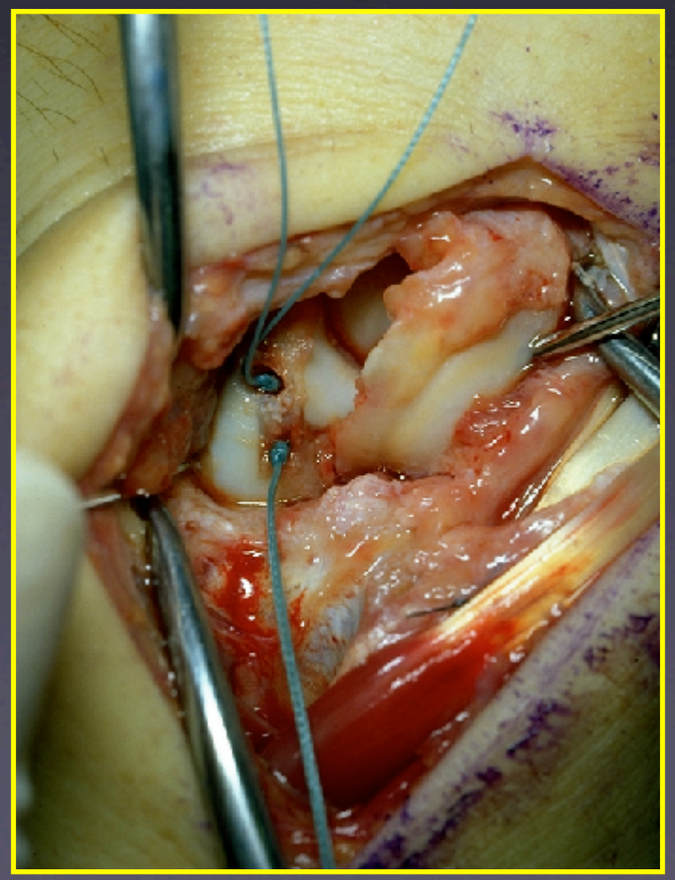




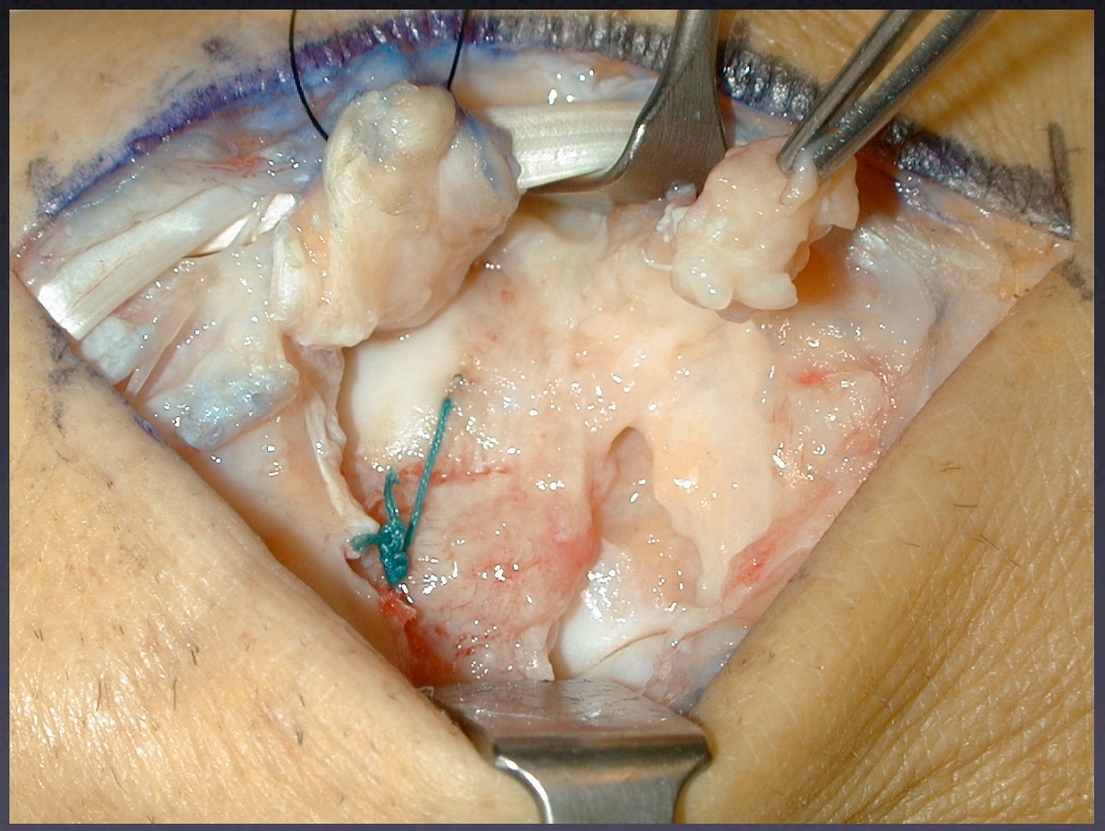






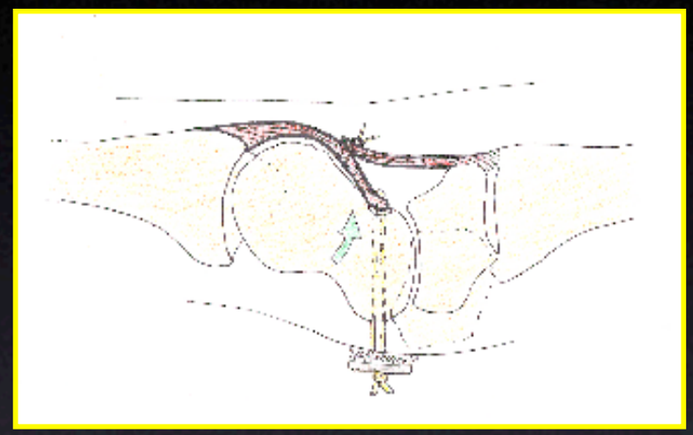


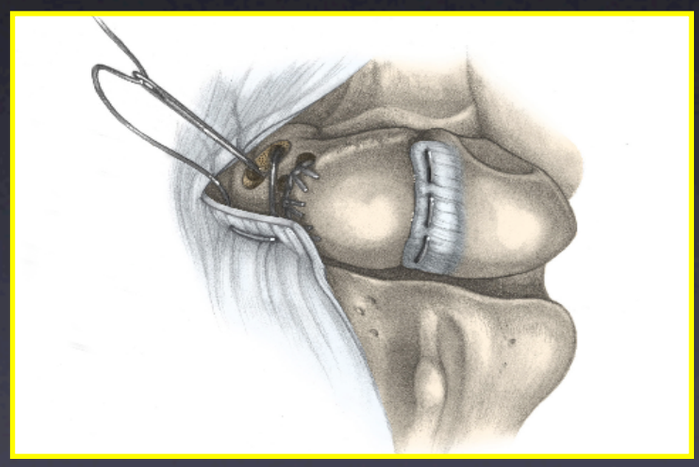
Treatment

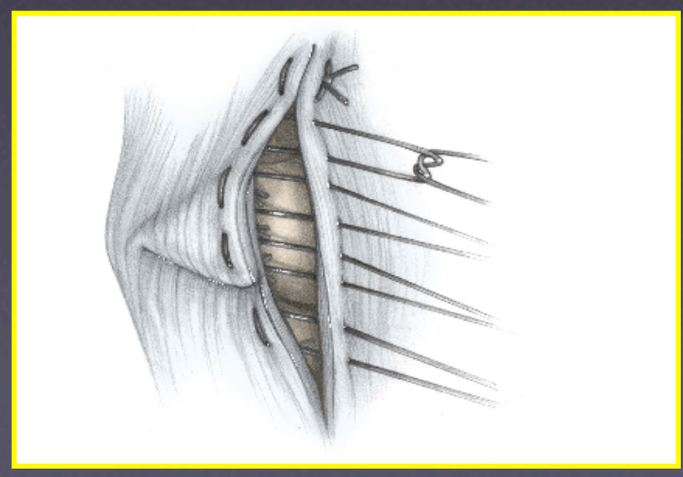


Dorsal capsulodesis

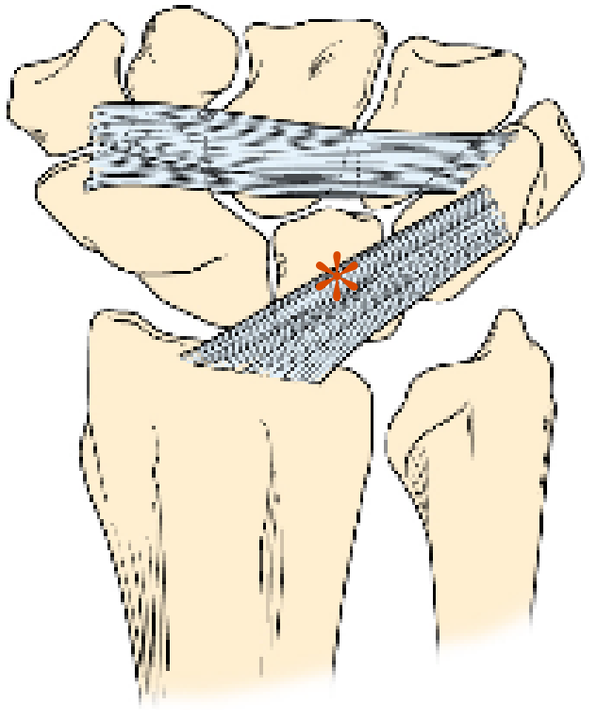
- Usually associated with ligamentous repair
- Blatt (Hand Clin 1997) Taleisnik (JHS 1992)

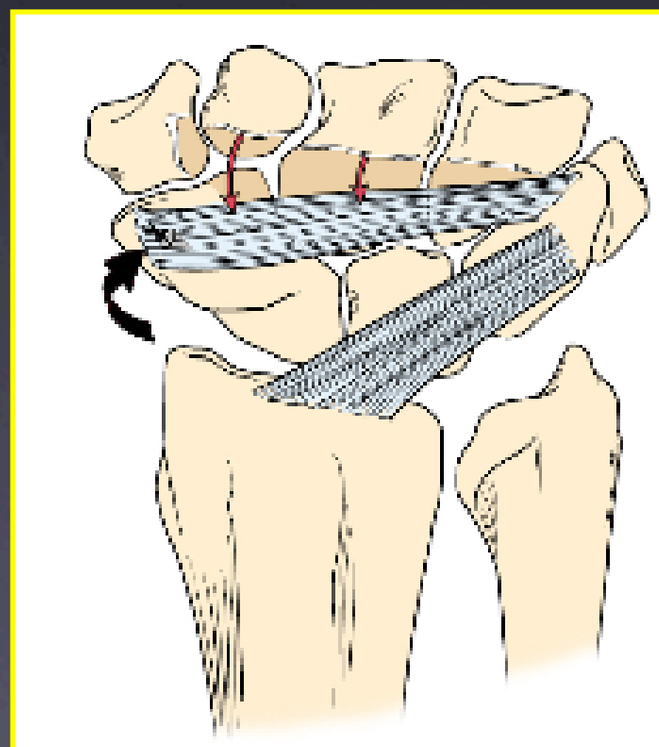




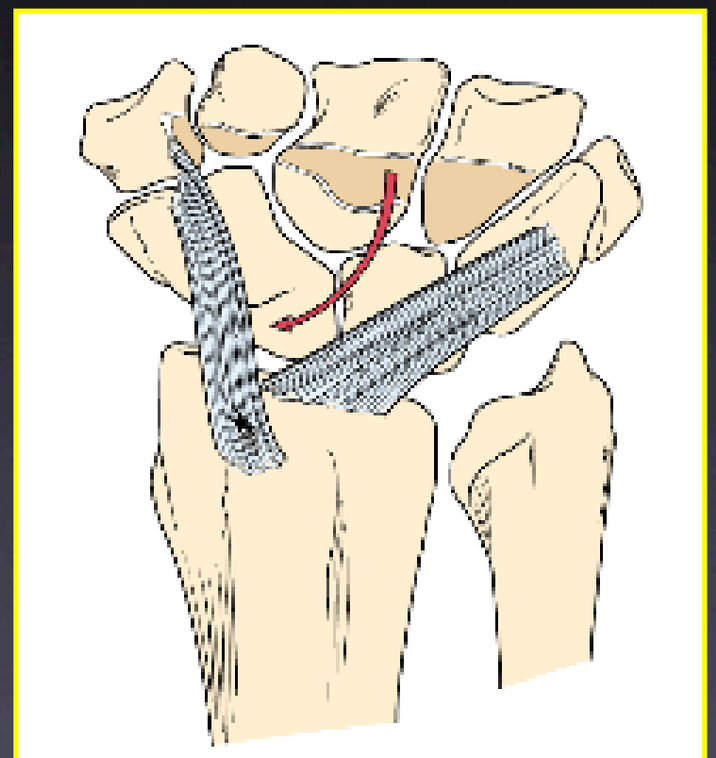


Capsulodesis modifications

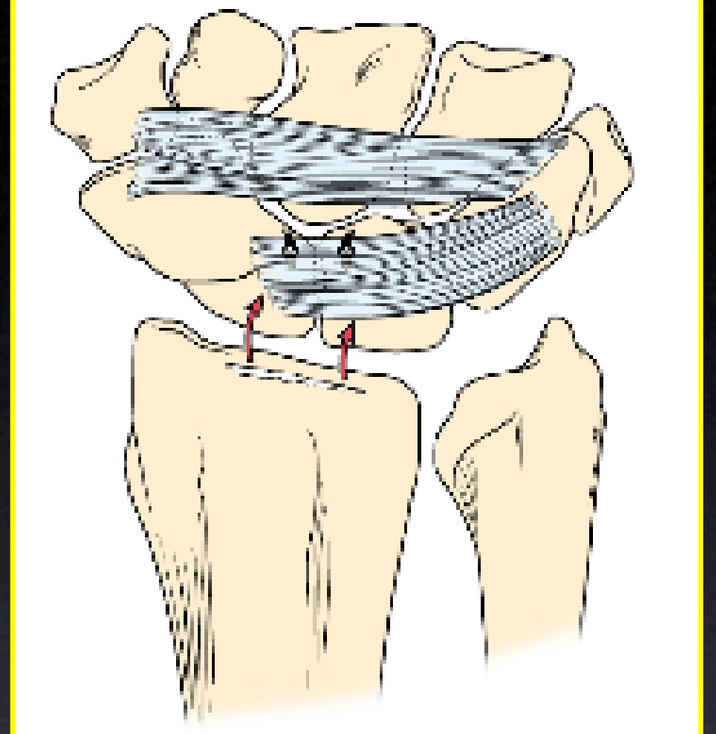


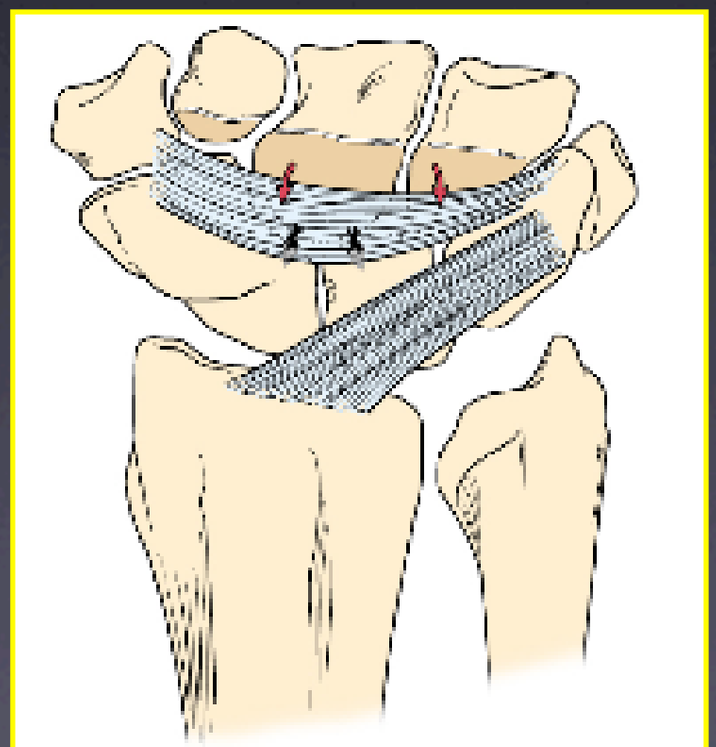


Szabo (JHS 1999)

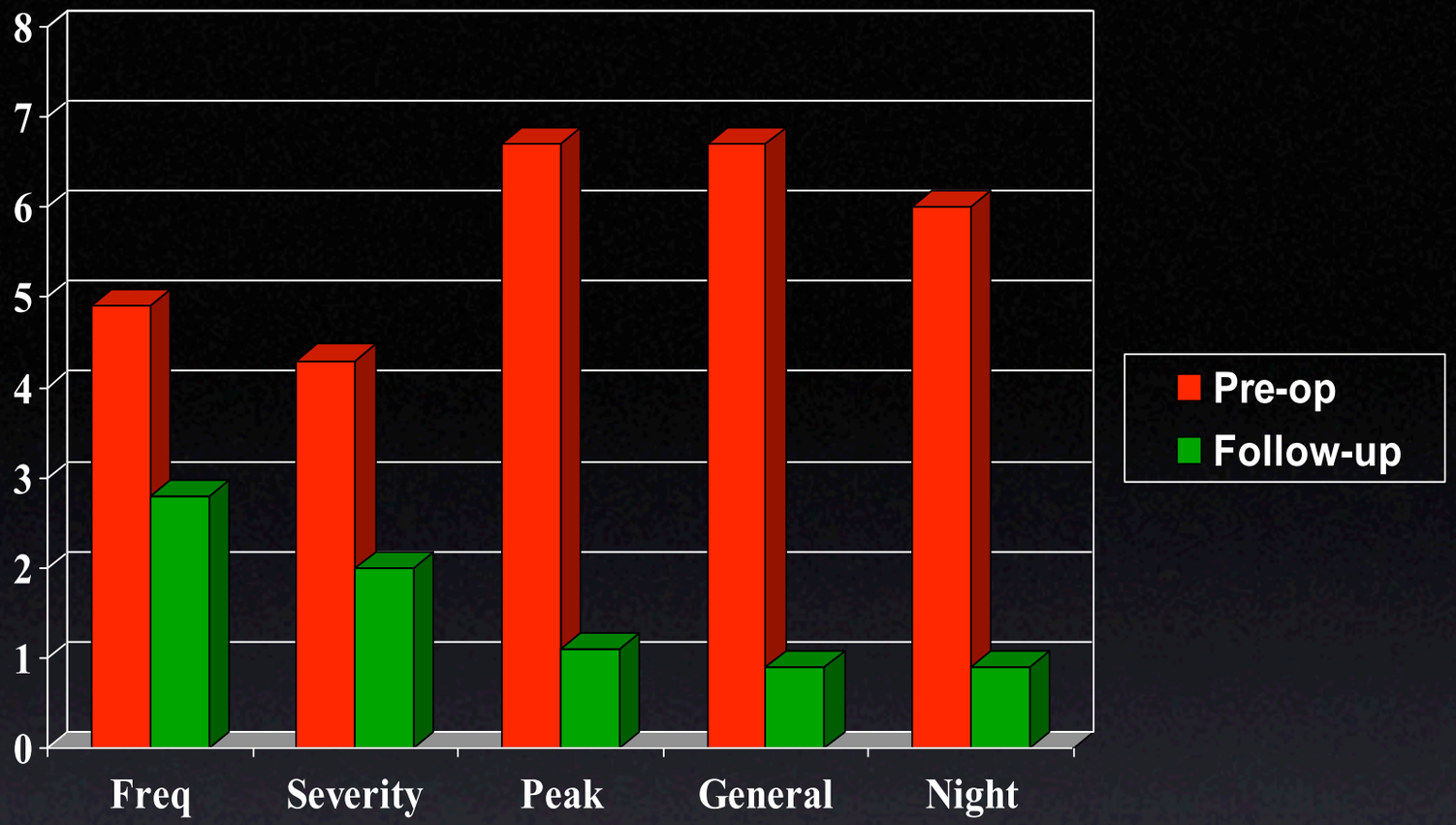


Kleinman (ASSH 2000)





Viegas (JHS 1999)

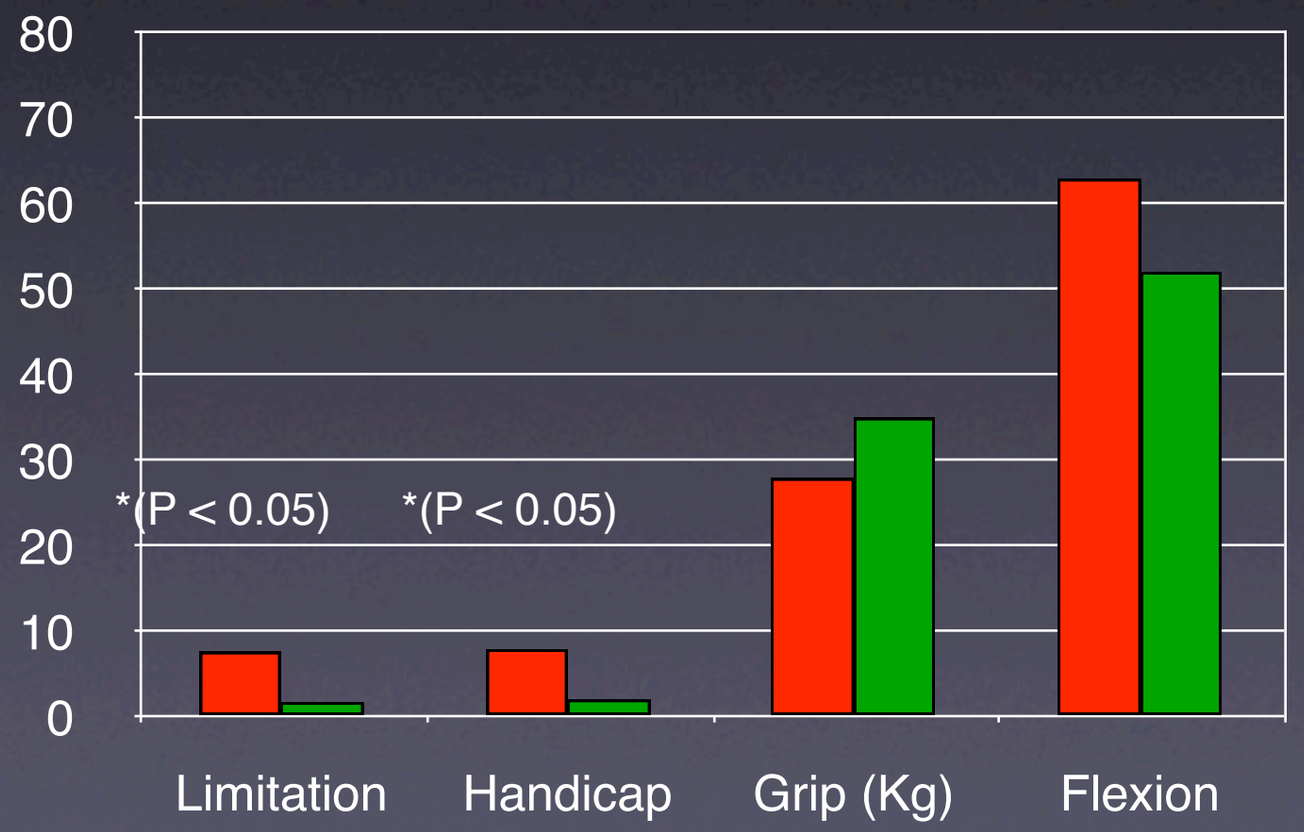


*(P < 0.05)

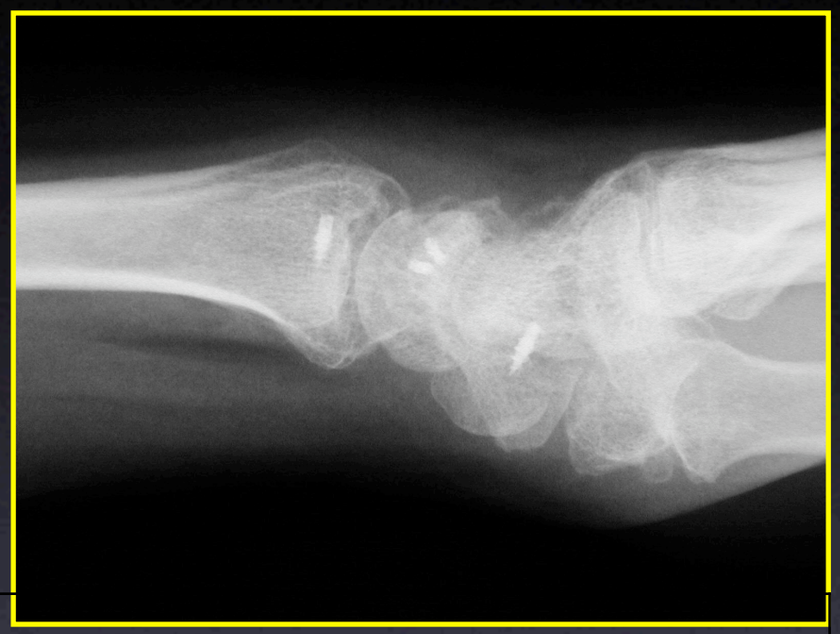
FUNCTION

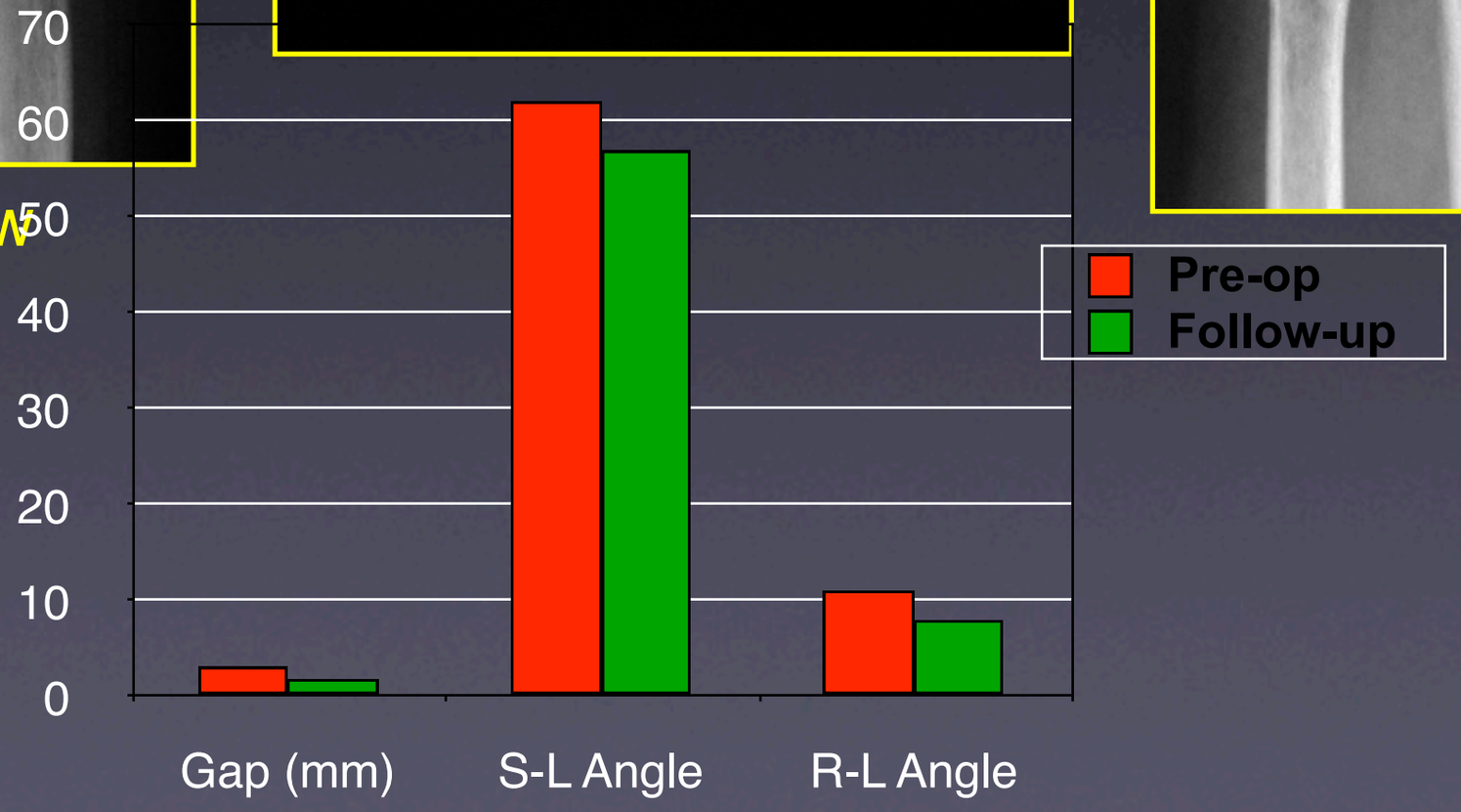
PAIN

Taleisnik, 21 pts, 3 yrs FU



Stress View





Saffar AOB 1999

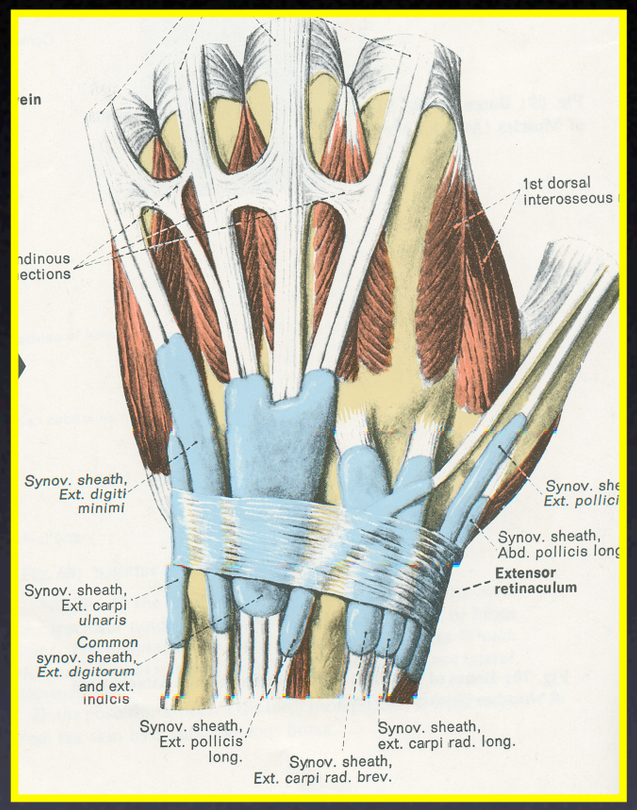
37 Patients
Motion - 82%
Pain Relief - 83%
Gap = 4.2 mm

Wyrick JHS 1998

17 Patients (≺ 3 months after injury, f/u 30 months)
Motion - 60%
Recurrent SL gap
15/17 - Fair/Poor

Bone-ligament-bone

Weiss et al J Hand Surg 1998

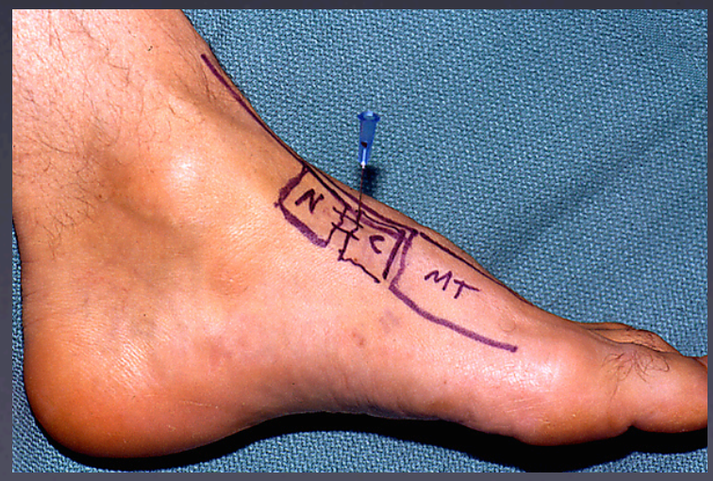


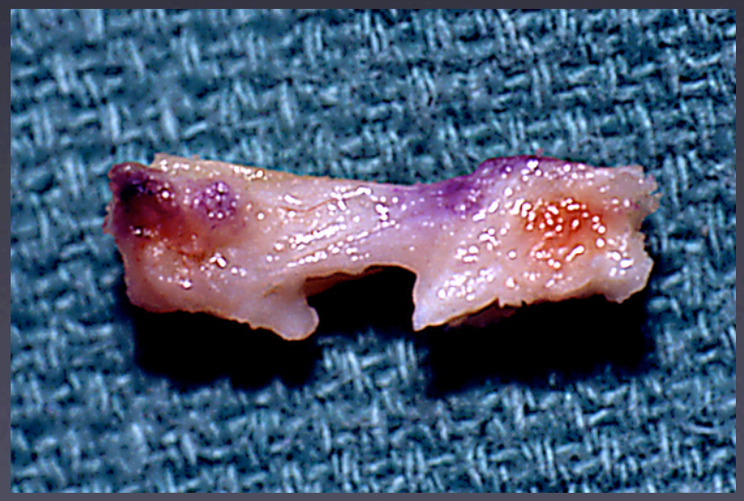
Extensor Retinaculum

- same stress/strain properties as SLI
- 1/3 cross sectional area as SLI
- 1/3 ultimate strength
- "toothpick vs 2X4"

1st cuneiform-navicular ligament

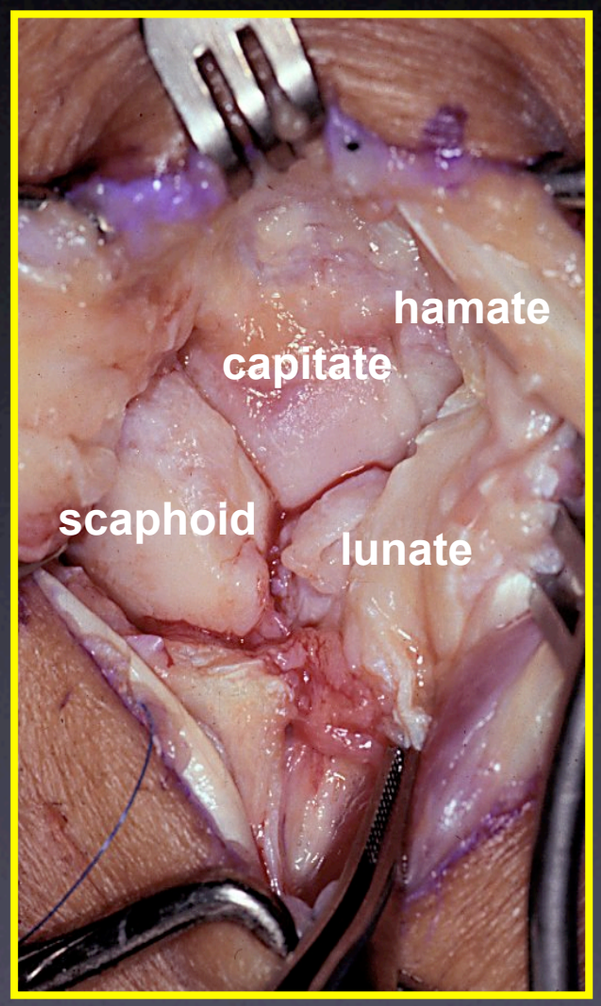
- excellent strength (479 N)
- articular surface interface
- remote donor site

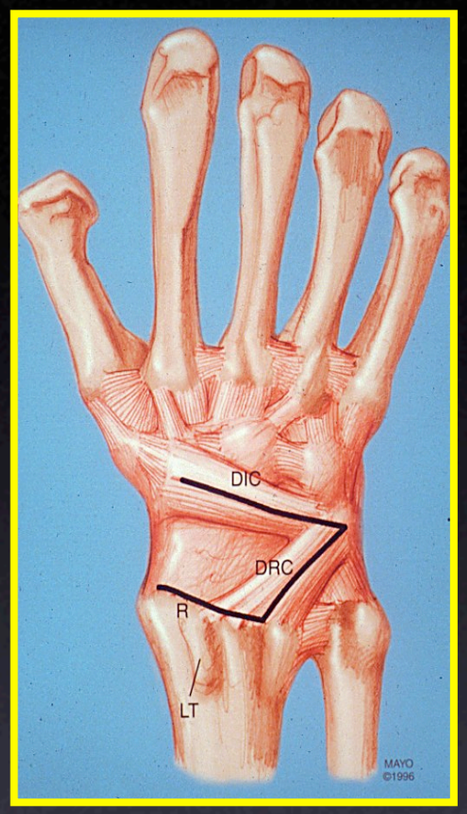




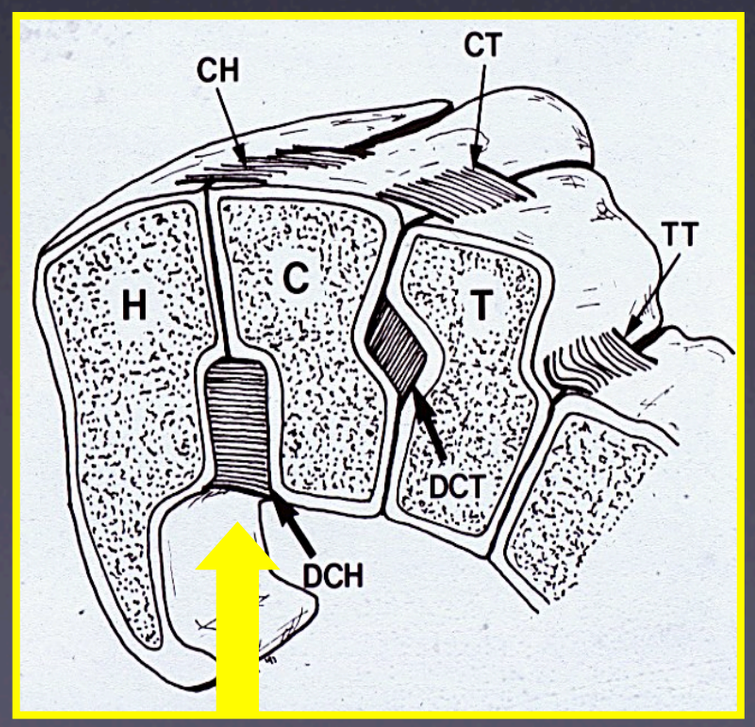
Davis, Culp, Hume, Osterman J Hand Surg 1998
Hofstede, Ritt, Bos J Hand Surg 1999

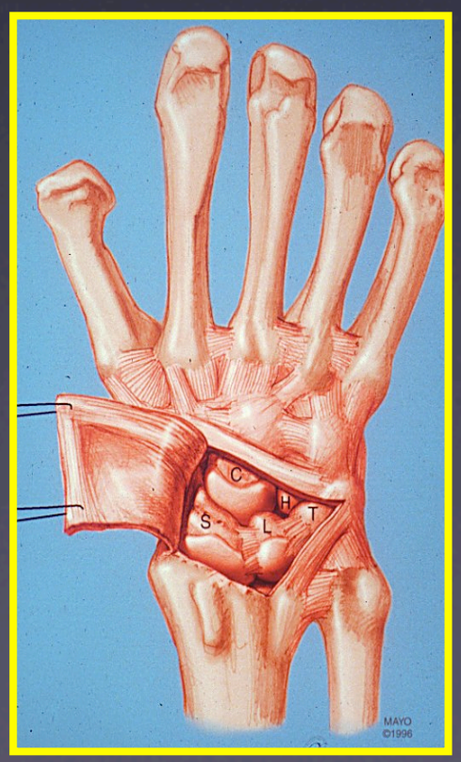
Capitohamate Ligament

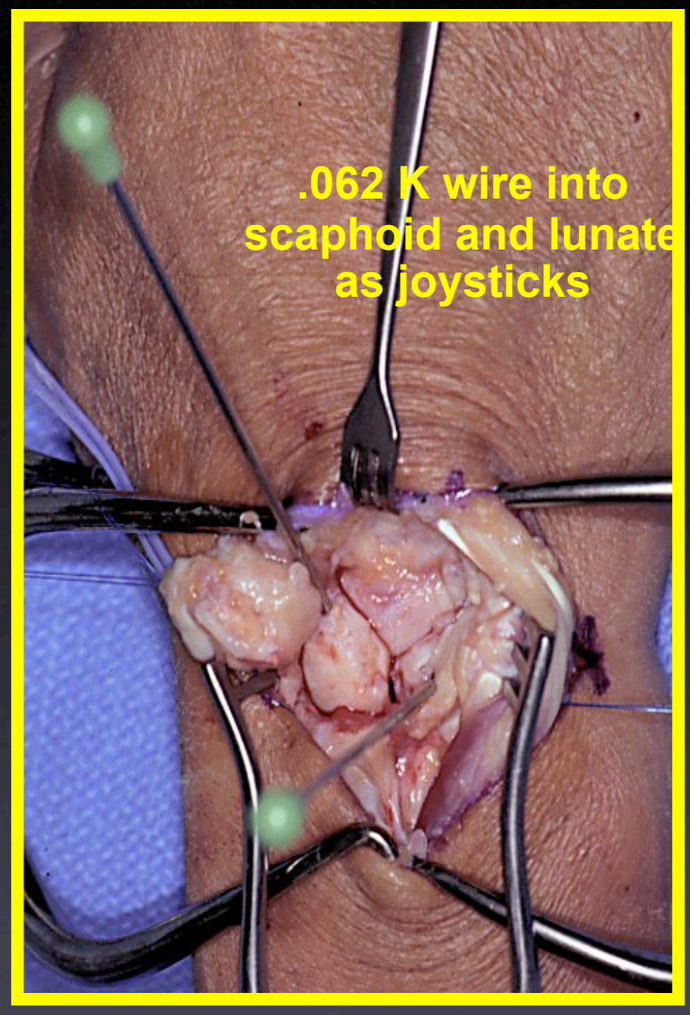


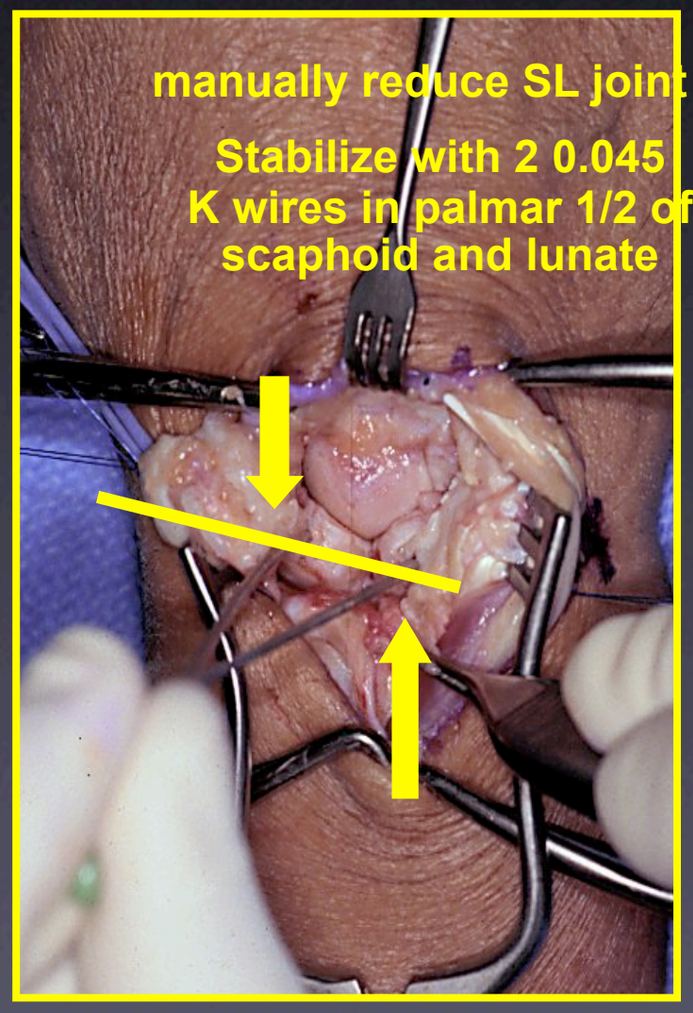


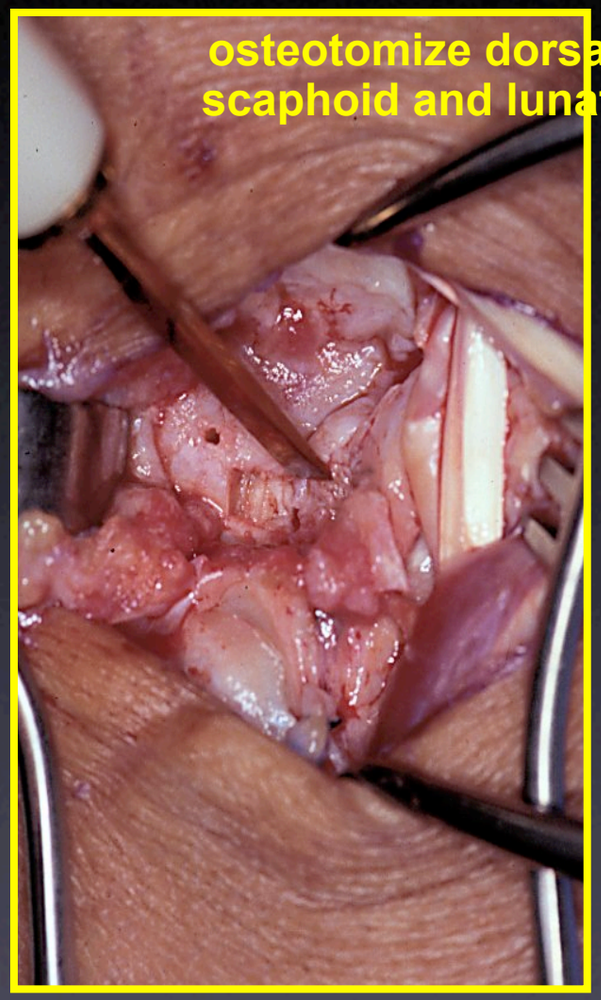
"deep" capitohamate

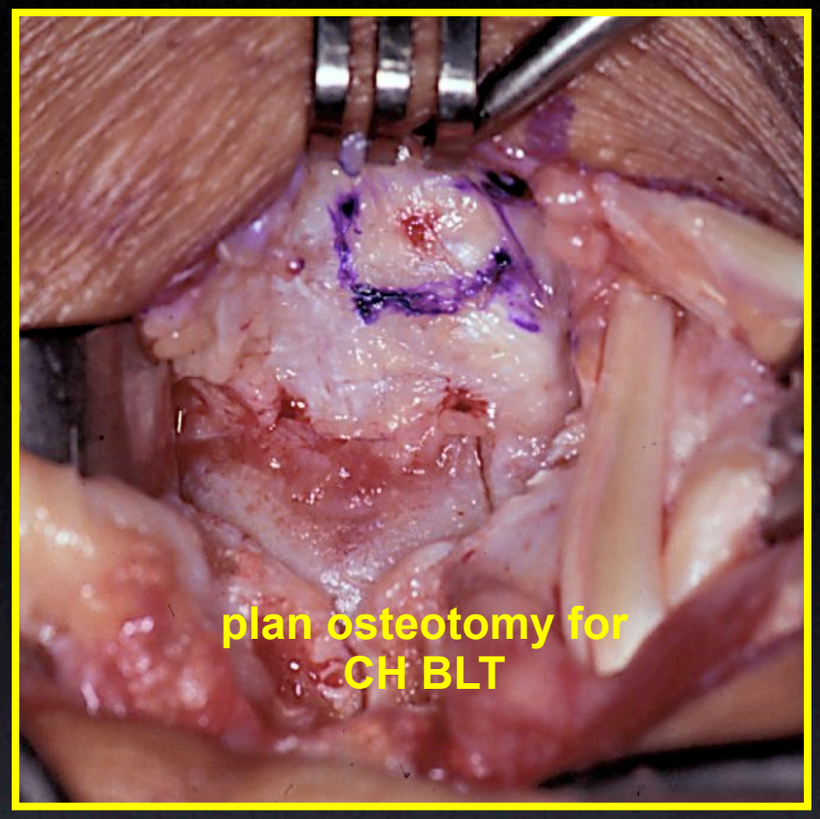


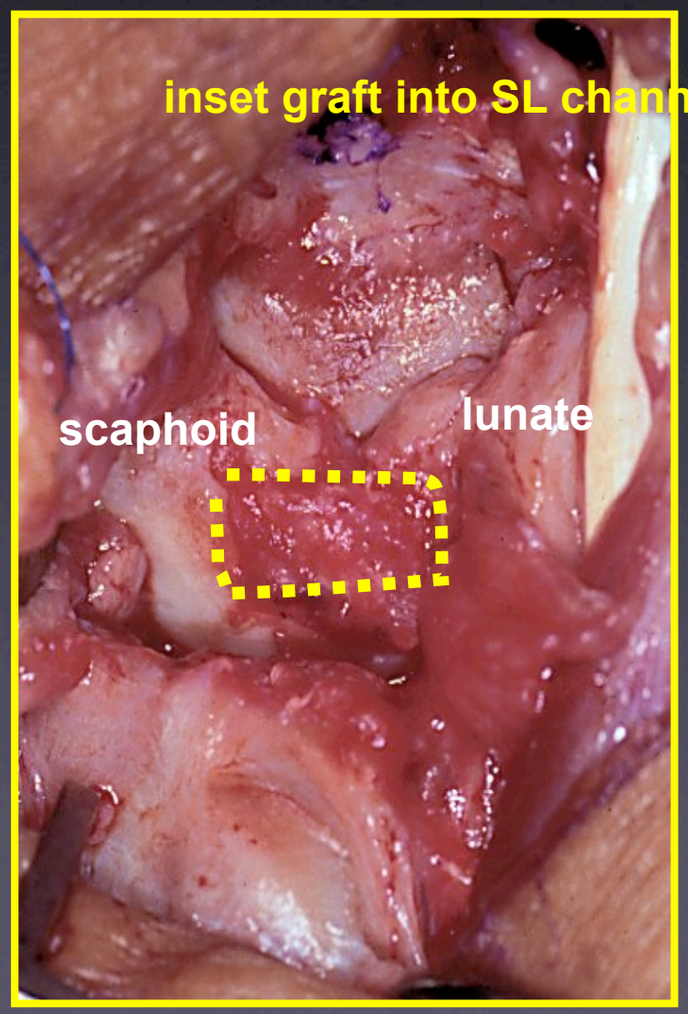


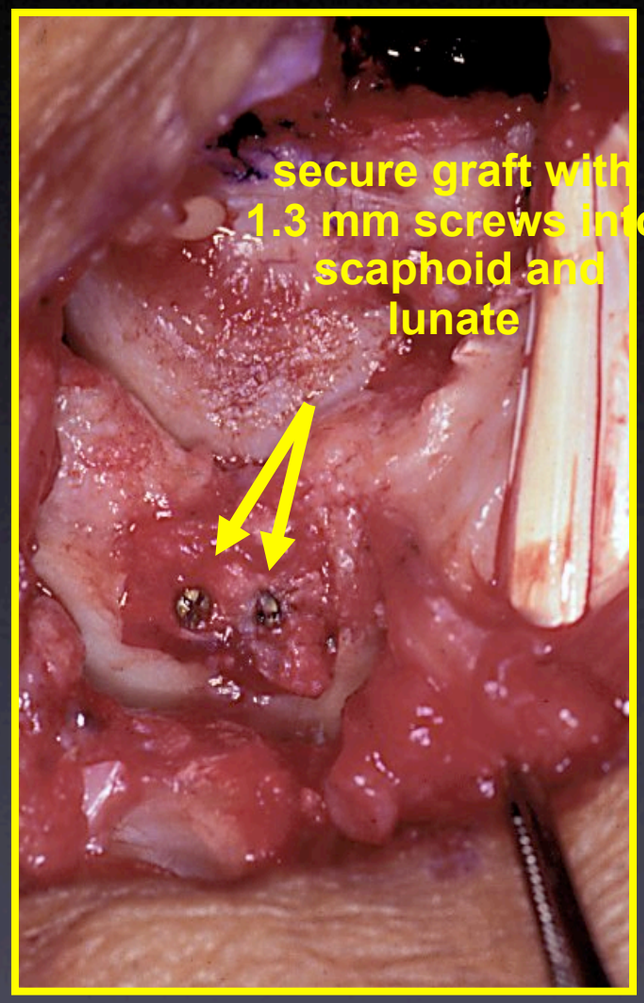

.062 K wire into
scaphoid and lunate
as joysticks

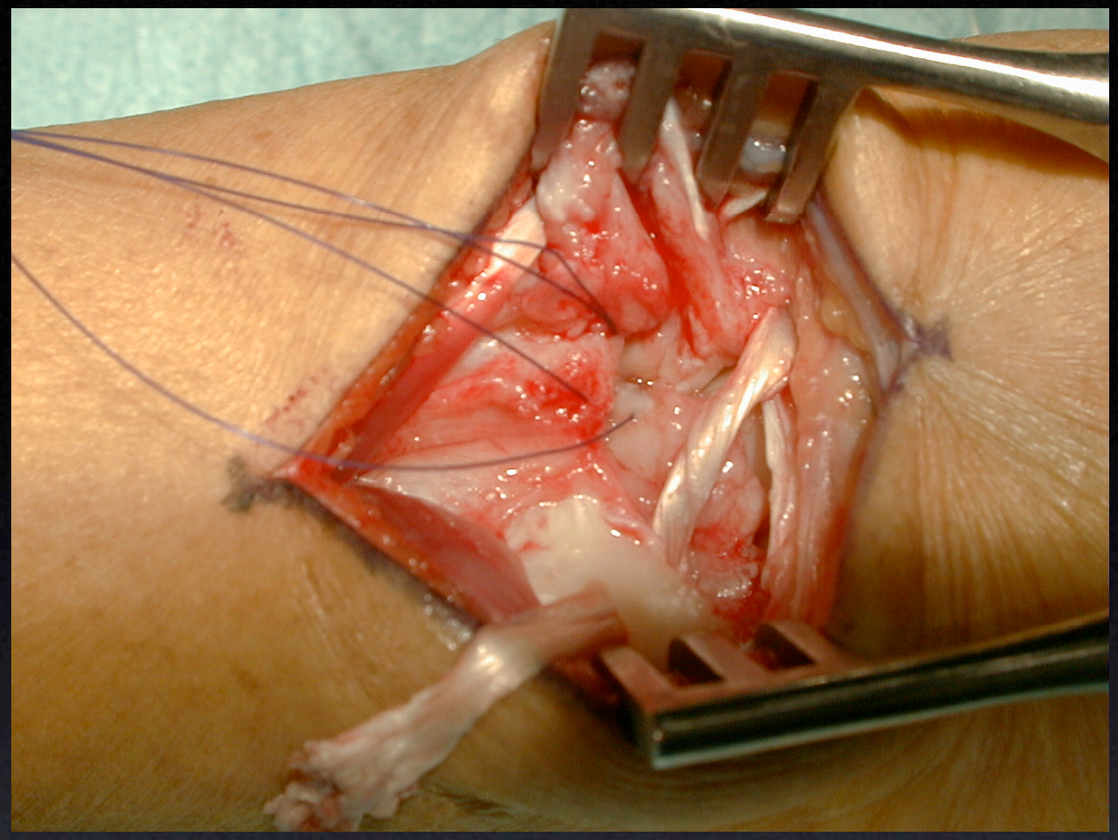

manually reduce SL joint
Stabilize with 2 0.045
K wires in palmar 1/2 of
scaphoid and lunate

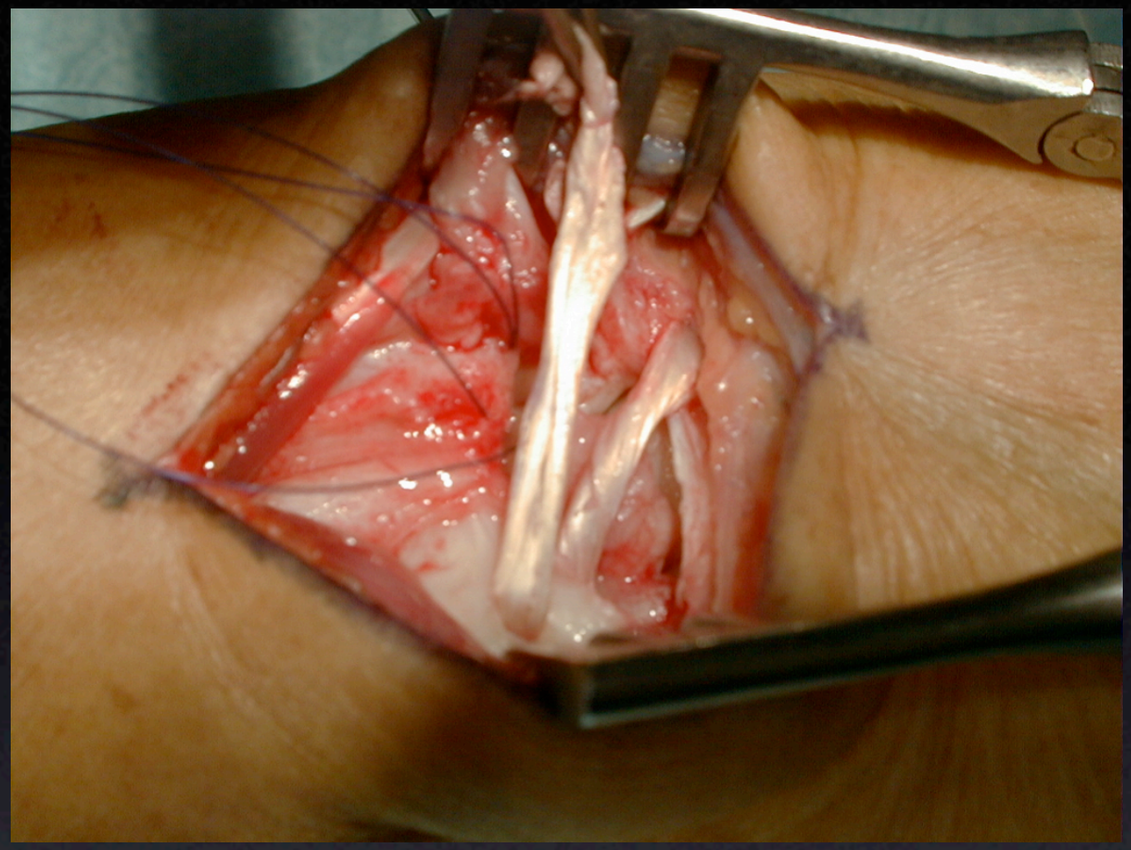

osteotomize dorsal
scaphoid and lunate

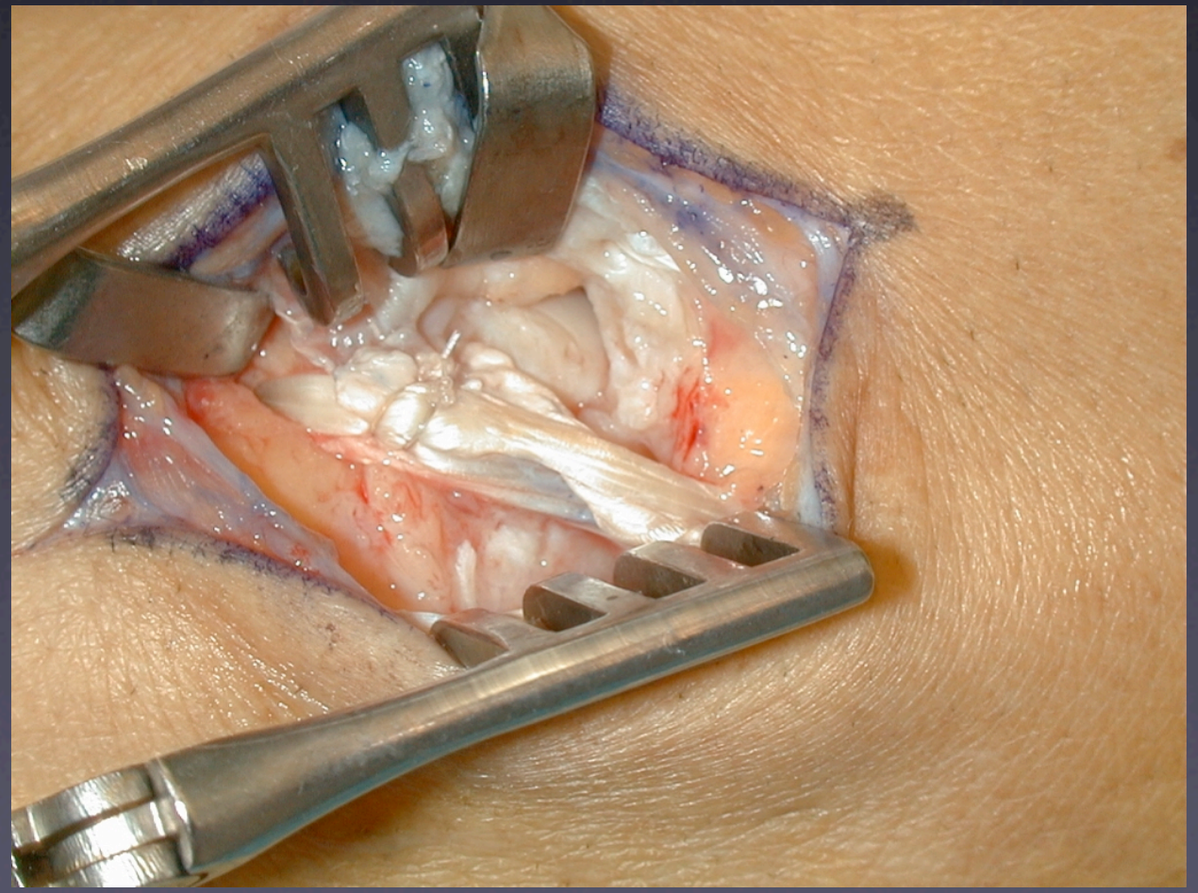

plan osteotomy for
CH BLT

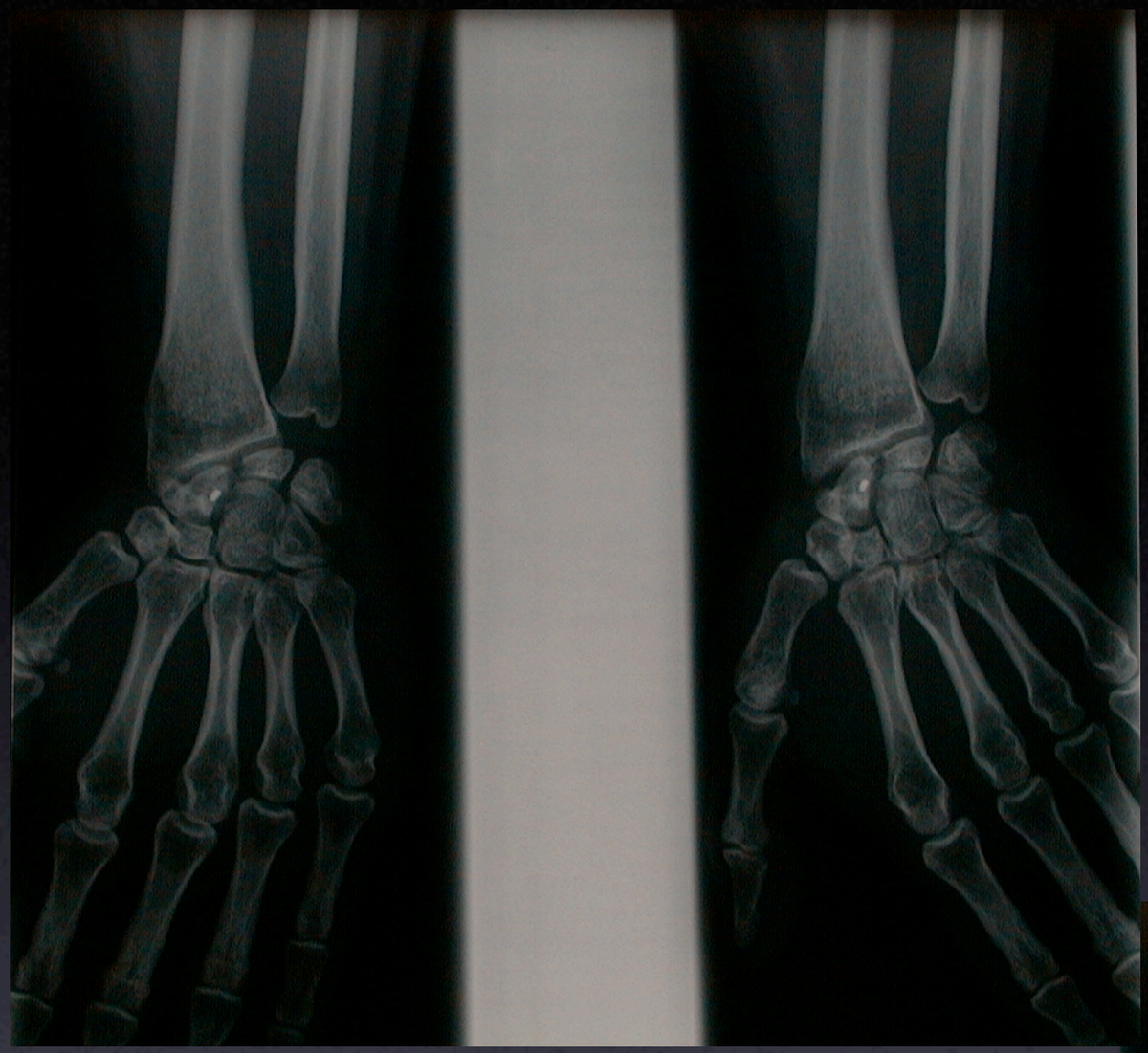

inset graft into SL channel
scaphoid
lunate

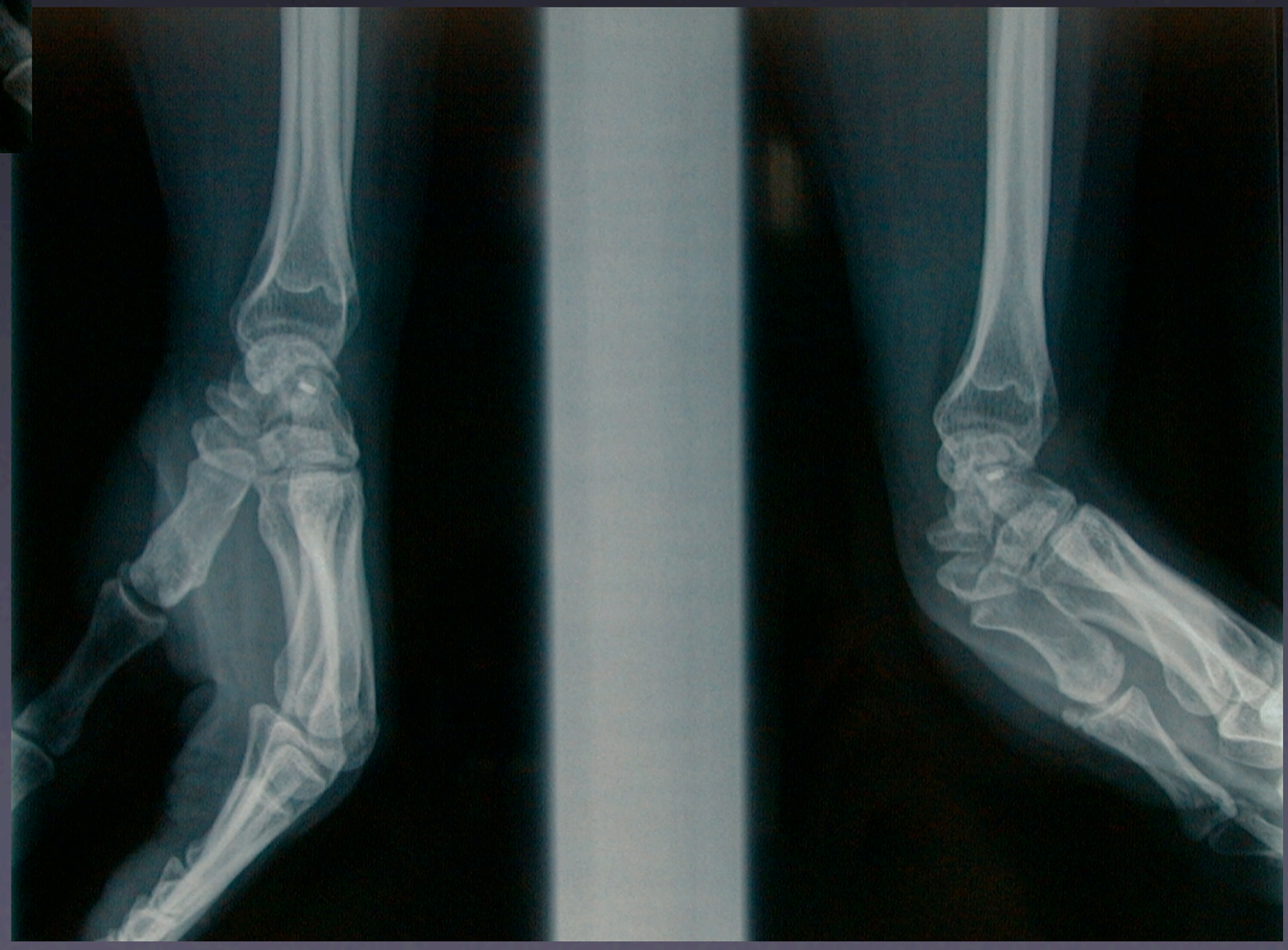

secure graft with
1.3 mm screws into
scaphoid and
lunate







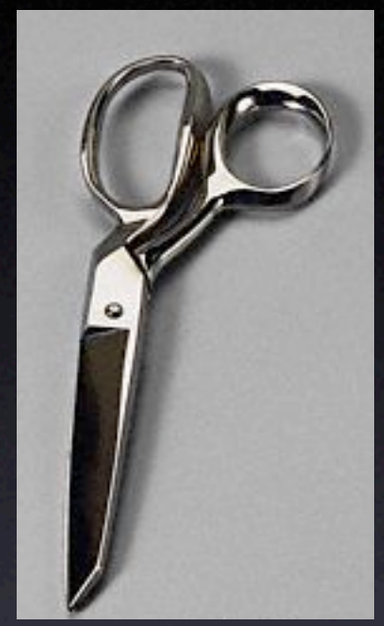




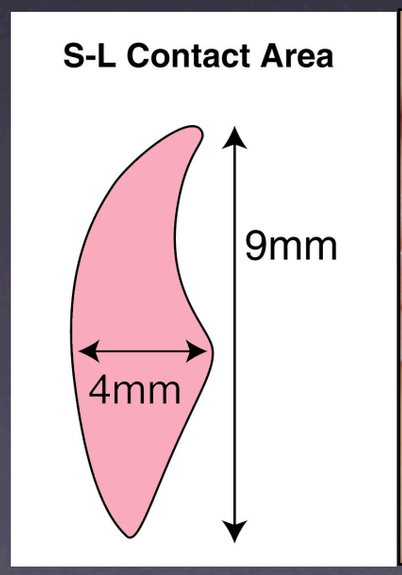
Partial arthrodesis

arthrodesis	Type	Ext / flex (%)	RD/UD (%)
STT	Clinical Simulated	62-80 73-88	52-64 68-83
SC	Clinical Simulated	47 81-82	79-81 52-64
SCL	Clinical Simulated	47 59-66	46 64-91

Scapholunate Az

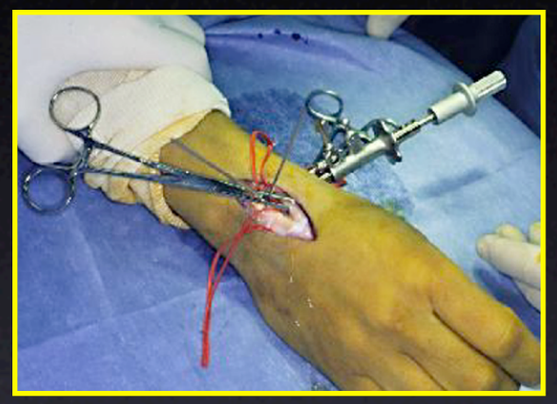


- Motion in flexion and extension goes through the SL joint
- There is no report of a congenital scapholunate fusion
- Fusion difficult to achieve
  - Considerable loads
  - Small surface area
  - About 50% nonunion



Hom J Hand Surg 1991 McAullife et al. J Hand Surg 1993 Hastings & Silver. J Hand Surg 1984

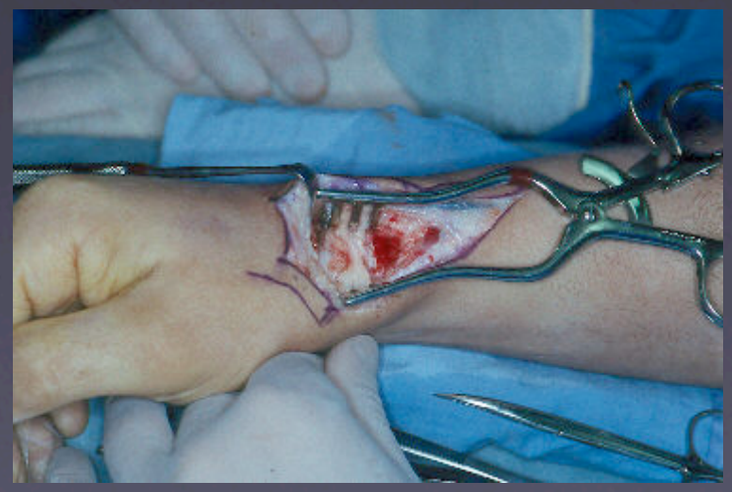
“incomplete” SL fusion



- The RASL procedure allows for correction of radiological parameters and improvement of symptoms
- However, radiolucency around the Herbert screw raises concern about the future

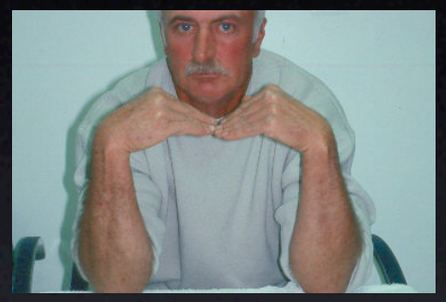
STT arthrodesis

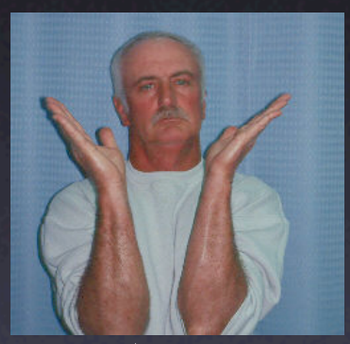
- Alters carpal kinematics
- All loads transfer to scaphoid fossa



Sutro Sugery 1946
Peterson & Lipscomb Arch Surg 1967
Watson & Hempton. J Hand Surg 1980

798 STT arthrodesis





- 543 "rotatory" subluxation
  - Union rate 96%
  - 86% "better or much better"
  - 80% returned to original employment
  - Flexion/extension & RD/UD 75%
  - Grip strength 80%

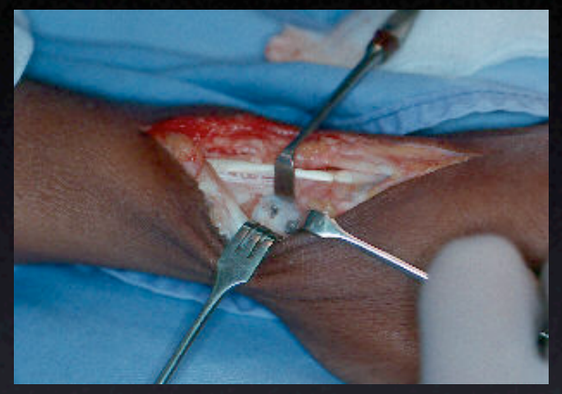
Watson et al. One Thousand Intercarpal Arthrodeses. J Hand Surg British 1999

STT fusion

- Complications
  - Nonunion 4-24%
  - Radial styloid scaphoid arthritis
  - Progressive carpal arthrosis (may be related to scaphoid reduction)

Fortin & Lewis. J Hand Surg 1990
Kleinman & Carroll. J Hand Surg 1990
McAullife et al. J Hand Surg 1993

SC fusion



- 17 patients (4 rotatory subluxation, 9 Kienbock's, 3 scaphoid nonunion, 1 lunate nonunion)
- Primary union 15/17 ROM averaged 42° extension, 32 ° flexion
- easier to fuse than STT, but gives more stiffness

Pisano, Peimer et al. J Hand Surg 1991

Douglas, Peimer et al. JBJS 1987
Garcia-Elias et al. J Hand Surg 1989

SLAC wrist

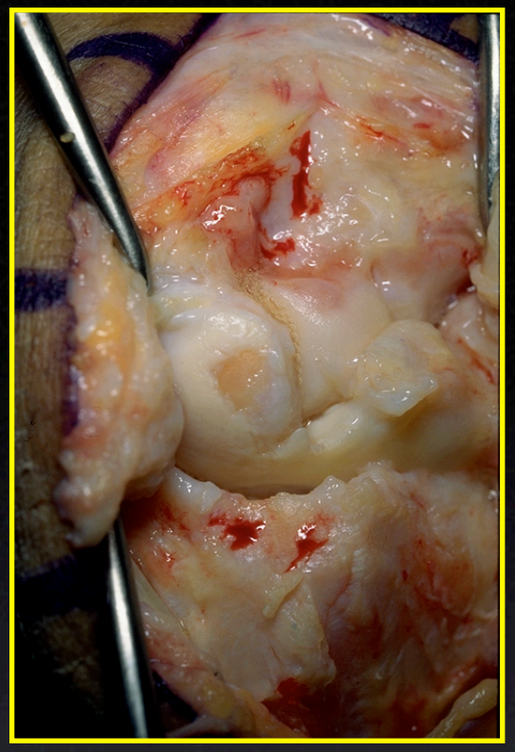
- I. Radial styloid- scaphoid distal pole
- II. Radius- proximal pole (ovoid anatomy, load change)
- III. Capitolunate joint
- IV. Radiolunate usually spared (spherical)

SLAC wrist

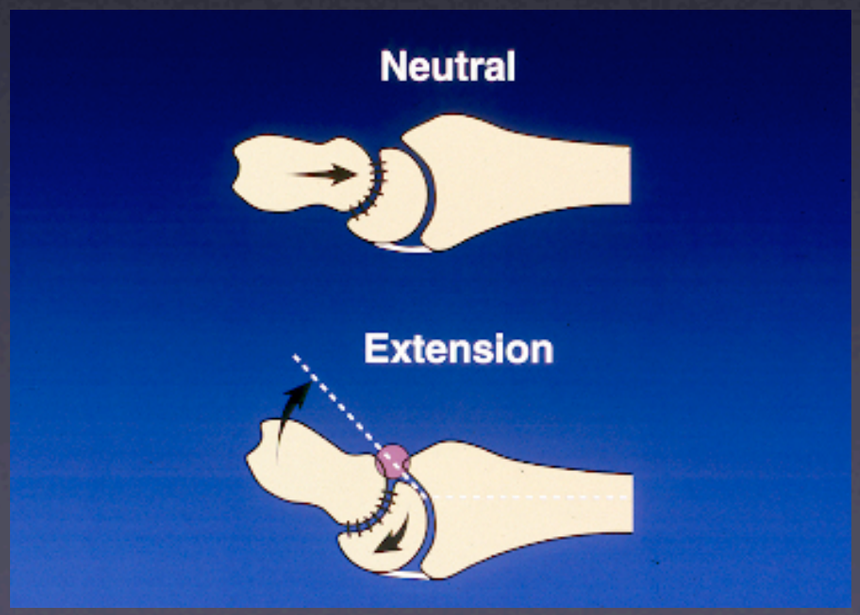
- SLAC treatment options
  - Wrist denervation
  - Radioscapholunate fusion
  - Proximal row carpectomy (PRC)
  - Scaphoid excision & 4-corner fusion

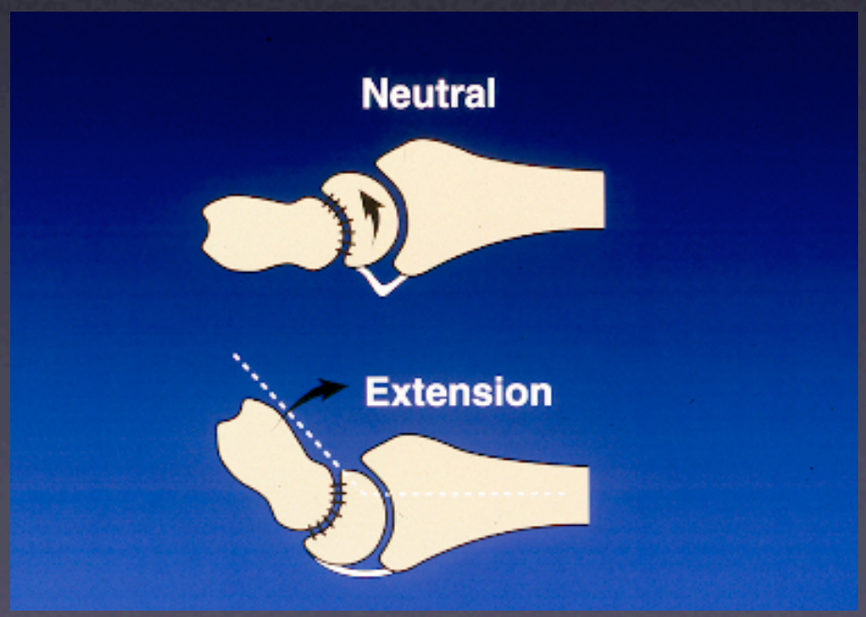
4-corner fusion

- Outcome- multiple studies
- Expected 50-70° (60-70%) flexion-extension and 40-50° (50-70%) radial-ulnar deviation, grip strength 70-80%
- Reliably decreases pain

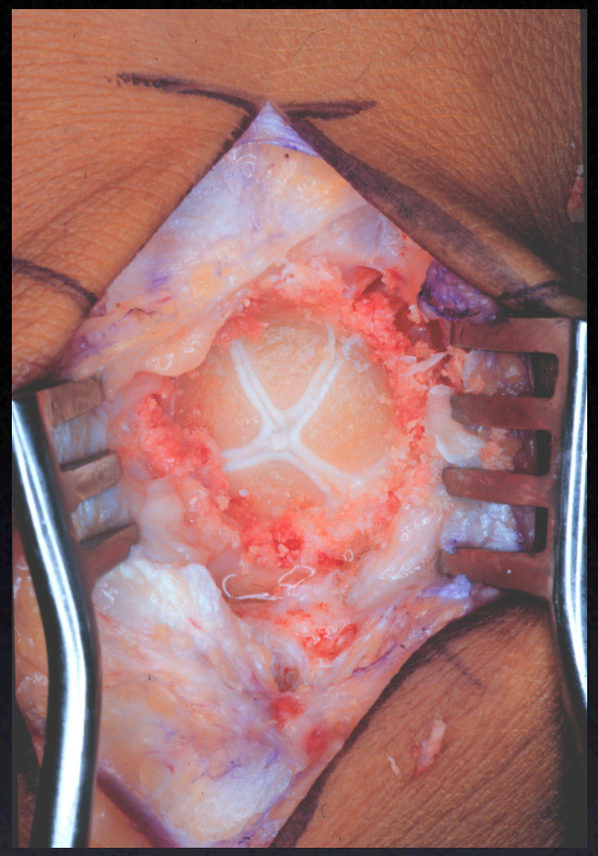


Must correct the DISI pattern to maximize wrist extension



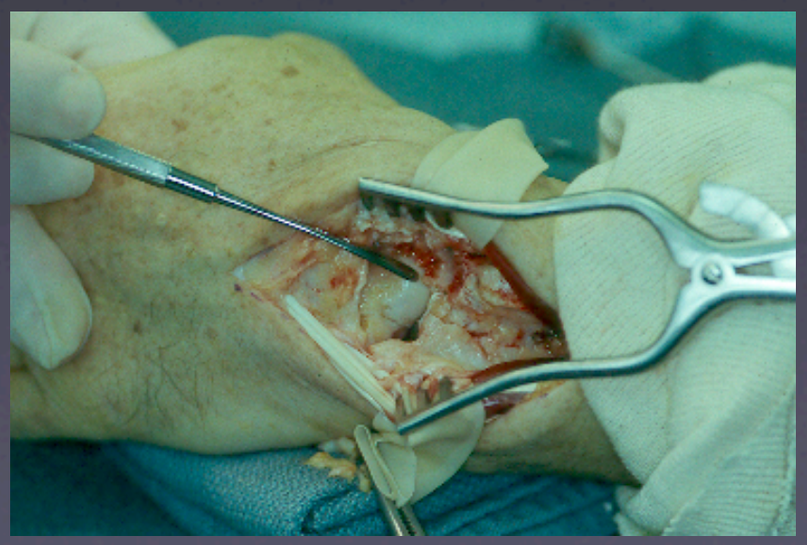


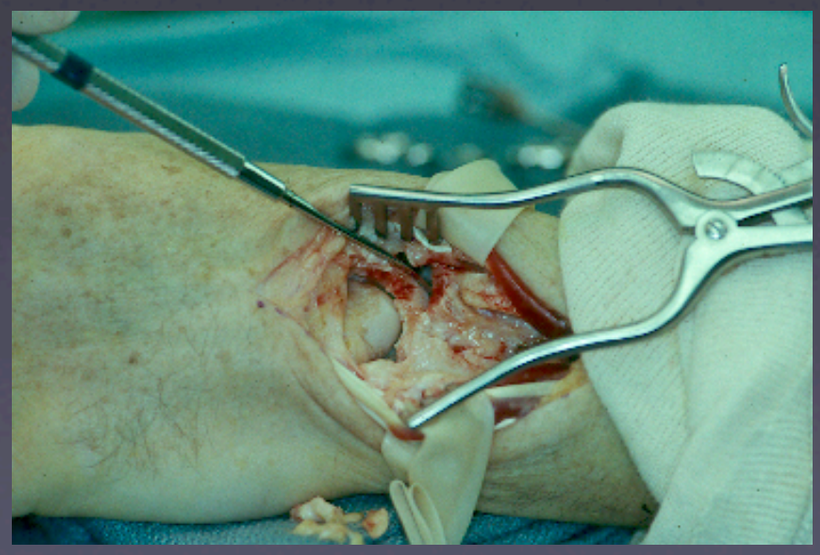
Cohen MS, Kozin SH. Proximal Row Carpectomy versus Scaphoid Excision and Four-Corner Arthrodesis. J Hand Surg 2001;26A:94-104.



Proximal row carpectomy

- In stages I & II
- Intact capitolunate joint ?
- Volar or dorsal incision



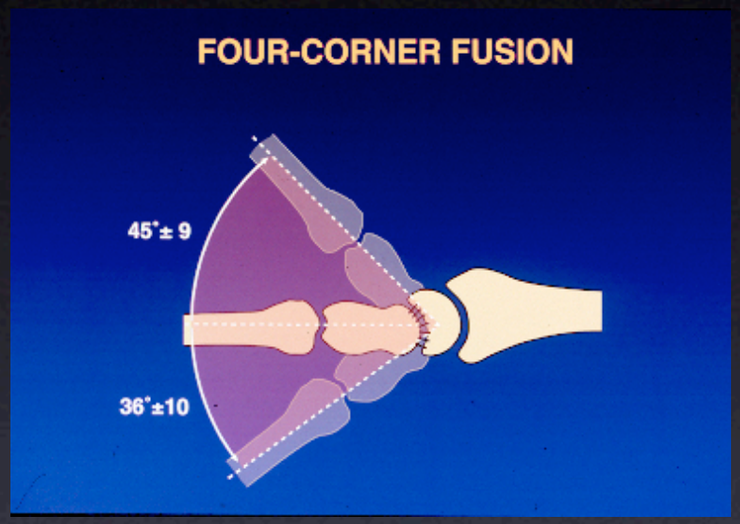


Proximal row carpectomy

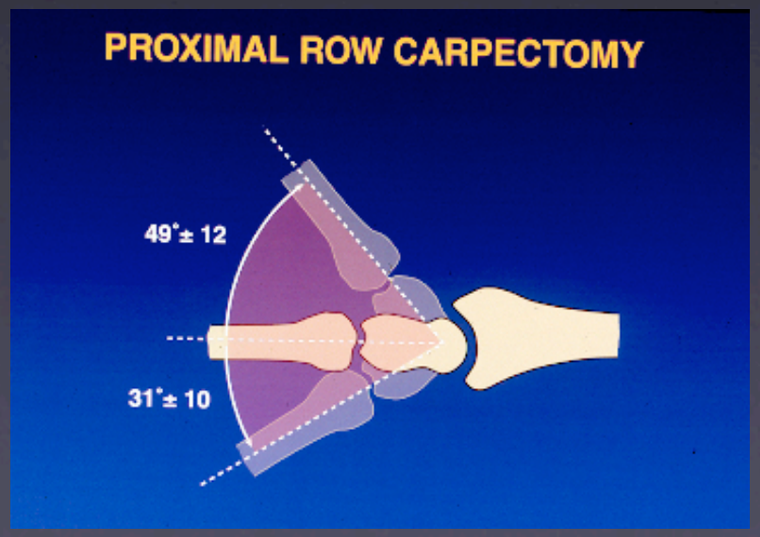
- Expected 50-70° (60-70%) flexion-extension and 20-40° (40-50%) radial-ulnar deviation, grip strength 70-80%
- Little to no radial deviation
- Mild x-ray changes over time, clinical results preserved

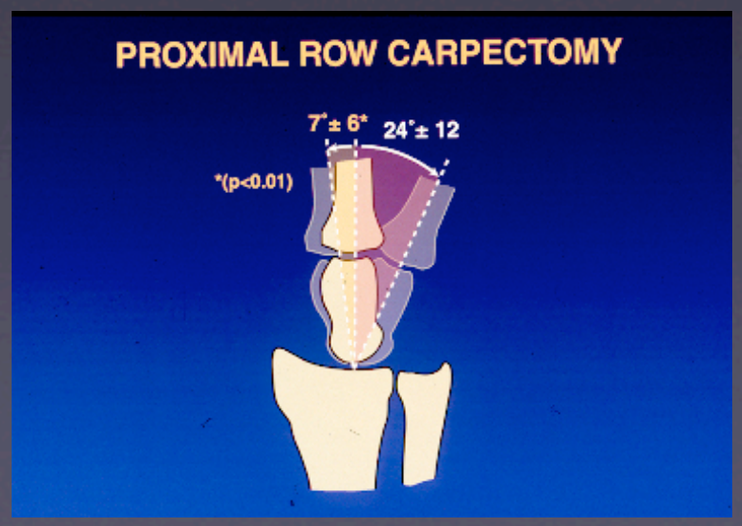
4-corner vs PRC

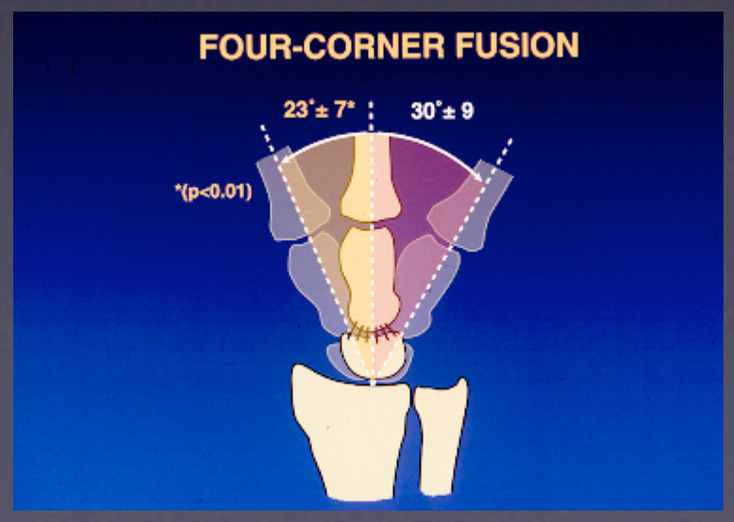
Temple University
19 Patients
Mean - 48 years
Follow-up - 17 months



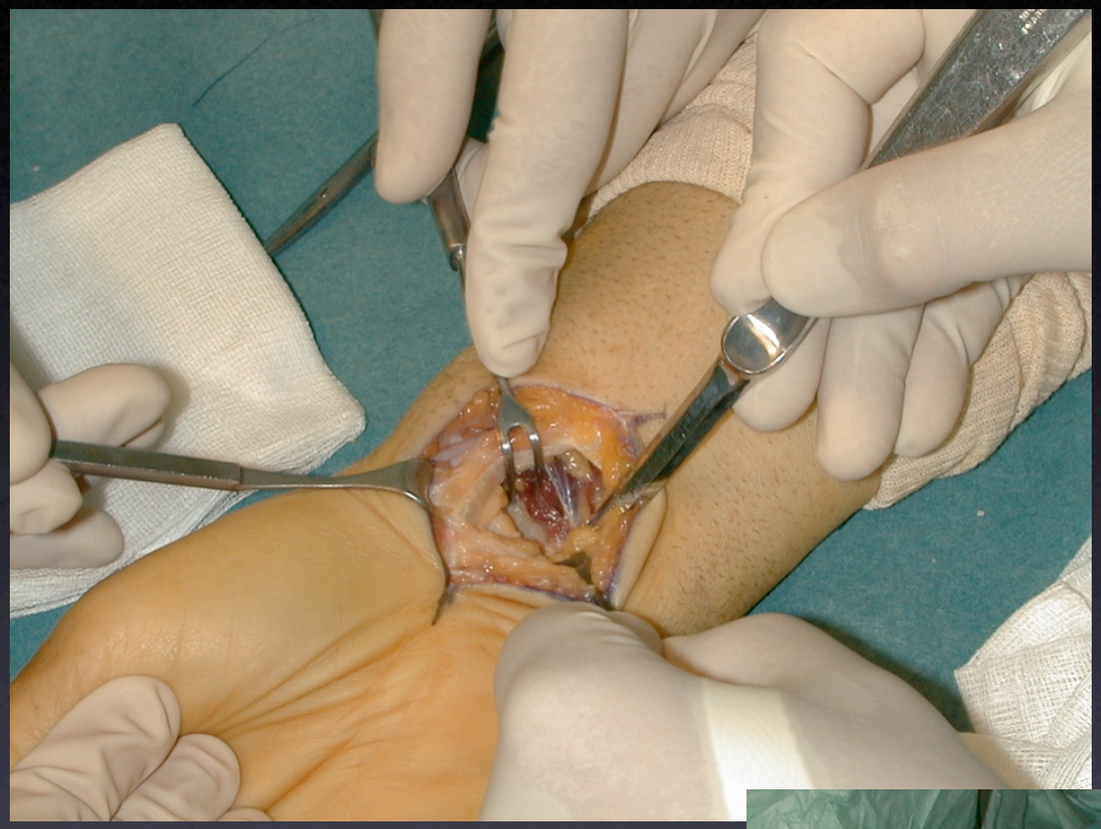
- Rush Medical Center
- 19 Patients
- Mean - 47 years
- Follow-up - 28 months

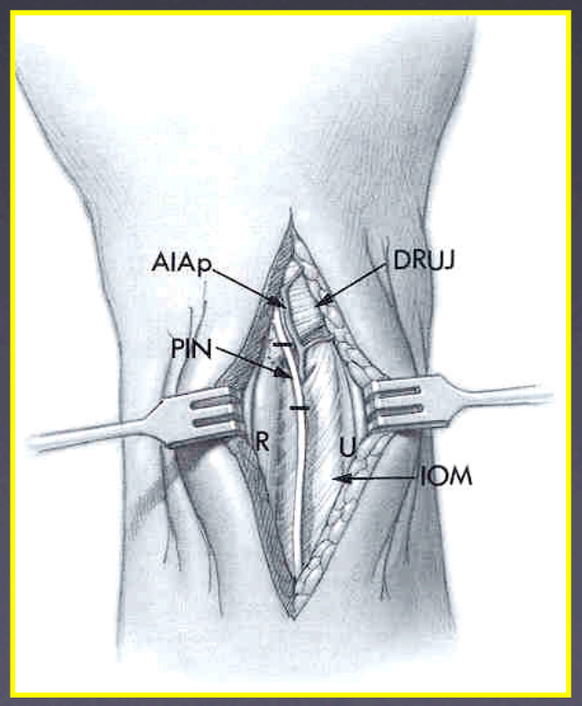




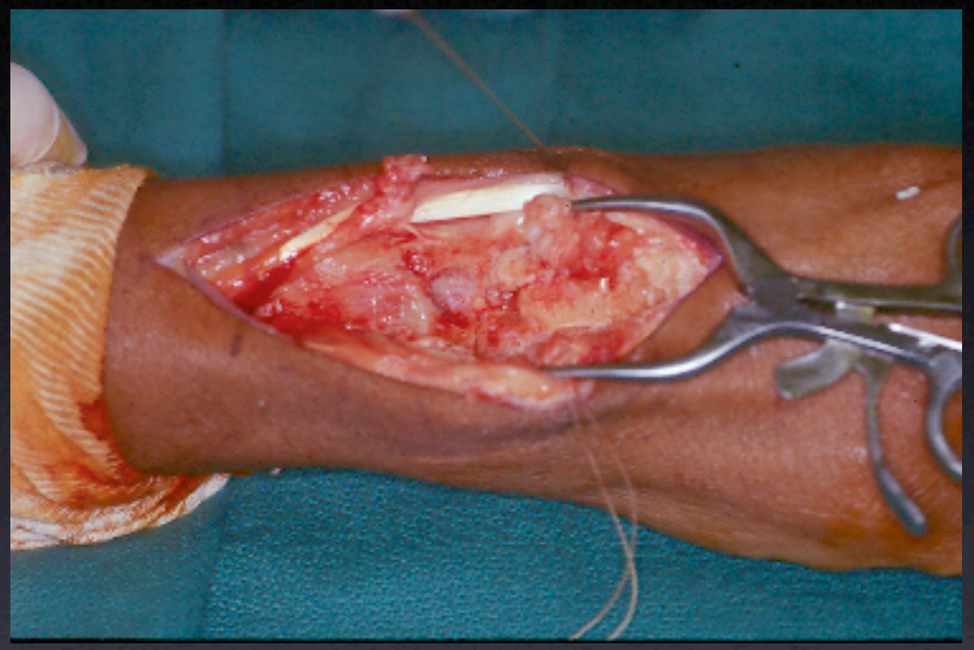


Wrist denervation





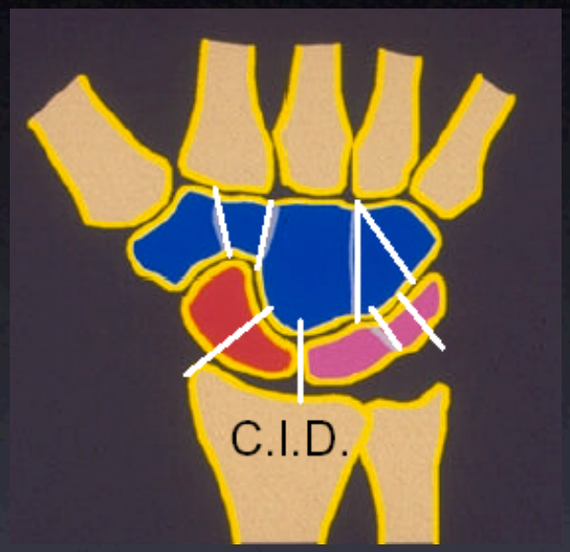
Wrist arthrodesis

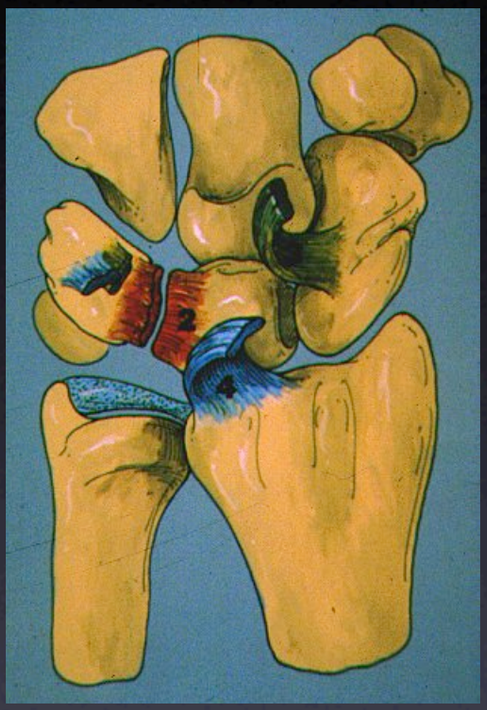


Hastings H et al. Arthrodesis of the wrist for traumatic disorders
J Bone Joint Surg 1996;78A:897-902.

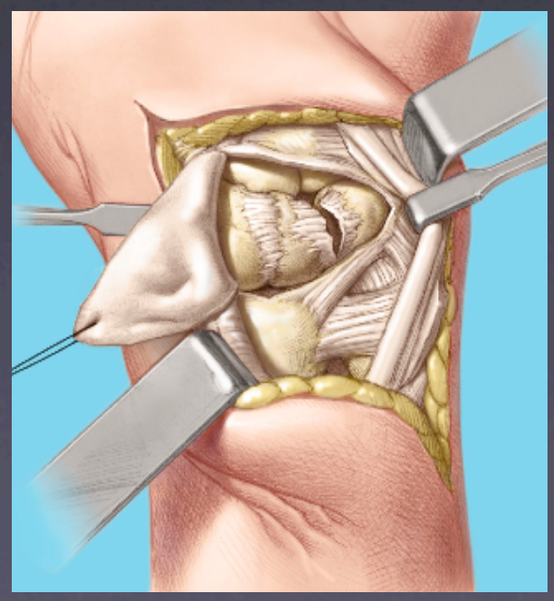
Partial	YES	YES	YES	YES	YES
Dynamic	no	YES	YES	YES	YES
2ary stabilizers	no	no	YES	YES	YES
Irreducible	no	no	no	YES	YES
Cartilaginous lesions	no	no	no	no	YES
	K-Wires Nothing	Bone-lgt -bone, lgt suture	Ligamento plasty	4-corner, PRC	Fusion

Lunotriquetral instability

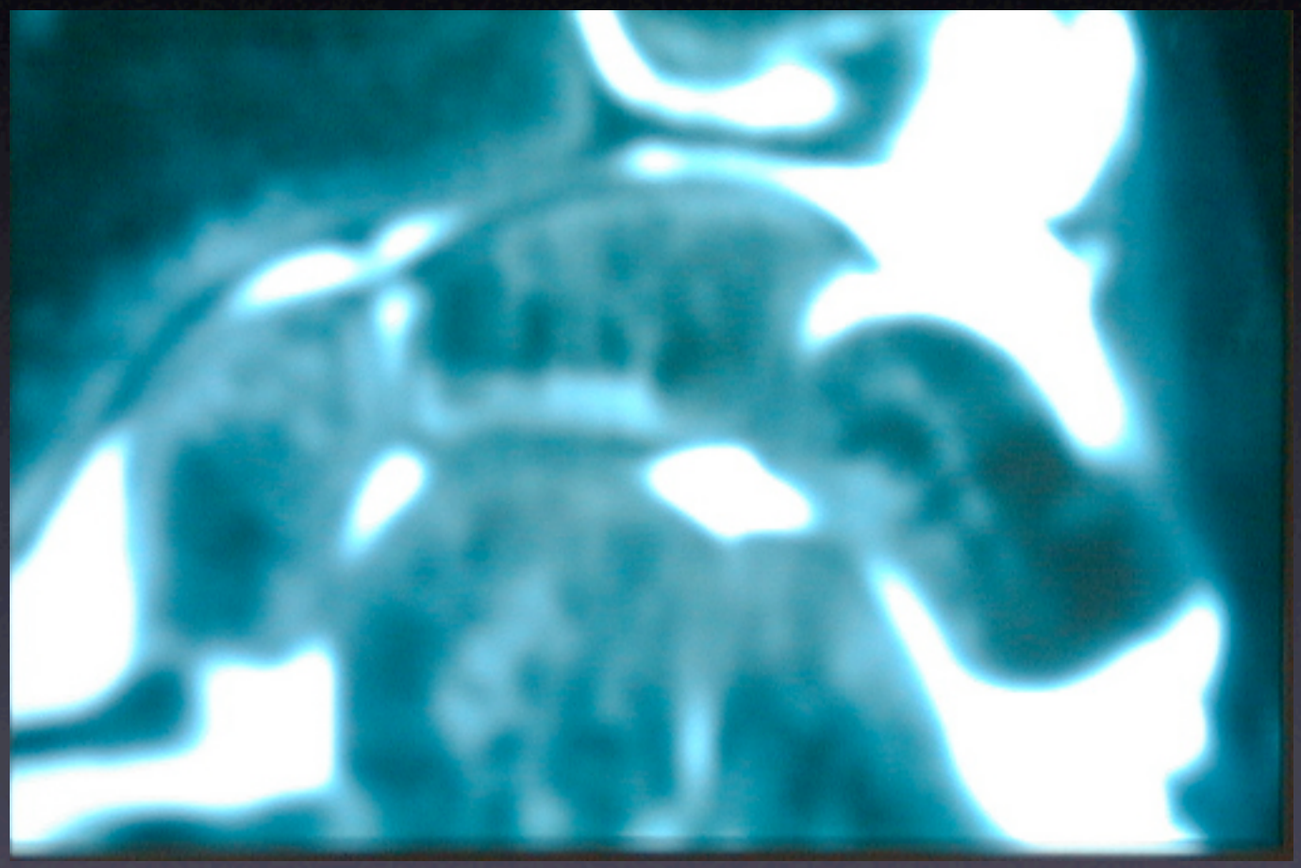


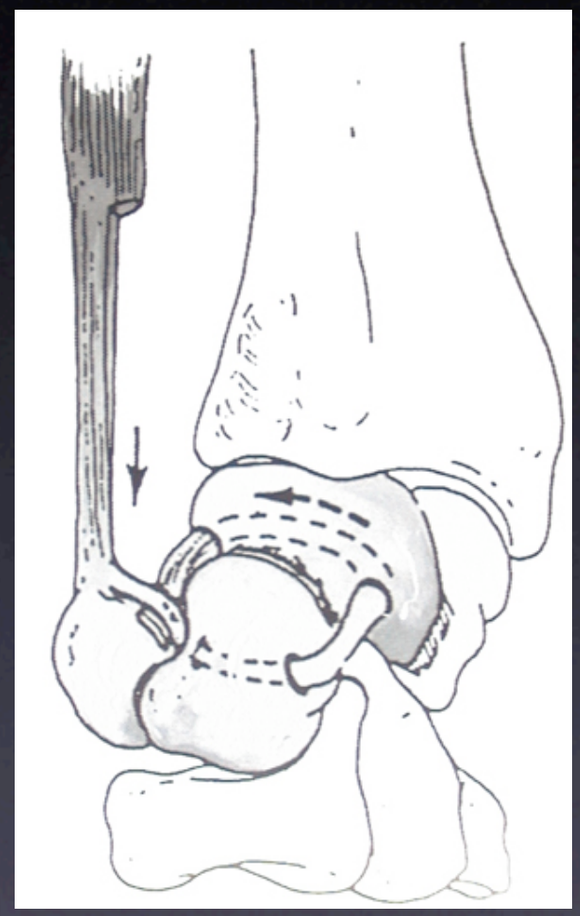


- Less symptomatic
- Do not evolve to a VISI type deformity, unless the dorsal radiotriquetral ligament is also torn

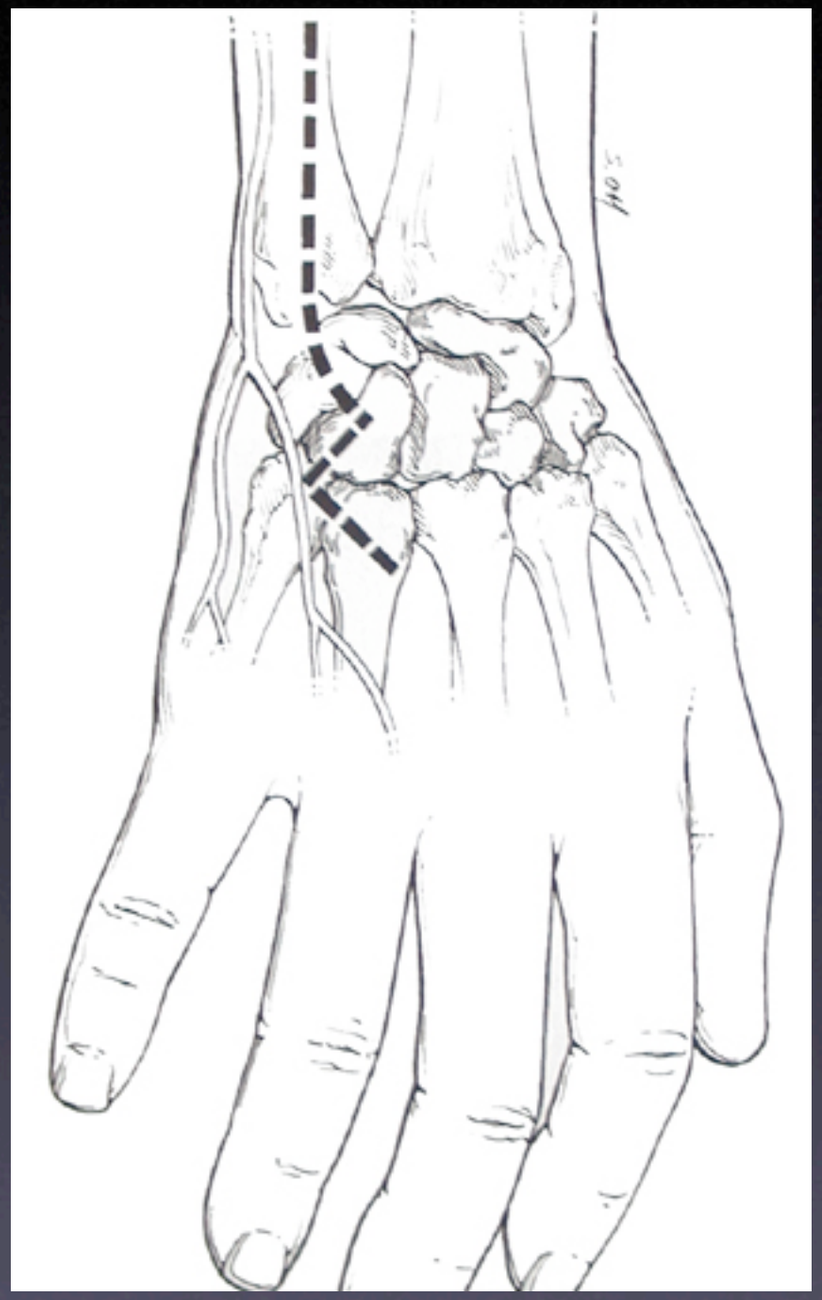


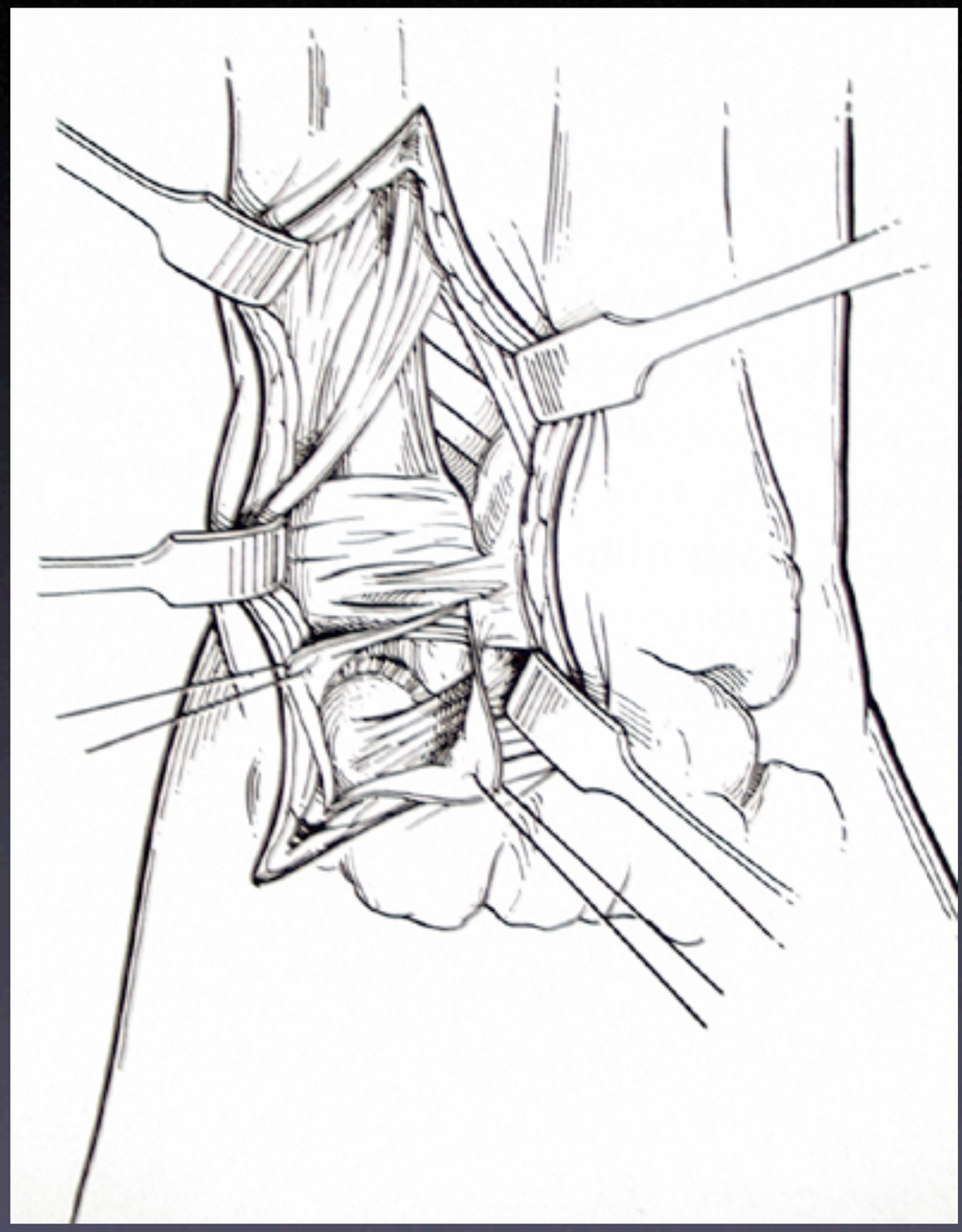
Lunotriquetral instability treatment

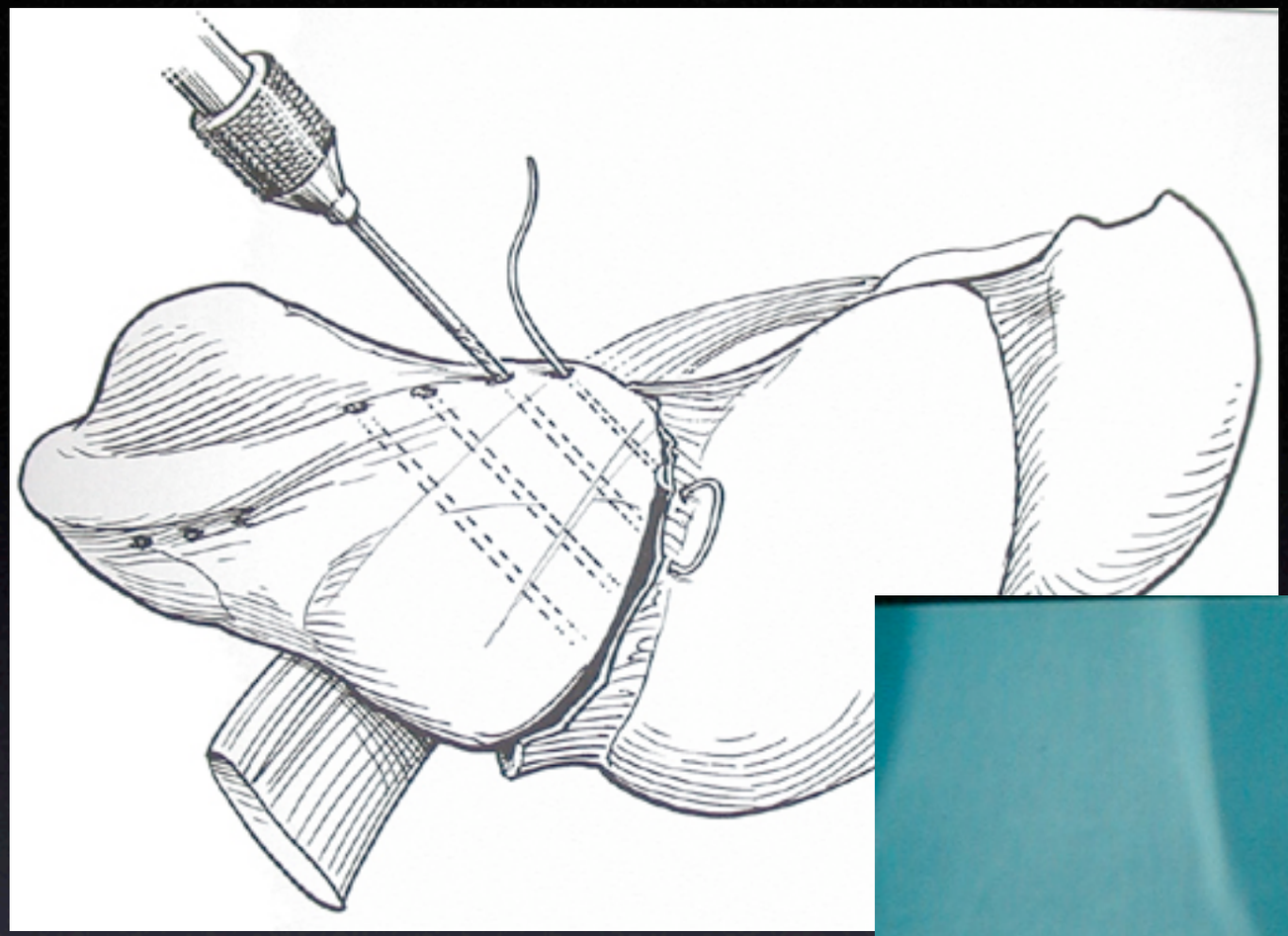


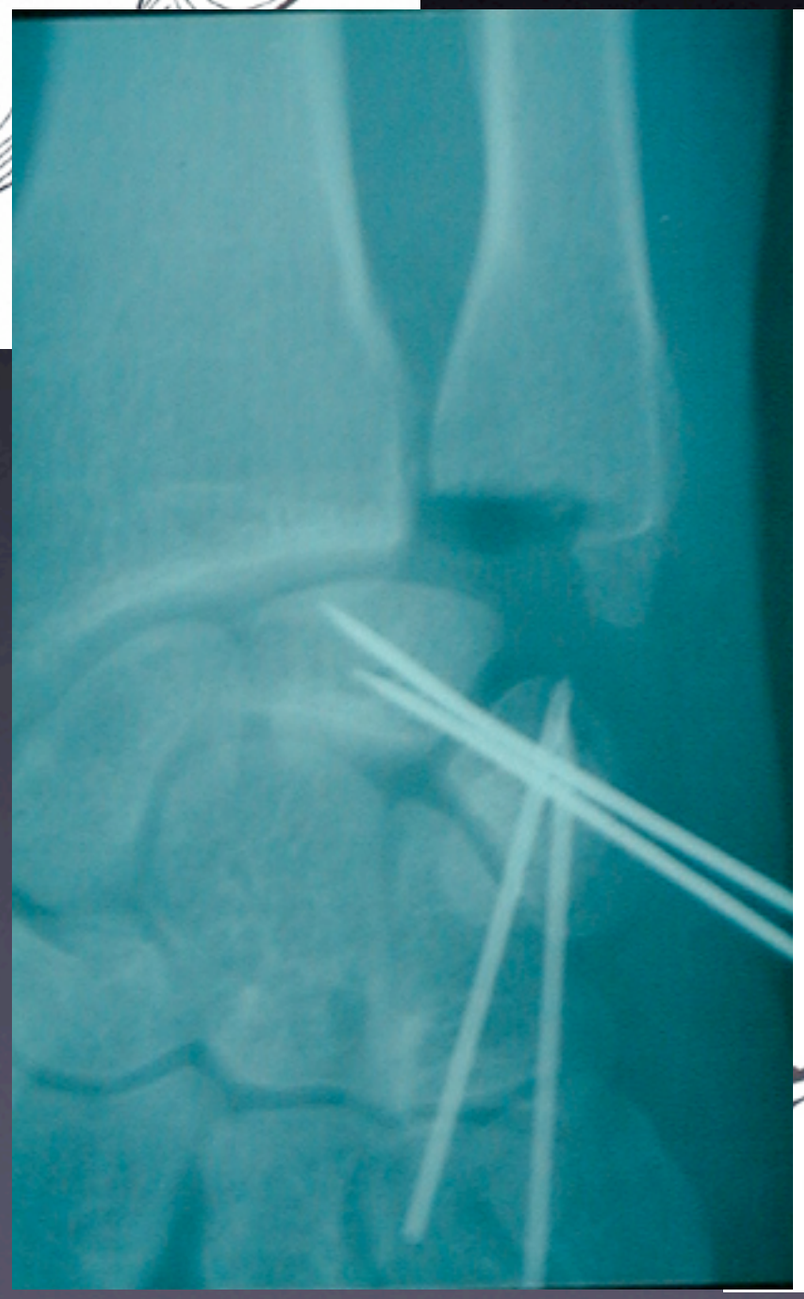


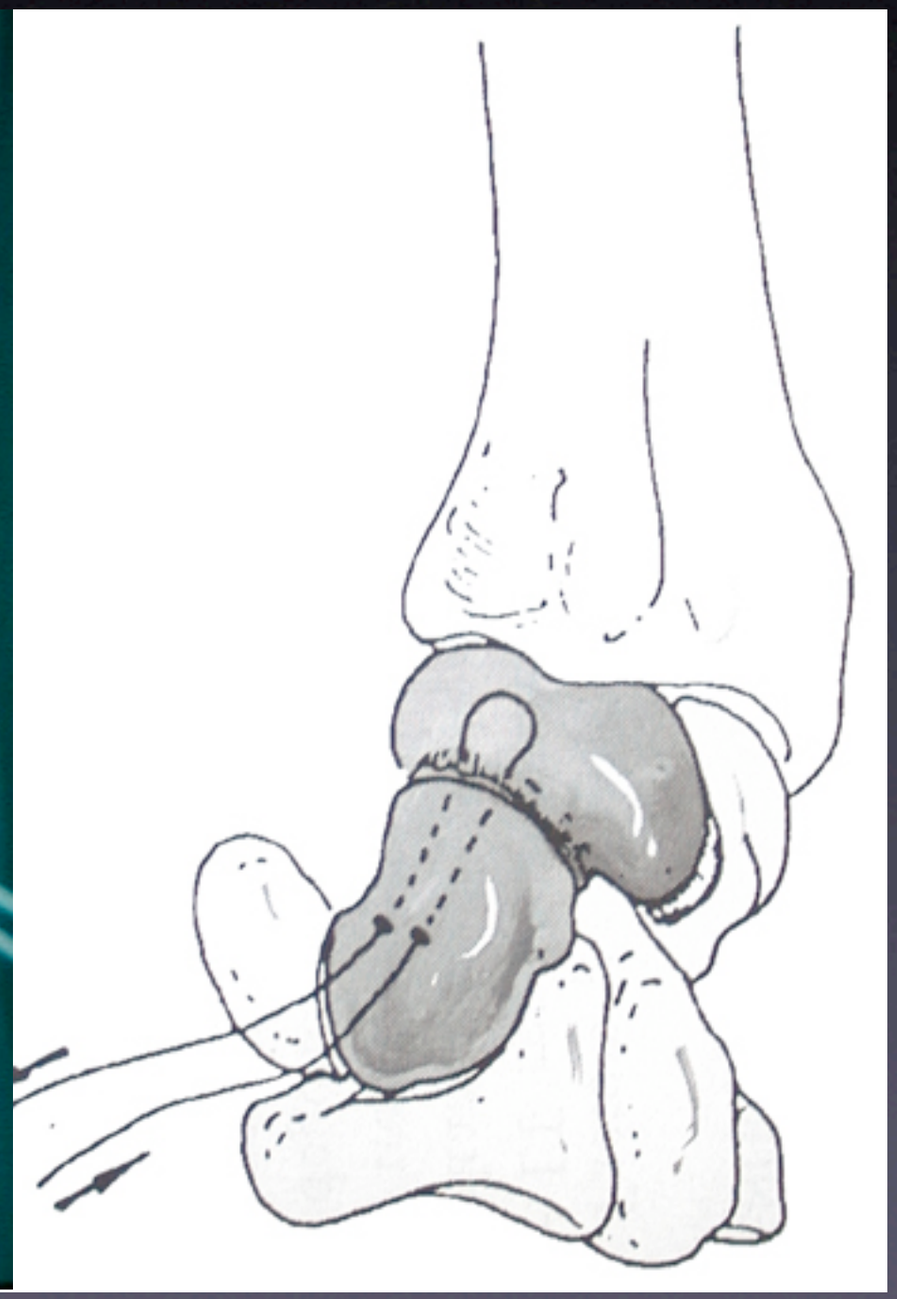
- Ligamentoplasty
- Lunotriquetral fusion

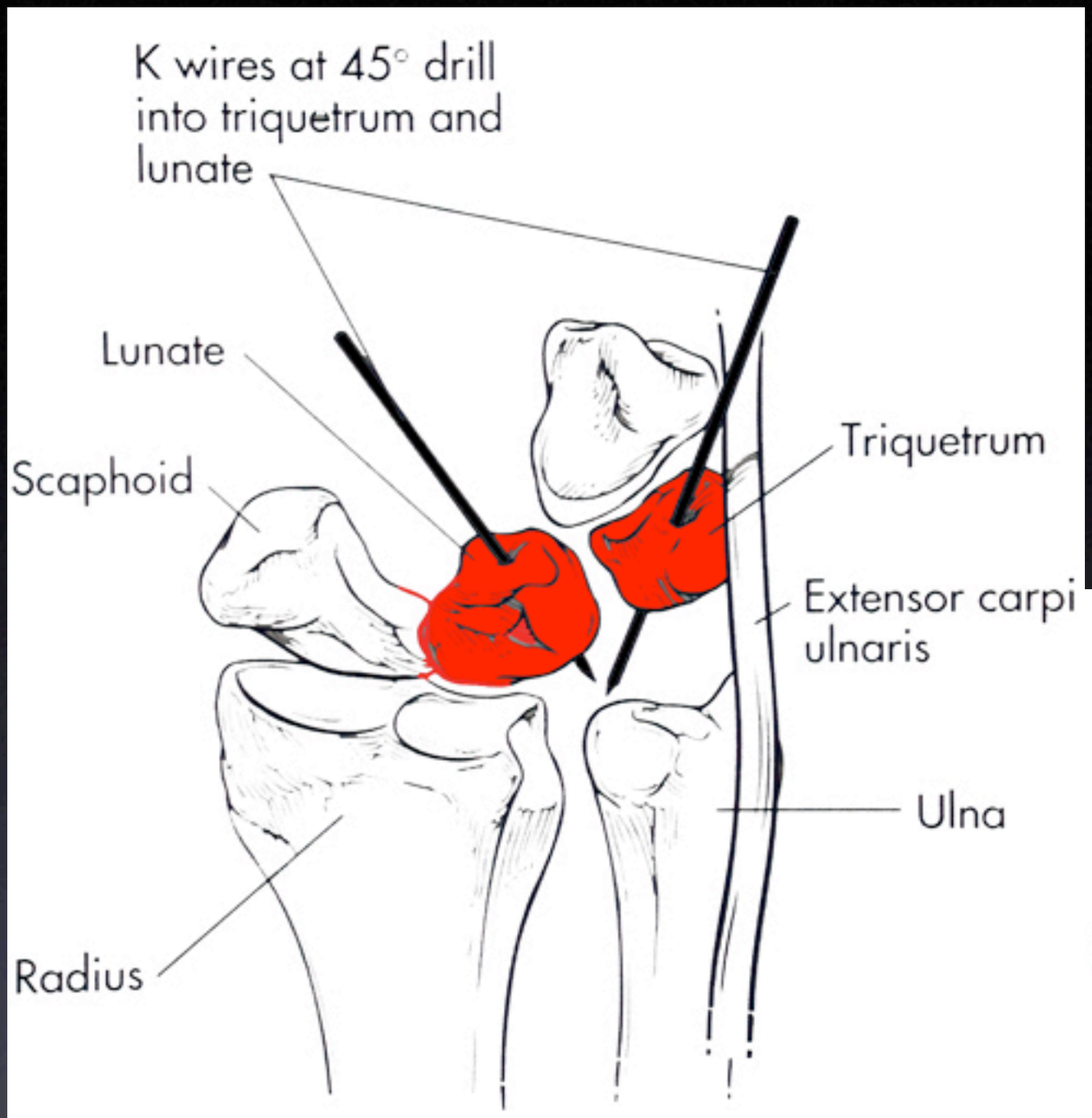


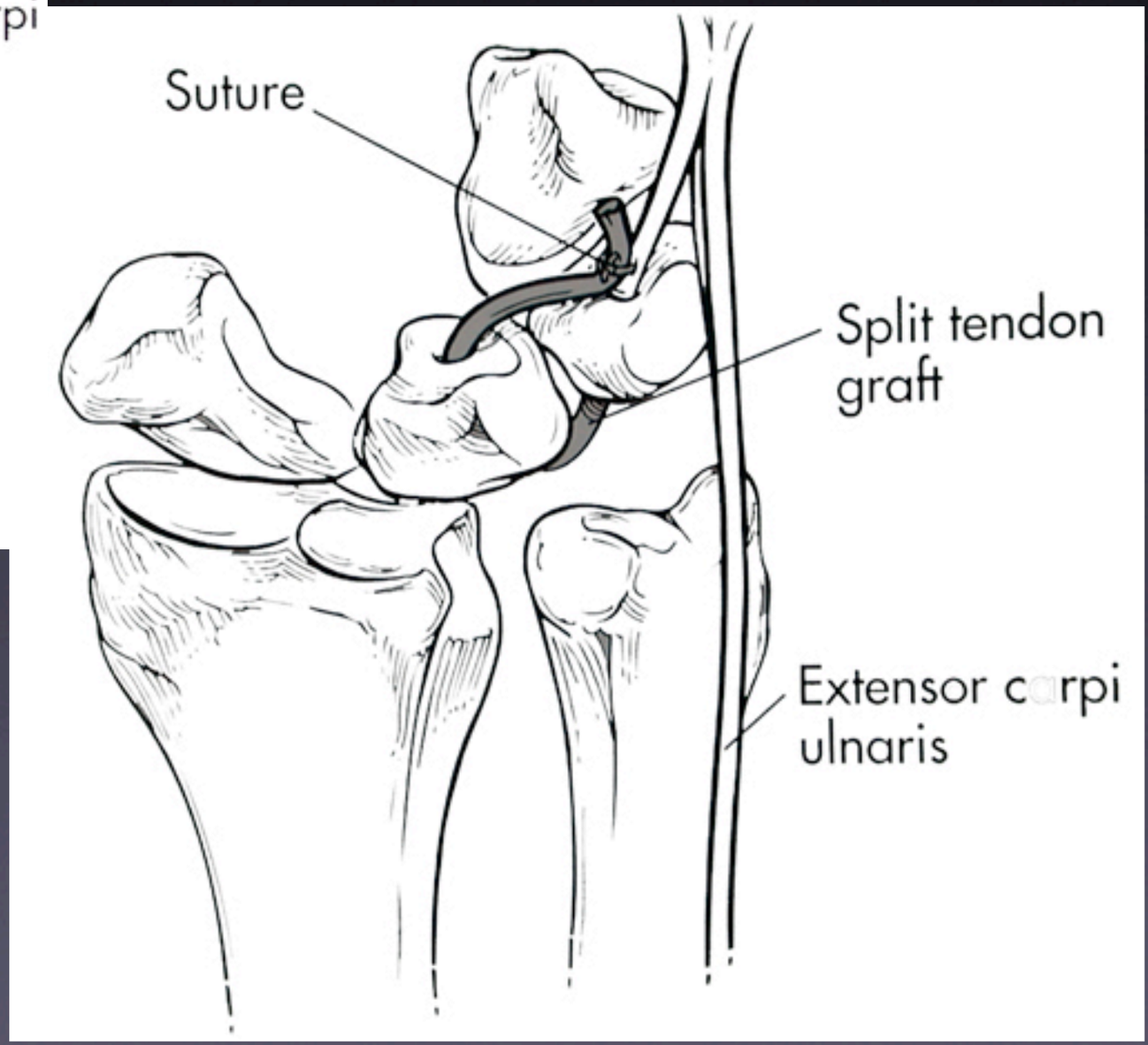




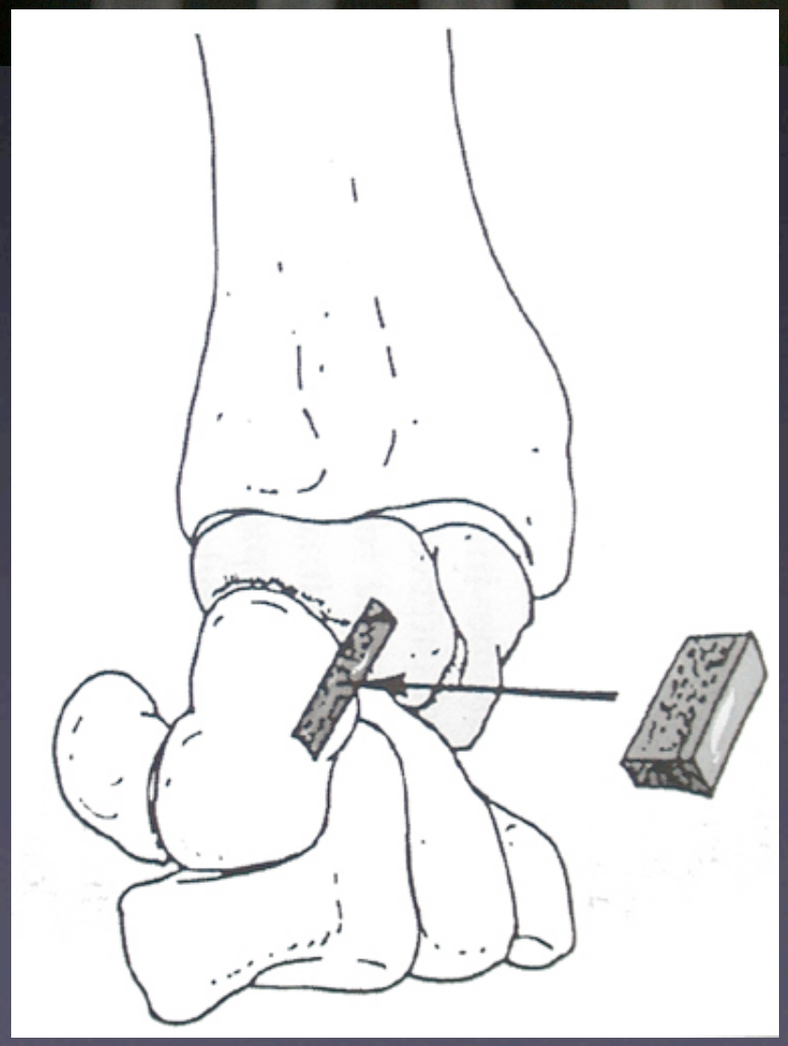





K wires at 45° drill into triquetrum and lunate
Lunate
Scaphoid
Triquetrum
Extensor carpi ulnaris
Ulna
Radius


Suture
Split tendon graft
Extensor carpi ulnaris

Although logical, up to 25% non-union rate has been reported



Midcarpal instability

- The less understood carpal instability
- 2 types (at least)
  - Radial type (STT instability)
  - Ulnar type

Conclusion (1)

- Wrist instability is a wild and mostly unknown world
- The scapholunate instability is the most frequent and most debilitating carpal instability.
- Diagnosis is difficult in early stages and requires sophisticated imaging techniques and/or arthroscopic evaluation

Conclusion (2)

- Many techniques have been developed but their indications should be discussed according to the extent of the lesions and patient's expectations