

Der ulnokarpale Komplex

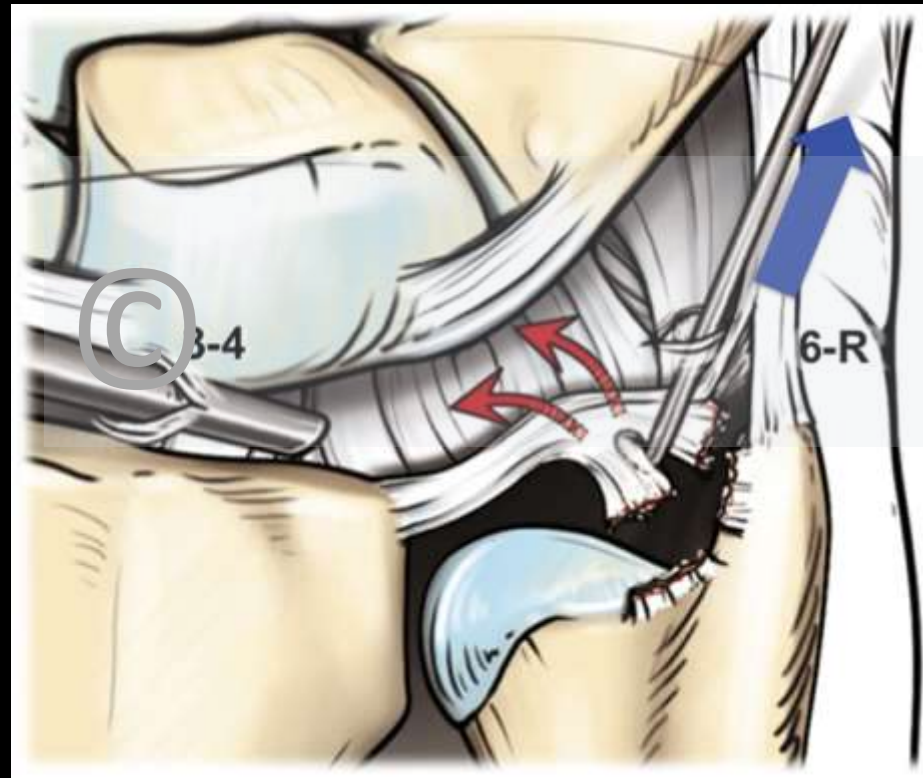
Neue klinische und radiologische Überlegungen

Schmitt R

msk-wissen

13.-14.07.2018

München



*Originalzeichnung aus A. Atzei,
Hand Clinics 2011*



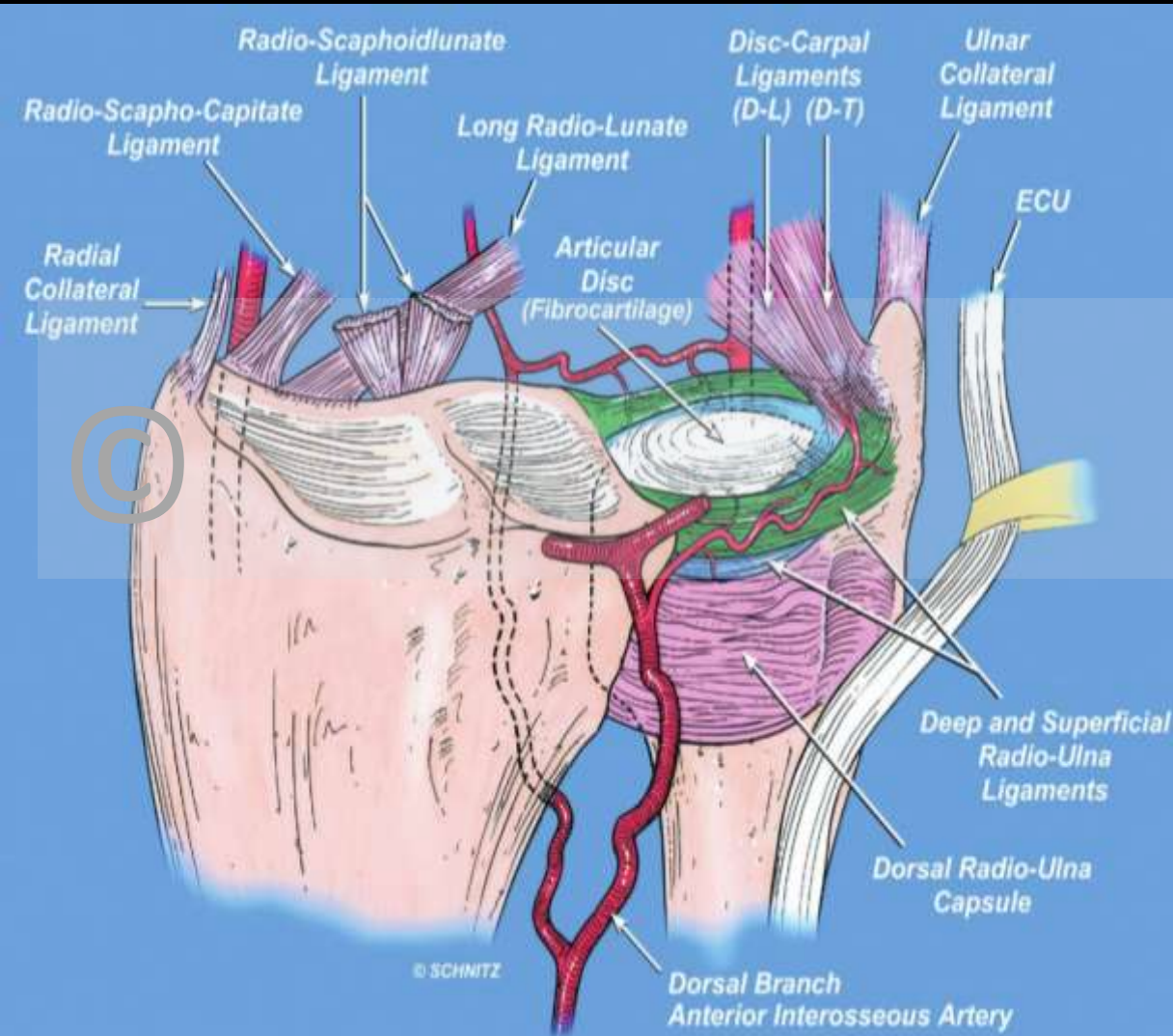
RHÖN-KLINIKUM
Campus Bad Neustadt
Medizinische Exzellenz aus Tradition

Uniklinikum
Würzburg



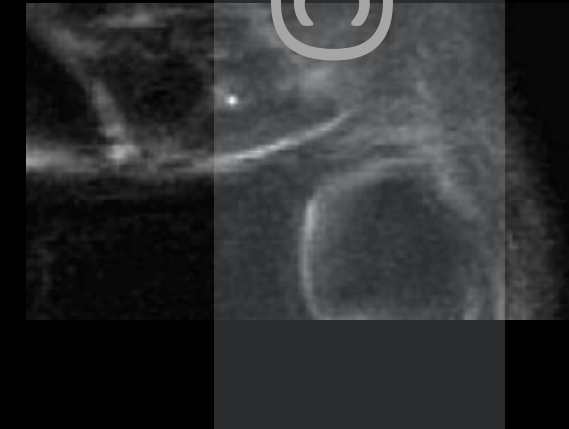
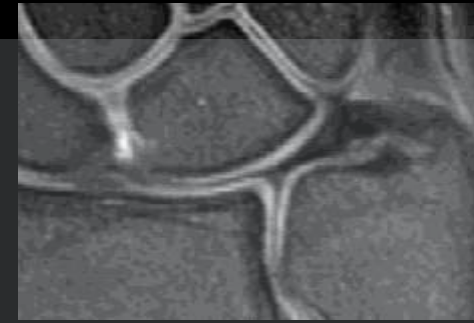
msk | wissen

Gesellschaft zur Förderung des Wissenstransfers
in der muskuloskelettalen Radiologie



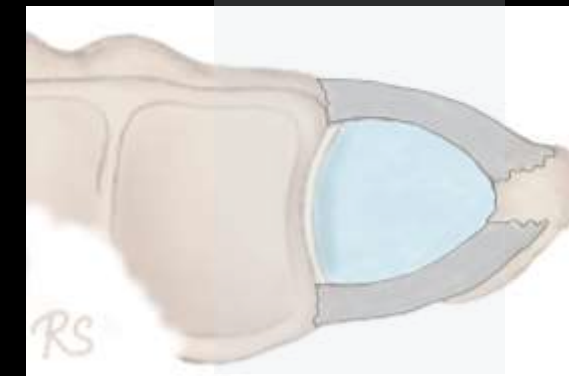
Ursprung am Radius avaskulär

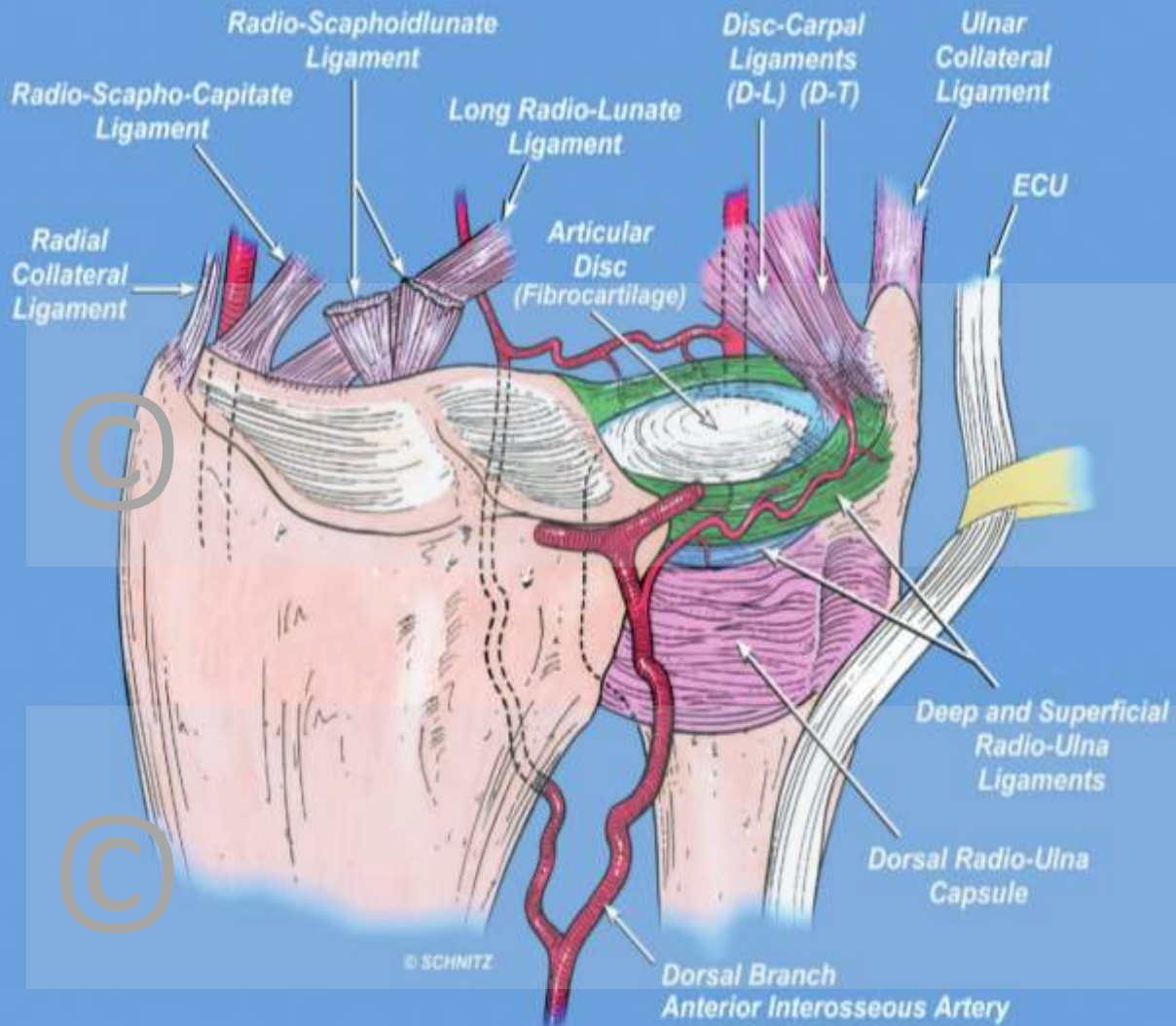
- Diskus vom Gelenknorpel der Incisura ulnaris radii
- Ligg. radioulnaria direkt vom Kortex des Radius



Diskuskörper

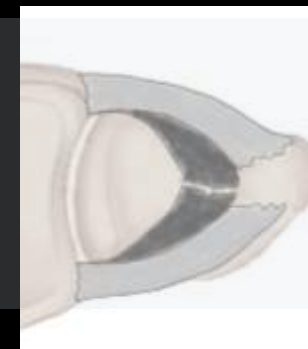
- bikonkav
- dreieckförmig, zum PSU konvergierend
- bradytroph, avaskulär





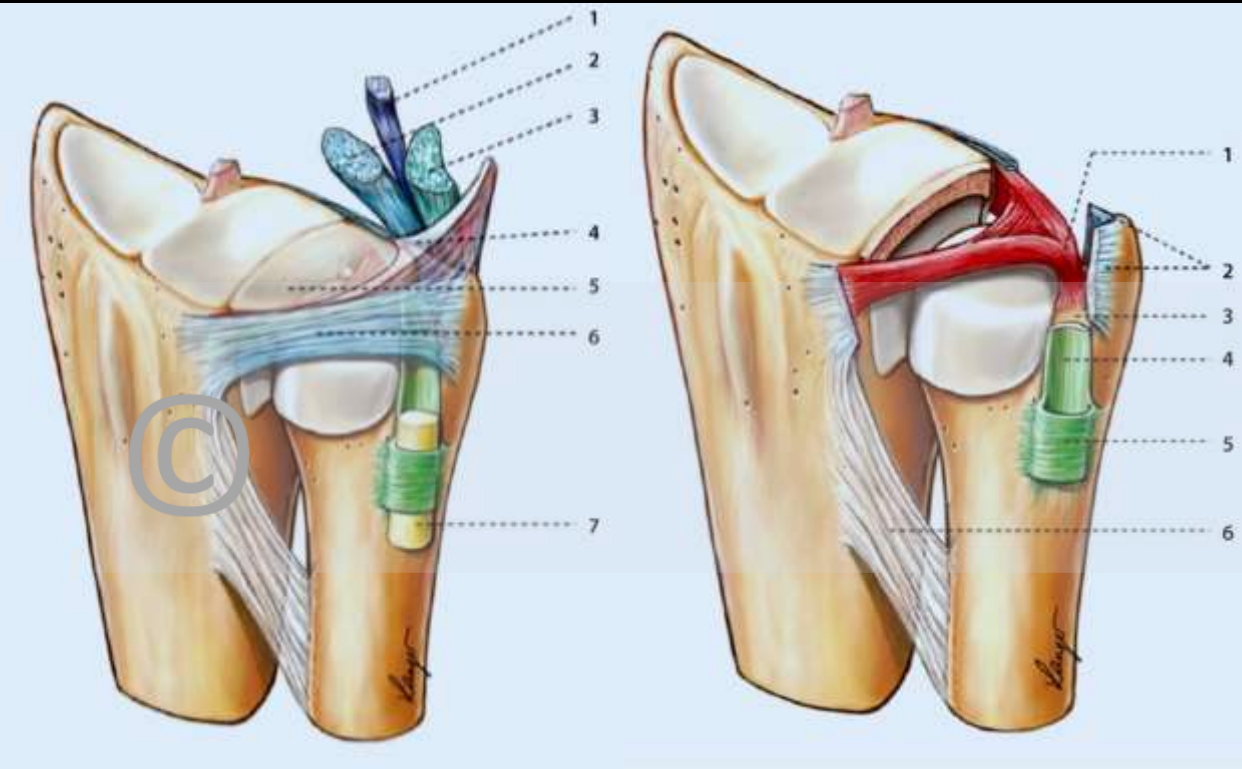
Ansätze am Ulnakopf vaskularisiert

- tiefes TFCC-Blatt an Fovea capitis ulnae – Stabilisator !
- oberflächliches TFCC-Blatt am Proc. styloideus ulnae



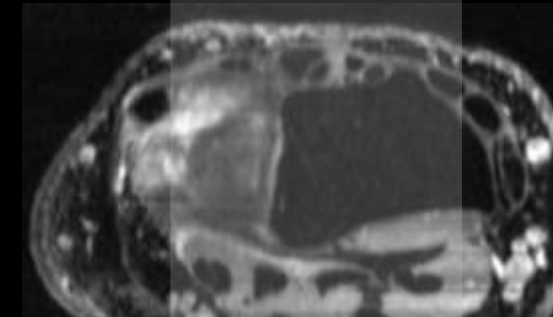
Peripherie vaskularisiert

- Ligg. radioulnaria (tief / oberflächlich)
- Meniscus homologue
- Lig. collaterale ulnare
- Ligg. ulnolunatum und ulnotriquetrum
- ECU-Sehnsenscheide



MRT vom 12.07.2018

Ulnarer Schmerz nach Extensions-Supinations-Trauma



4 = Meniscus homologue

5 = Discus ulnocarpalis

6 = Lig. radioulnare dorsale

7 = ECU-Sehne

1 = tiefes TFCC-Blatt („Lig. subcruentum“)

2 = oberflächl. TFCC-Blatt (reseziert)

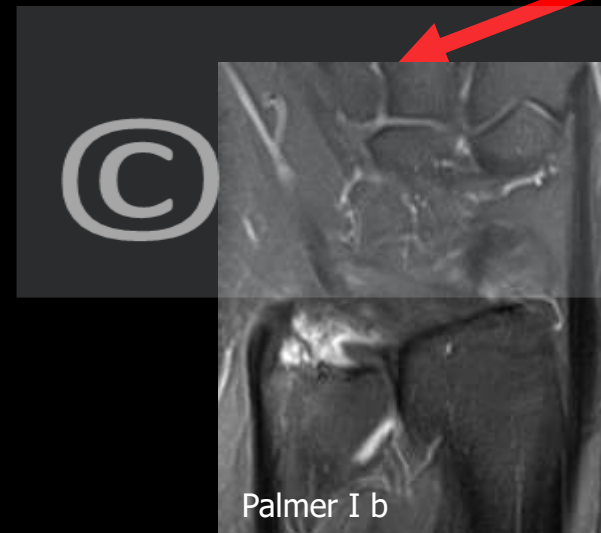
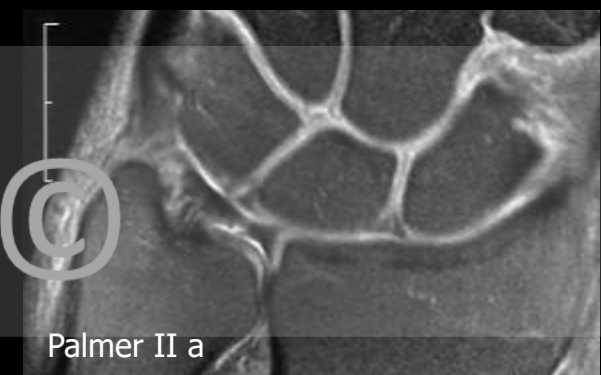
3 = Fovea capitis ulnae

4 = ECU-Sehnscheide

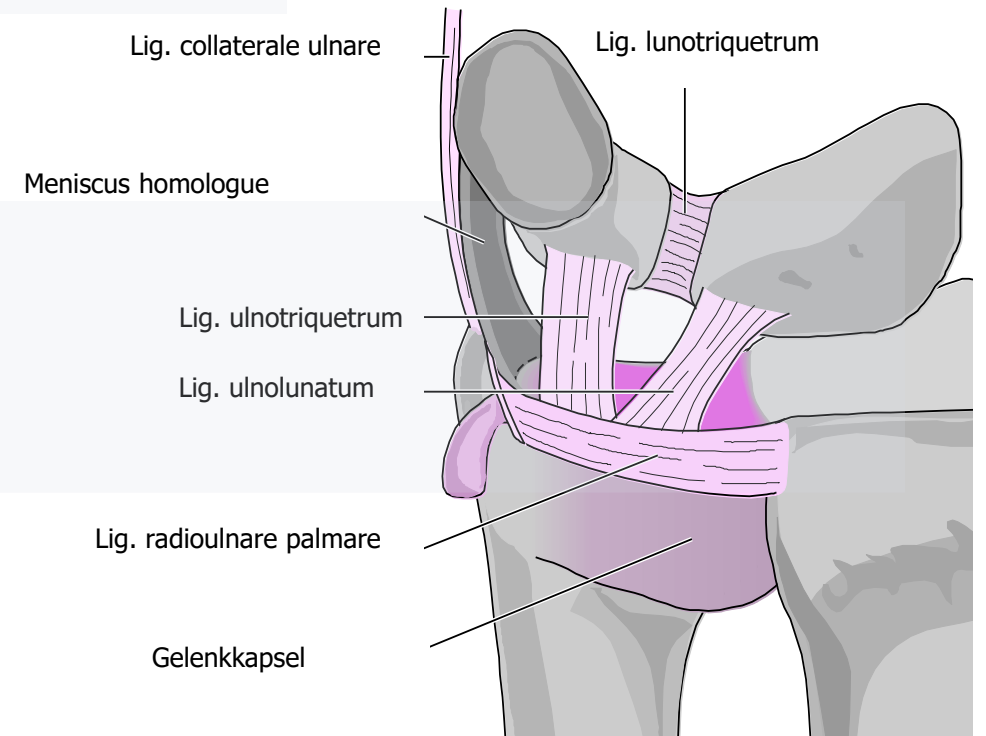
- tiefes TFCC-Blatt intakt
- oberflächl. TFCC-Blatt mit Partialruptur
 - palmares RUL intakt
 - dorsales RUL mit Enhancement

aus: Spieß, Orthopäde 2018

MRT-Techniken am TFCC



Kontrast	Zentrum	Peripherie
T2 - intrinsisch	XX	X
T1 - i.v.Gadolinium	-	XX
T1 - MR-Arthro	XXX	XXX



MRT-Sequenzen

1.5 oder 3 Tesla, 16-Kanal-Phased-array-Spule

FoV 80 mm, Matrix 320 x 320

ceMRT

T1 FSE	nativ	koronal	2 mm
PD FSE fs	nativ	koronal	2 mm
PD FSE fs	nativ	axial	2 mm
T1 FSE fs	Gad i.v.	koronal	2 mm
T1 FSE	Gad i.v.	sagittal	3 mm
3D-DESS	(Gad i.v.)	koronal	0.5 mm
		Rekon axial + radiär	0.5 mm

MR-Arthro

T1 FSE	n. Arthro	koronal	2 mm
T1 FSE fs	n. Arthro	koronal	2 mm
PD FSE fs	n. Arthro	koronal	2 mm
PD FSE fs	n. Arthro	axial	2 mm
3D-DESS	n. Arthro	koronal	0.5 mm
		Rekon axial + radiär + sagittal	0.5 mm

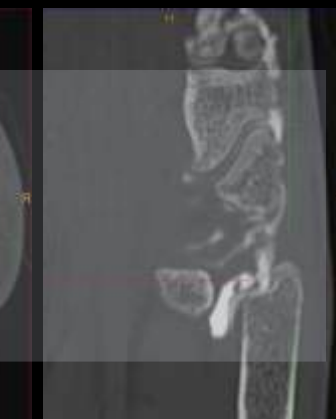
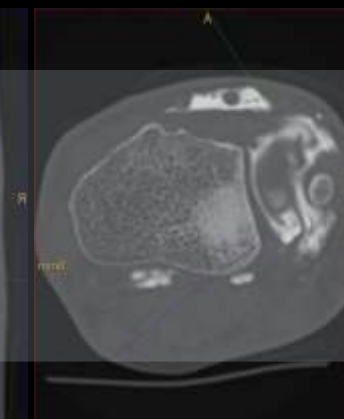
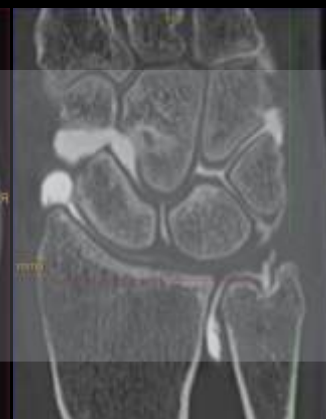
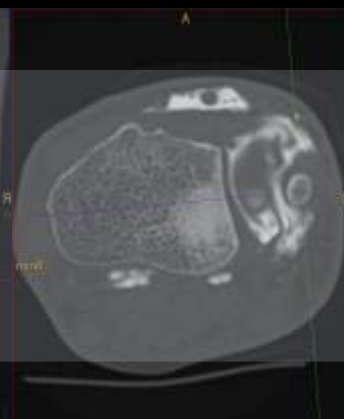
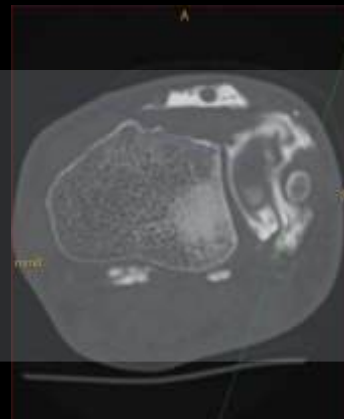
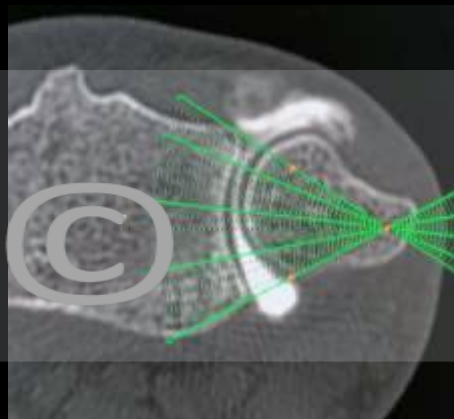
2D- und 3D-Techniken am TFCC

Methode	Schichtdicke	MPR
Kontrastverstärkte MRT	2.0 mm	--
MR-Arthrographie	0.5 mm	orthogonal + radiär
CT-Arthrographie	0.625 mm	orthogonal + radiär

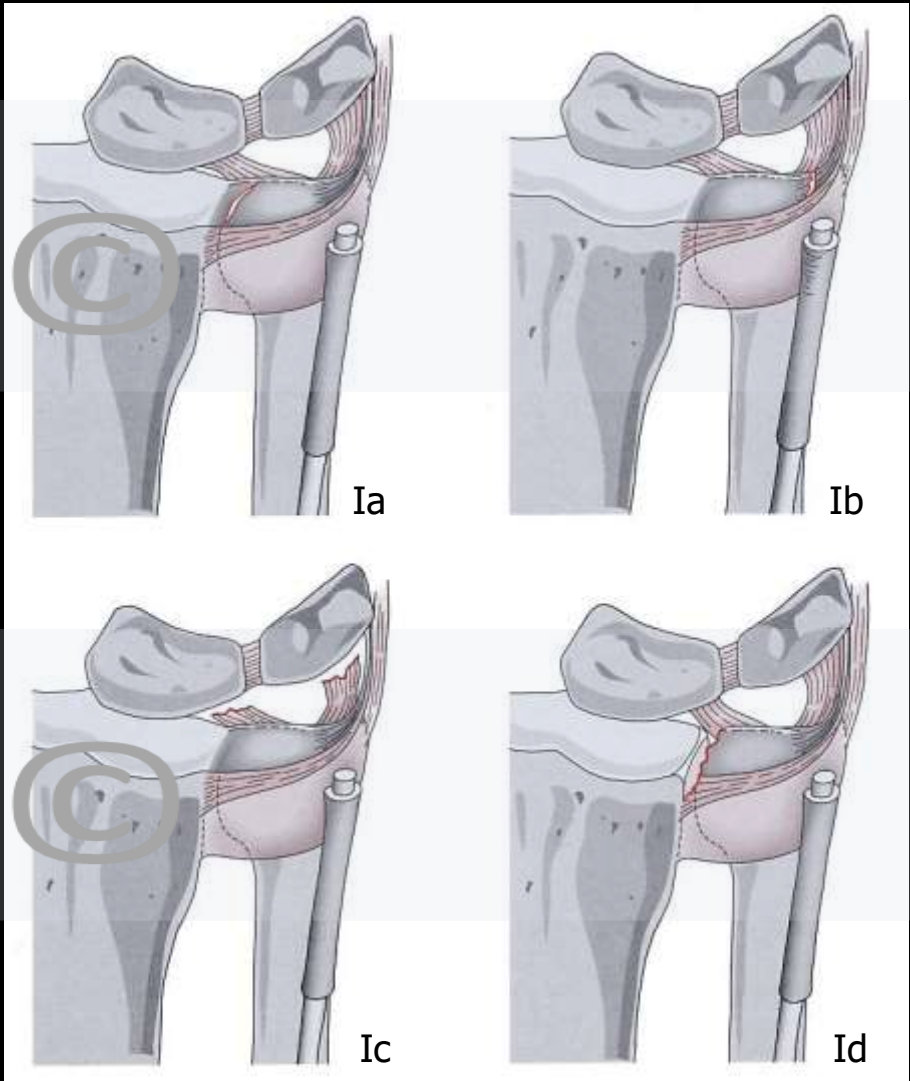


Rekonstruktionen

- MPR in den orthogonalen Raumebenen
- radiale MPR mit Zentren in der Fovea capitis ulnae und im Proc. styloideus ulnae

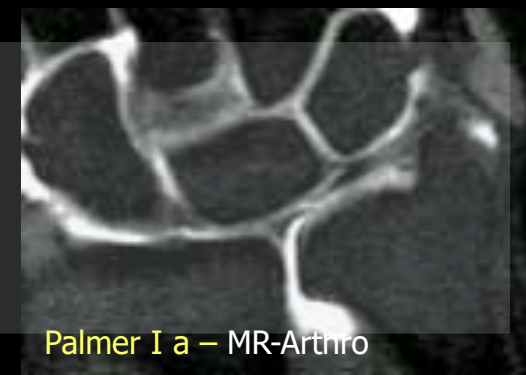


Traumatische TFCC-Läsionen - Palmer-Klasse I

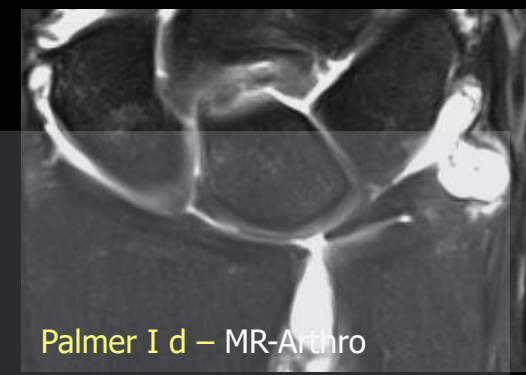


Typ Pathologie

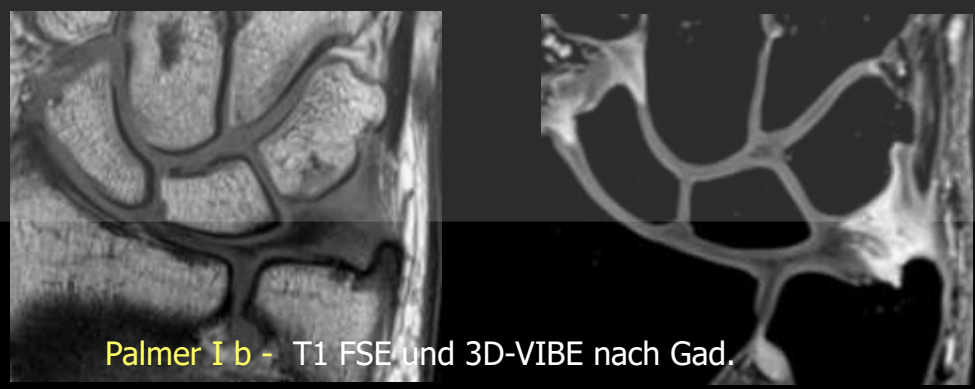
Ia	Längsriss zentral
Ib	Abriss ulnar
Ic	Abriss Lig. ulnolunatum / -triquetrum
Id	Abriss radial



Palmer I a – MR-Arthro

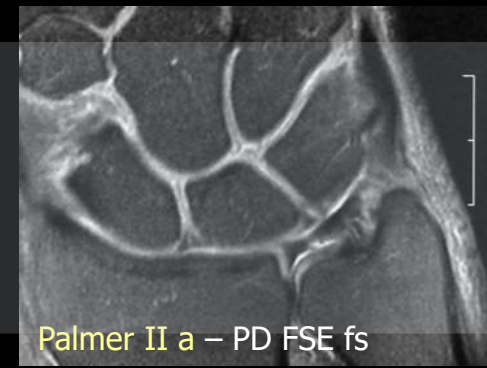
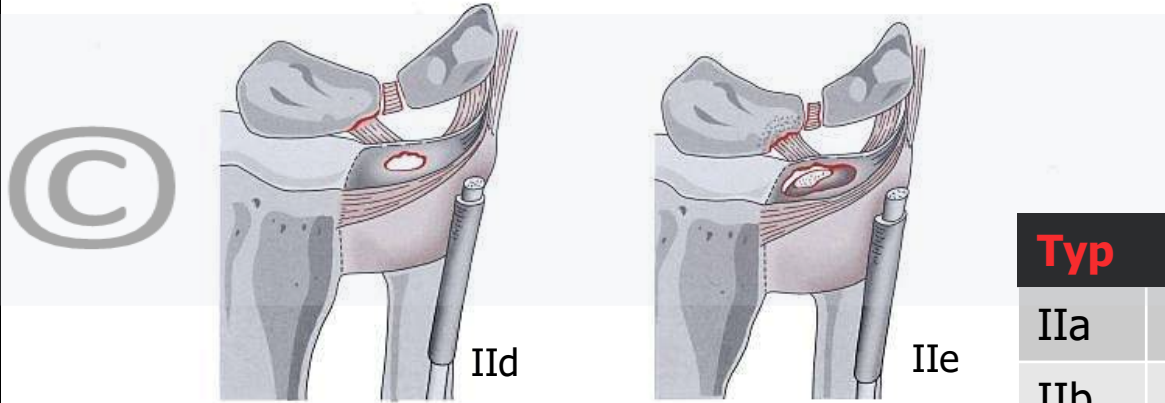
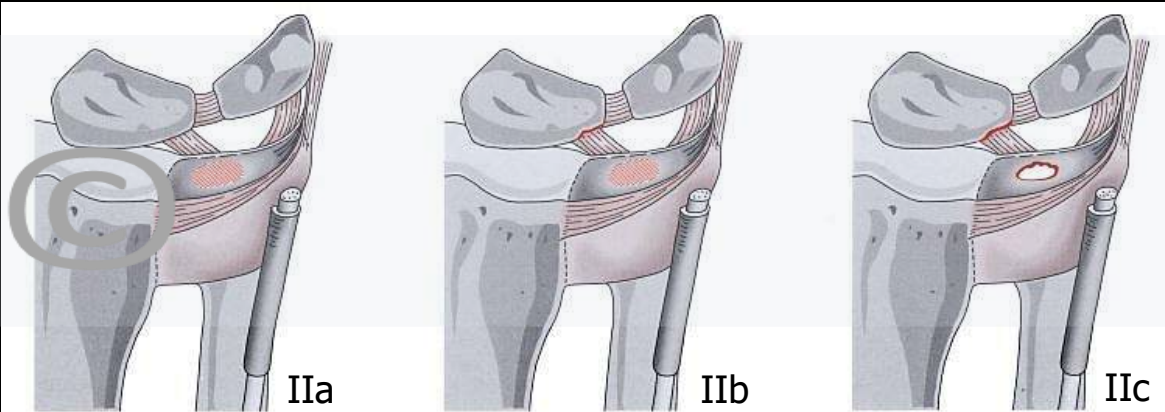


Palmer I d – MR-Arthro

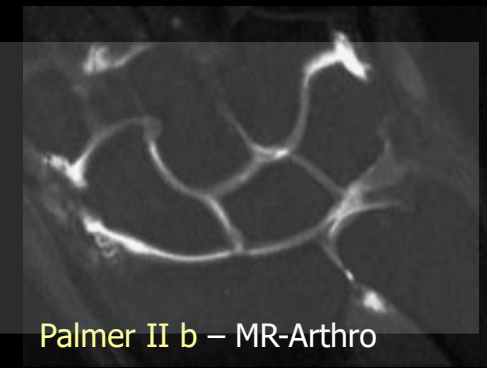


Palmer I b - T1 FSE und 3D-VIBE nach Gad.

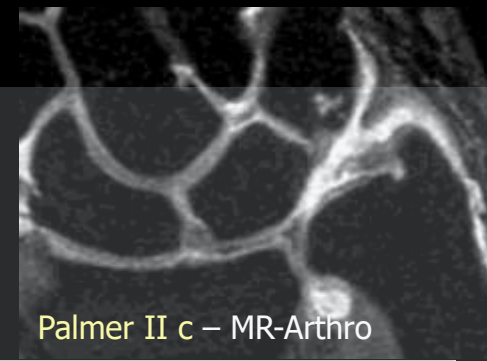
Degenerative TFCC-Läsionen - Palmer-Klasse II



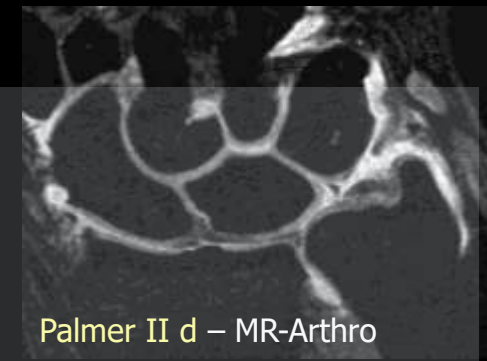
Palmer II a – PD FSE fs



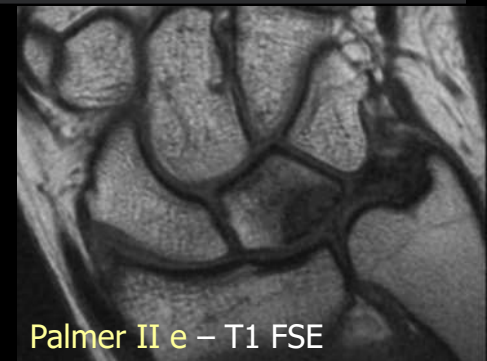
Palmer II b – MR-Arthro



Palmer II c – MR-Arthro



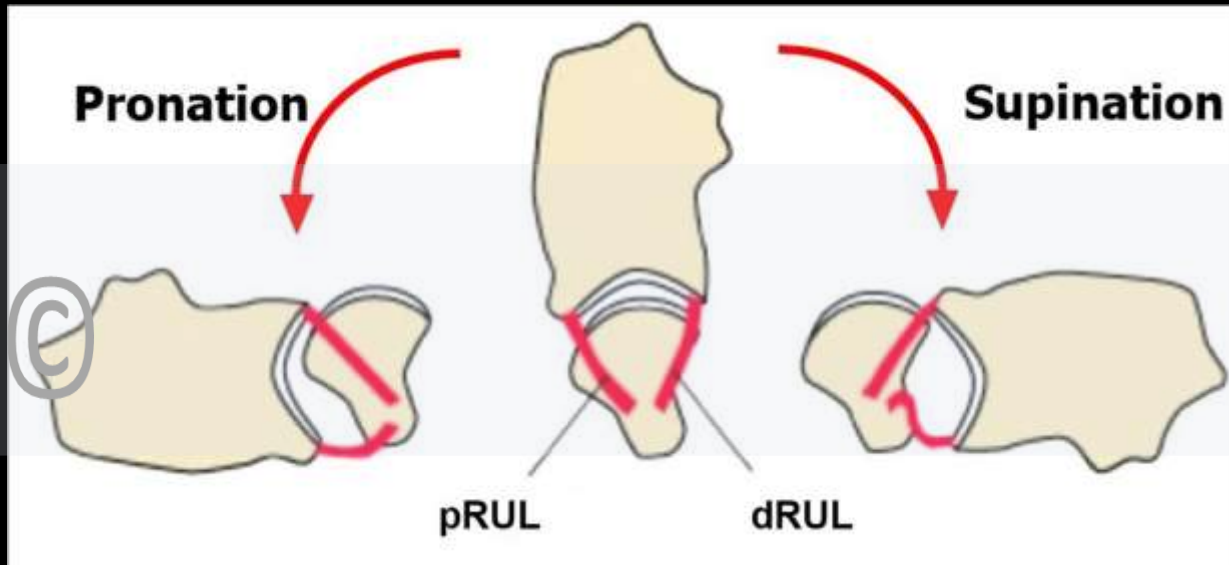
Palmer II d – MR-Arthro



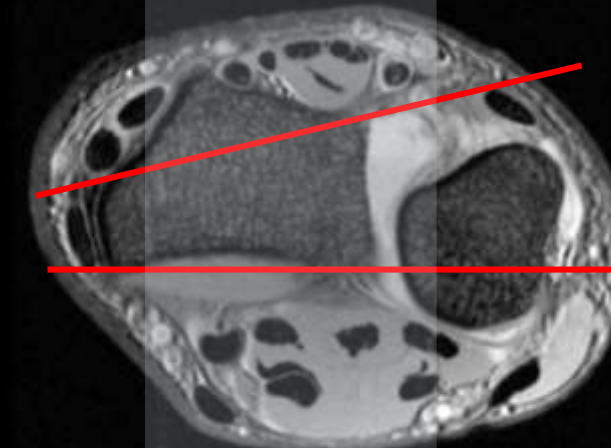
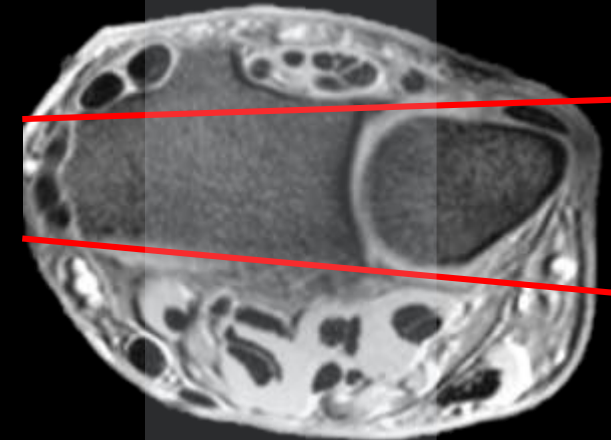
Palmer II e – T1 FSE

Typ	Pathologie
IIa	mukoide Diskusdegeneration
IIb	Diskusperforation
IIc	Diskusperforation + Chondropathie
IIe	Diskusperforation + Chondropathie + LTD
IIe	Arthrose (ulnokarpales Impaction)

Ligg. radioulnaria und DRUG-Instabilität



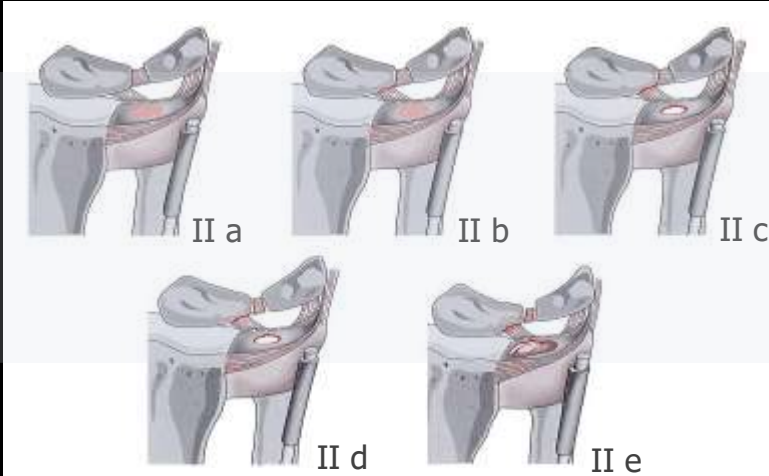
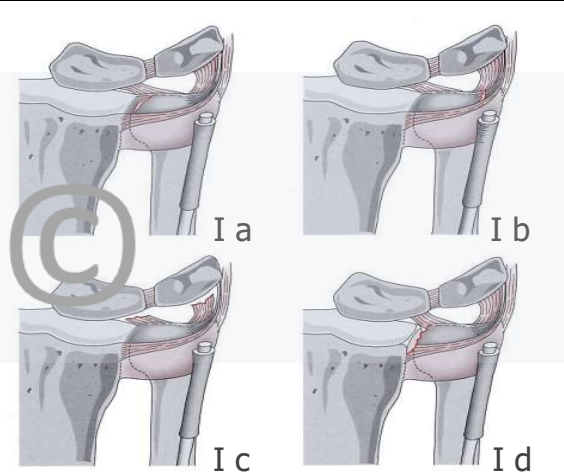
Mino-Linien zur Analyse der DRUG-Stabilität



- Drehpunkt ist Ulna, d.h. Radius luxiert
- Richtung der Radiusluxation bestimmt die Bandverletzung
„Das Pferd bricht durch die offene Tür aus“

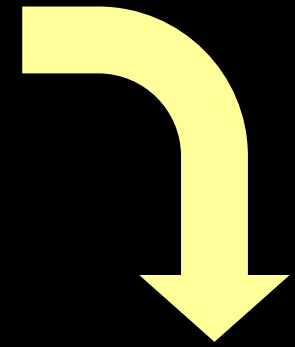
- tiefe Blätter stabilisieren
- Spannung von Umwendbewegung abhängig
 - in Pronation dorsale Bänder gespannt
 - in Neutralstellung beide Bänder gespannt
 - in Supination palmare Bänder gespannt

Klassifikationen



Palmer et al., J Hand Surg 1989

- alle TFCC-Strukturen
- kein tiefes TFC-Blatt ulnar
- DDx Trauma vs. Degeneration



Atzei Classification of TFCC Injuries

Class	0	1	2	3	3-A	4	5
Description	Ulna styloid tip fracture	Distal TFCC tear	Distal & Proximal TFCC tear	Proximal TFCC tear	Ulna styloid base fracture	Irreparable proximal TFCC tear	Advanced DRUJ arthritis
Clinical DRUJ stability	Stable	Stable	Mild to severe instability				Variable
Imaging							
Distal TFCC	Intact	Torn	Torn	Normal	Normal	Irreparable tear	Variable
Proximal TFCC	Intact	Intact	Torn	Torn	Intact	Irreparable tear	Variable
Hook test	Negative (Taut)		Positive (Abnormal laxity)				Variable
Treatment	Immobilization	TFCC suture repair	Fixation of proximal TFCC to fovea		Ulna styloid fixation	TFCC reconstruction	DRUJ salvage

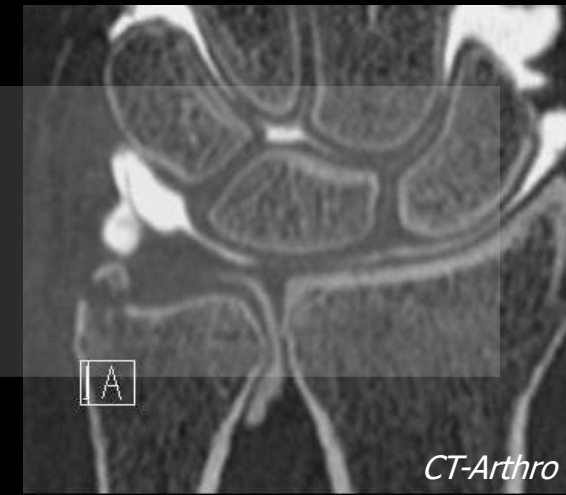
Atzei et al., Hand Clinics 2011

- Schwerpunkt ulnar
- keine periphere Ligamente
- keine DDx Trauma vs. Degeneration

PSU-Frakturen - stabil vs. instabil

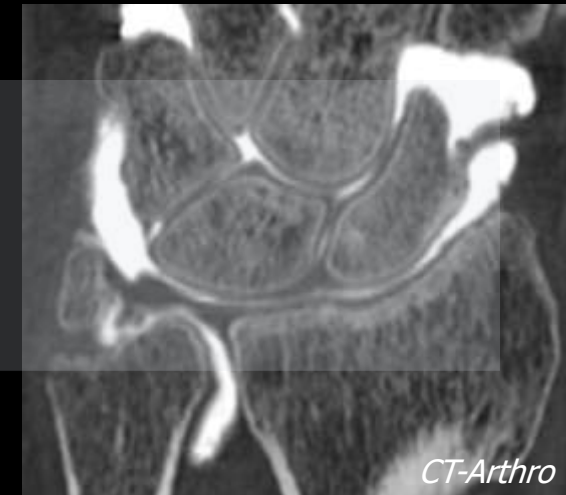
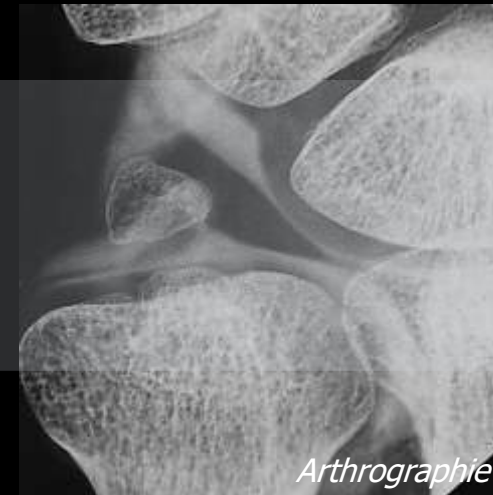
Atzei-Klasse 0

- Fraktur der PSU-Spitze
- beide TFCC-Blätter intakt
- DRUG stabil



Atzei-Klasse 3 A

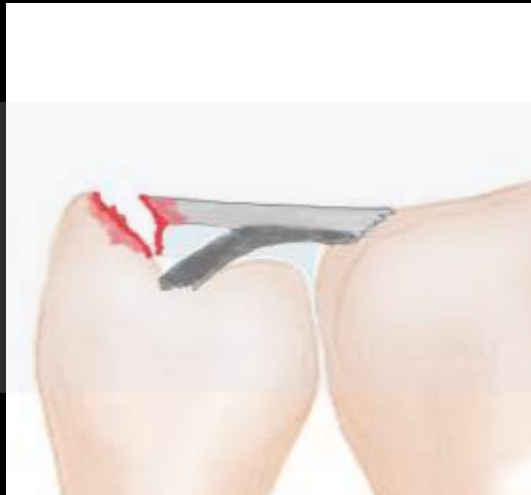
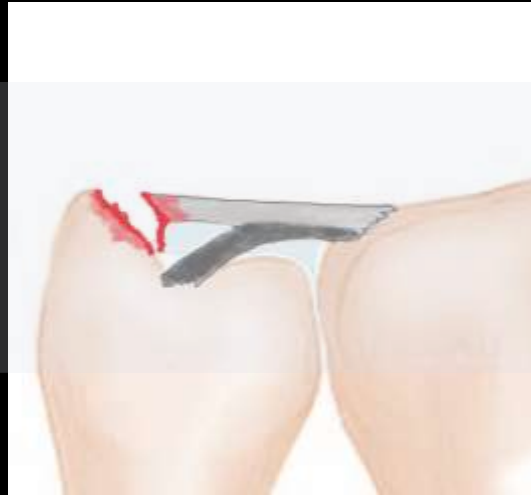
- Fraktur der PSU-Basis
- tiefes TFCC-Blatt rupturiert
- DRUG instabil



Isolierte TFCC-Läsionen - stabil

Atzei-Klasse 1

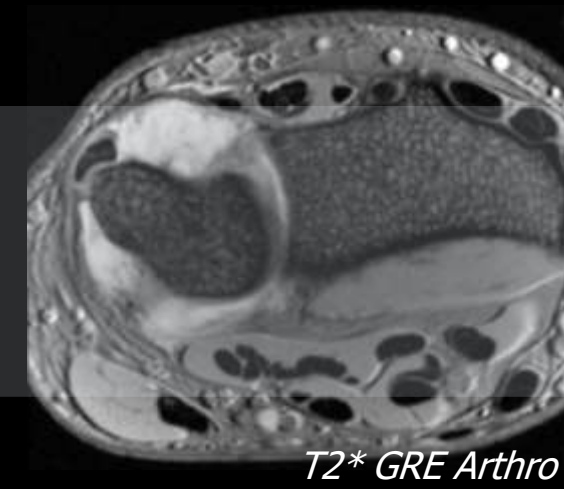
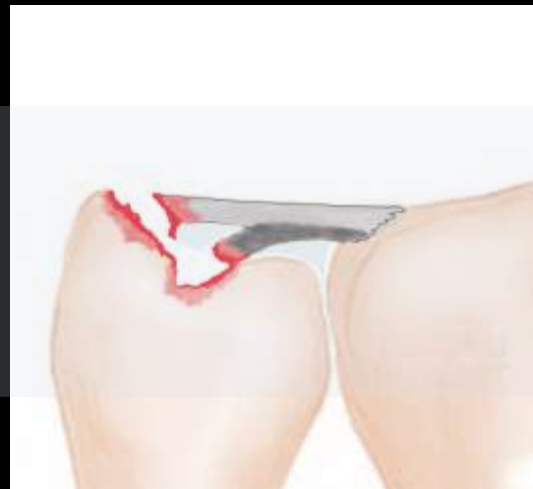
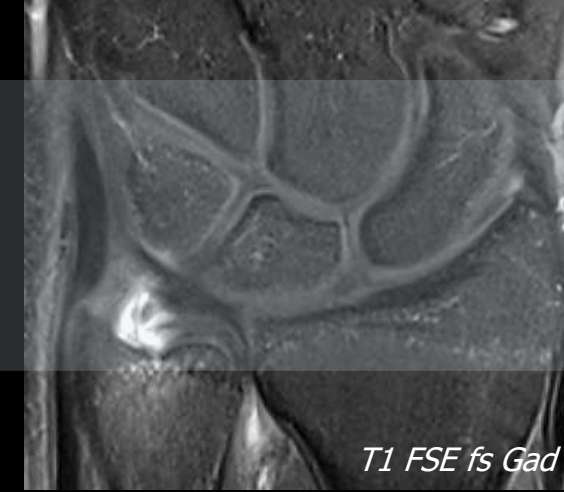
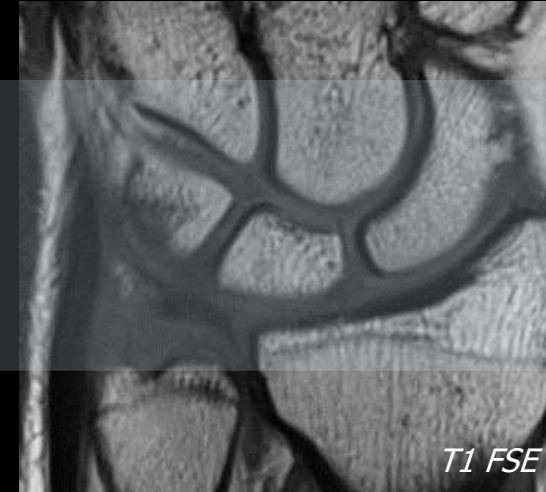
- oberflächliches Blatt rupturiert
- tiefes Blatt intakt
- DRUG stabil



Isolierte TFCC-Läsionen - instabil

Atzei-Klasse 2

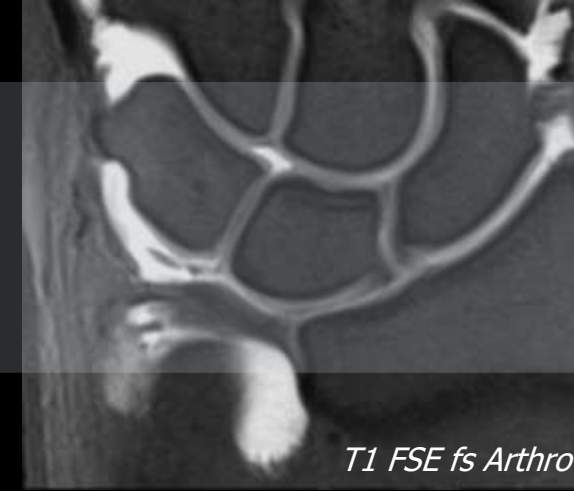
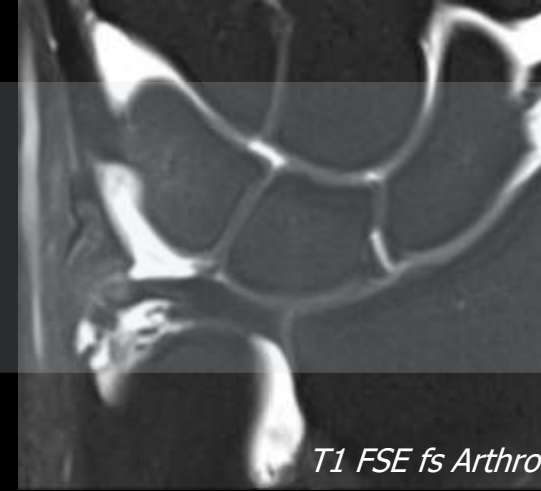
- oberflächliches Blatt rupturiert
- tiefes Blatt rupturiert
- DRUG stabil



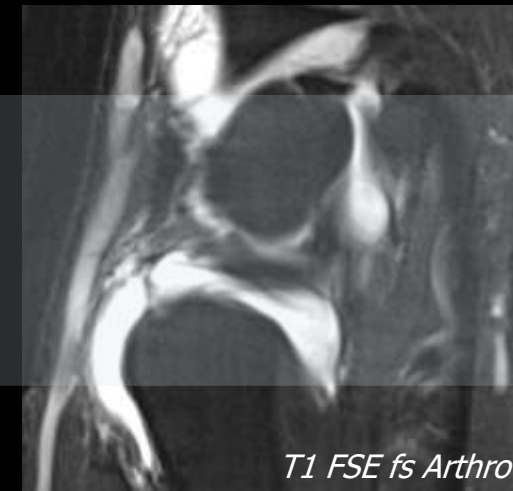
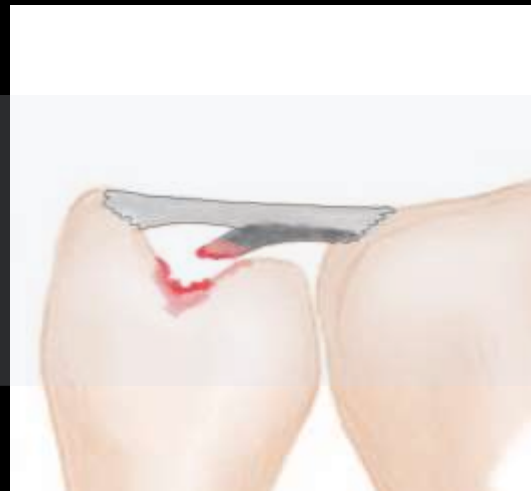
Isolierte TFCC-Läsionen - instabil

Atzei-Klasse 3

- oberflächliches Blatt intakt
- tiefes Blatt rupturiert
- DRUG instabil



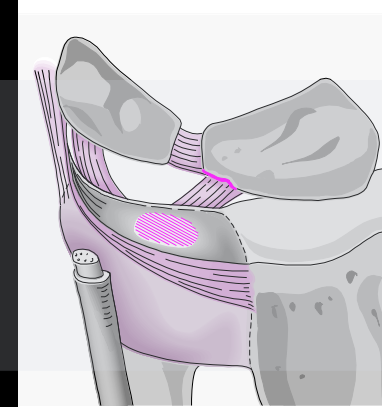
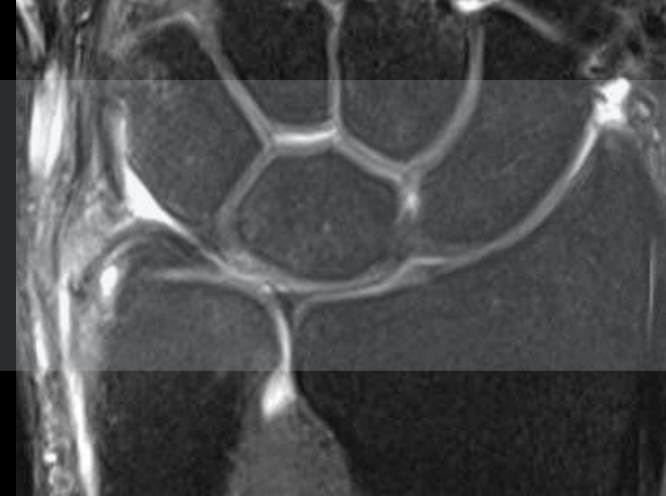
- Bildgebung essentiell vor offener oder arthroskopischer Refixation



Isolierte TFCC-Läsionen - irreparabel

Atzei-Klasse 4

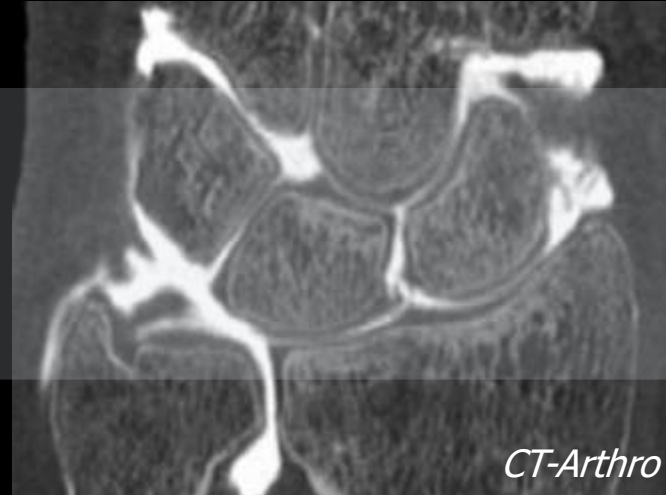
- Diskuskörper perforiert
- funktionell dehiszent
- DRUG instabil



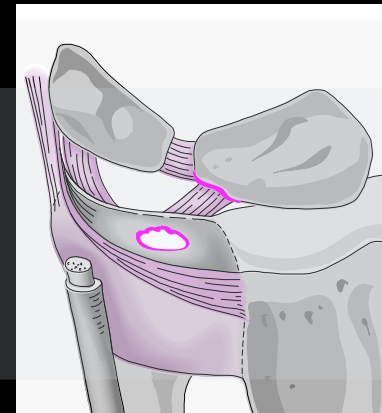
Entspricht **Palmer II b**

Unklassifizierbar

- Horizontalrisse
- komplexe Risse



CT-Arthro



Entspricht **Palmer II c**

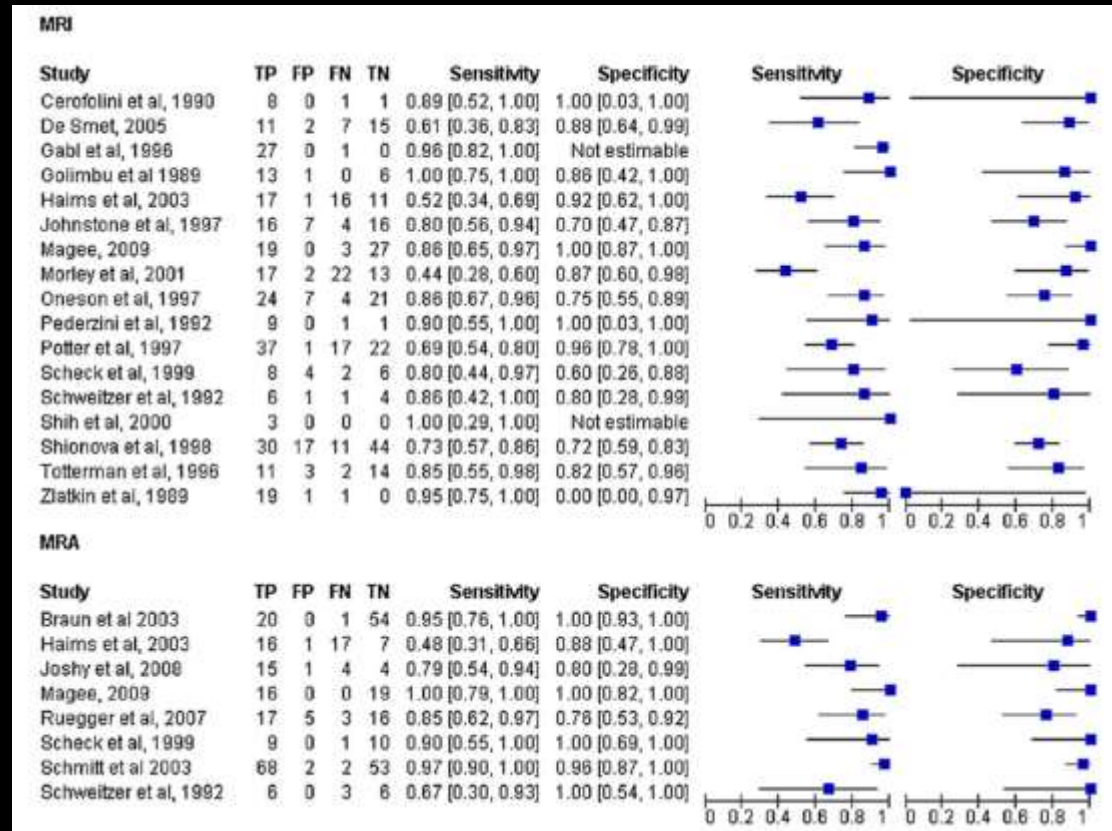
MRT / CT versus ASK / Op.

65 Patienten	ceMRT	MR-A	CT-A	gesamt
Anzahl	24	20	21	65
richtig-positiv	23	20	21	61
richtig-negativ				
falsch-positiv	1	0	0	1
falsch-negativ	3	0	0	3

Statistik	ceMRT	MR-A	CT-A
Sensitivität	88,5	100,0	100,0
Spezifität			
pos. Vorhersag.	95,8	100,0	100,0
neg. Vorhersag.			

Metaanalyse

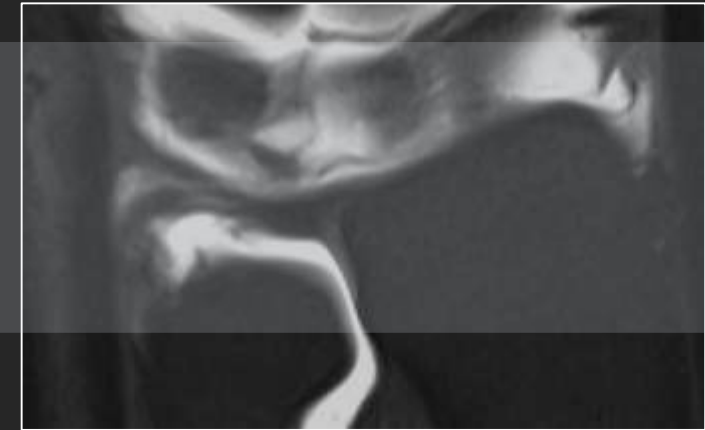
(Smith et al., J Bone Jt Surg 2012)



- MR-Arthro > MRT (keine ceMRT berücksichtigt)
- CT-Arthro = MR-Arthro

Methodenwertung

- **Atzei-Klassifikation** bewertet ulnaren TFCC-Abschnitt einschließlich stabilisierendem, tiefem Blatt
- Bildgebung sehr gut im Vergleich zur ASK und Operation
 - ceMRT **um 90 %** (Sens. und PPV)
 - MR-A und CT-A **um 100 %** (Sens. und PPV)
- MR-A und CT-A kann ASK und Operationen vermeiden helfen

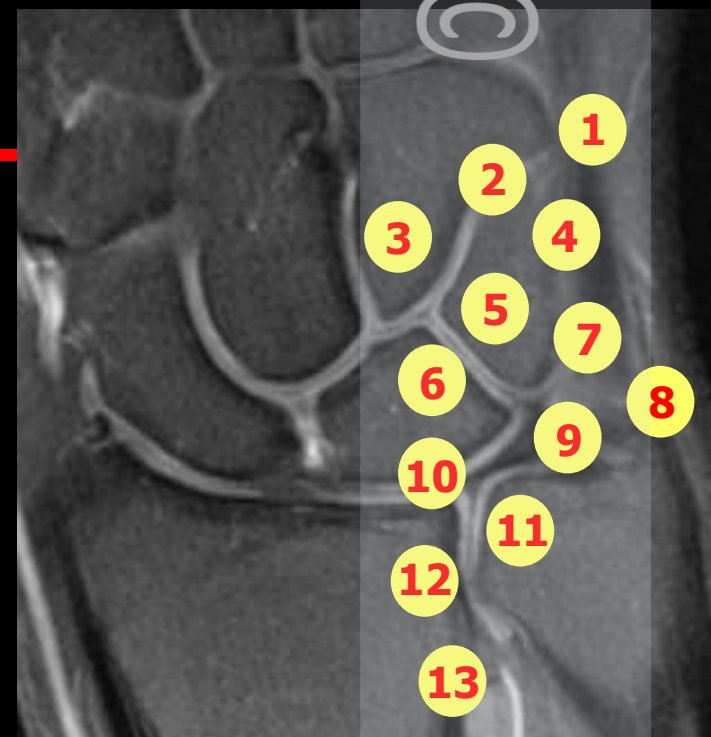


- Atzei A et al.: Hand Clin 2011
- Burns JE et al.: RadioGraphics 2011
- Cerezal L. et al.: Sem MSK Radiol 2012
- Harms E et al.: Radiology 2003
- Nakamura T et al.: J Hand Surg [Br] 2001
- Oneson SR et al.: RadioGraphics 1996
- Palmer A et al.: J Hand Surg 1989
- Rügger et al.: Am J Roentgenol 2007
- Schmitt R et al.: RöFo 2003

Empfehlungen

■ ulnarer Schmerz

- **MRT mit i.v.-Kontrastmittel**
- vorzugsweise mit isotroper 3D-Sequenz + anatomischer Rekon
- viele DDx



1. ECU-Tendosynovialitis
2. TILT-Syndrom
3. Hamatumspitzensyndrom
4. pisotriquetrale Arthrose
5. lunotriquetrale Dissoziation
6. lunotriquetrale Synchondrose
7. Syndrom der Loge de Guyon
8. Syndrom des Recessus ulnaris
9. **TFCC-Läsion**
10. ulnokarpale Impaktation
11. **DRUG Instabilität**
12. DRUG-Arthrose
13. radioulnares Impingement

■ instabiles DRUG

- **MR- oder CT-Arthrographie**
- Frage: Tiefes TFCC-Blatt ?

