

## FRÄMRE KORSBAND, SCANPLAN, ASSOCIERADE SKADOR

SEPPO KOSKINEN

## DISPOSITION

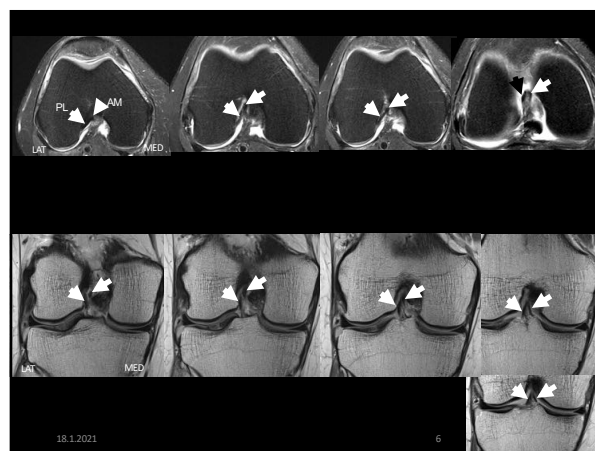
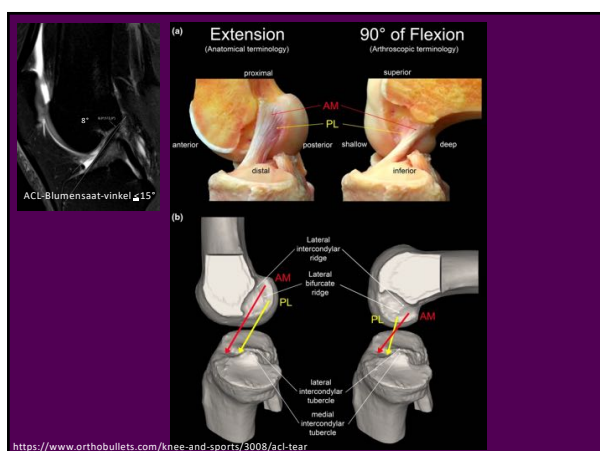
- MR-SEKVENSER – THE GOOD, THE BAD, THE UGLY
- FRÄMRE KORSBAND, SCANPLAN, ASSOCIERADE SKADOR
- PLC + BROSK + AVANCERADE TEKNIKER

## ACL

- ACL skada är 20-50 x vanligare jmf med bakre
- rotationsvåld, ofta vid kontakt-idrott, fotboll, handboll, innebandy och ishockey
- cirka 6 000 individer skadar sitt främre korsband årligen i Sverige
- ung. hälften opereras
  - Svenska korsbandsregistret (<https://www.acregister.nu>)
- ~ 90% kan diagnostiseras kliniskt
- 10-43% är partiella rupturer

## ACL

- svarar för 85% av den kraft som hindrar främre translation av tibia vid 30-90% flexion
- intrakapsulär, extrasynovial
- Längd 22-41 mm (32 mm)
- Bredd 7-12 mm
- Två delar
  - Anteromedial, tajt i flexion, motstår främre translation
  - Posterolateral, tajt i extension; stabiliserar leden vid rotation




## ACL

- MRs STÖRSTA ROLL ÄR ATT UTESLUTA/BEKRÄFTA ASSOCIERADE SKADOR 

- Meniskrupturer 73%<sup>1</sup>
  - 11 % med, 70% lat, 20 bilat
  - perifera vertikala rupturer
  - flap
  - "ramp"-lesions
- Kollateralrupturer, ffa MCL (~20%)
- Benkontusioner, frakturer (~85-97%)
- PLC (posterolateral corner)

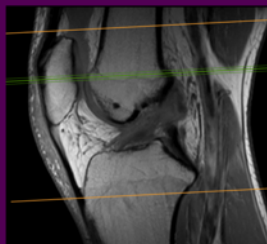
1) Hagino et al. Meniscal tears associated with anterior cruciate ligament injury. Arch Orthop Trauma Surg. 2015 Dec;135(12):1701-6. doi: 10.1007/s00402-015-2309-4. Epub 2015 Aug 19.

## ACL - MRT

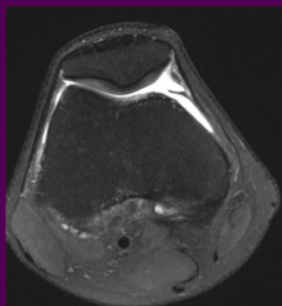
- ACL
  - SENS 87 % (95 % CI 77–94 %)
  - SPEC 93 % (95 % CI 91–96 %)
- Med Men
  - SENS 89 % (95 % CI 83–94 %)
  - SPEC 88 % (95 % CI 82–93 %)
- Lat Men
  - SENS 78 % (95 % CI 66–87 %)
  - SPEC 95 % (95 % CI 91–97 %)
- Fältstyrkan påverkade inte resultaten
- MRT bra på komplet ACL ruptur 

Phelan, N., Rowland, P., Galvin, R. et al. A systematic review and meta-analysis of the diagnostic accuracy of MRI for suspected ACL and meniscal tears of the knee. Knee Surg Sports Traumatol Arthrosc. 24, 1525–1539 (2016). <https://doi.org/10.1007/s00167-015-3861-8>

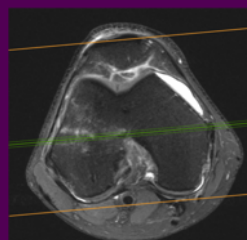
### MRT knä



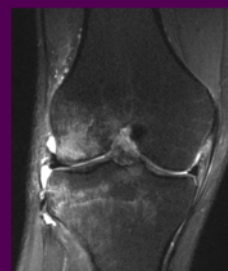
Axiala snitt  
inkluderande:  
distala quadriceps  
Patella +  
tuberositas tibia



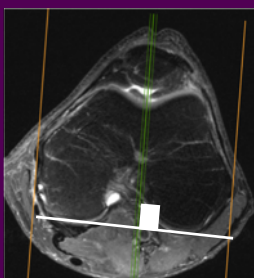
### MRT knä



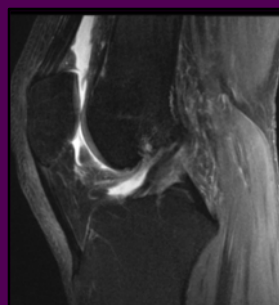
Koronal: Parallellt med bakre kondyplanet



### MRT knä

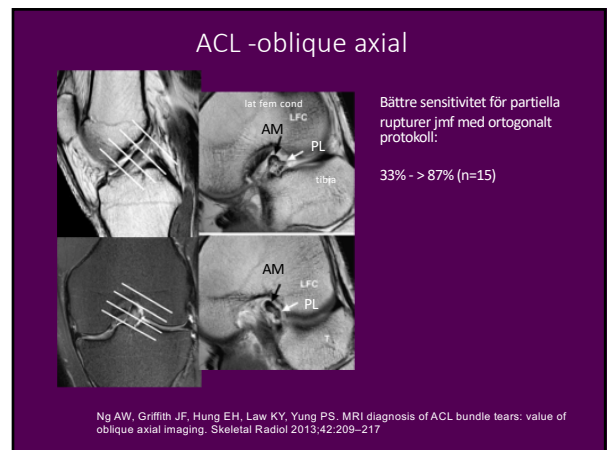
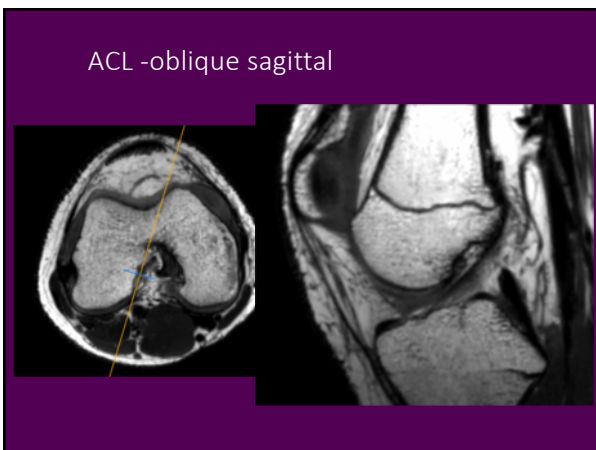
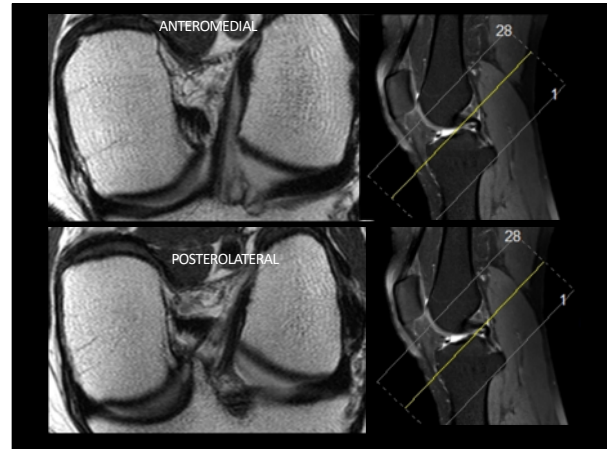
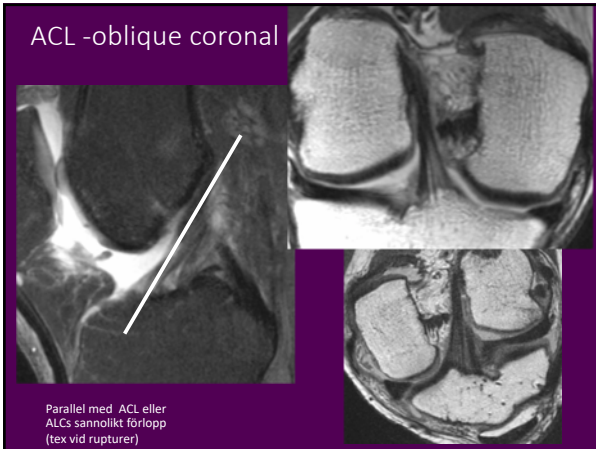


Vinkelrät mot bakre kondyplanet



## SCANPLAN vid ACL skador

- 1) Oblique coronal – parallel med ACL
- 2) Oblique sagittal – parallel med laterala femorala kondylens inre kant
- 3) Oblique axial - i rätt vinkel mot ACL



## SCANPLAN

*Additional oblique imaging for an ACL tear improved the specificity.*

*Either of the oblique imaging methods (sag, cor) is sufficient, and no further improvement in the diagnostic efficacy was achieved by simultaneous use*

J W Kwon, Y C Yoon, Y N Kim, J H Ahn, B K Choe. Which oblique plane is more helpful in diagnosing an anterior cruciate ligament tear? Clin Radiol. 2009;64(12):1067-71. doi:10.1054/bcr.2009.32002. Epub 2009 Dec 17.

## SCANPLAN

**TABLE 6: Specificity, Sensitivity, and Accuracy of Orthogonal, Oblique Sagittal, and Oblique Coronal Views in Diagnosing Selective Bundle Tear on 3T MRI**

View	Specificity (%)		Sensitivity (%)		Accuracy (%)	
	Reader 1	Reader 2	Reader 1	Reader 2	Reader 1	Reader 2
Orthogonal	66.7 (18/27)	66.7 (18/27)	80.5 (33/41)	85.4 (35/41)	75.0 (51/68)	77.9 (53/68)
Oblique(sagittal)	81.5 (22/27)	81.5 (22/27)	85.4 (35/41)	87.8 (36/41)	83.8 (57/68)	85.3 (58/68)
Oblique coronal	92.6 (25/27)	96.3 (26/27)	80.5 (33/41)	82.9 (34/41)	85.3 (58/68)	88.2 (60/68)
All	92.6 (25/27)	96.3 (26/27)	90.2 (37/41)	90.2 (37/41)	91.2 (62/68)	92.6 (63/68)

Note—Data in parentheses are number/total.

**CONCLUSION:** The oblique coronal view and the combination of the orthogonal view and both additional ACL views provide better diagnostic information with an improvement in specificity on 3-T MRI compared with orthogonal views alone in the diagnosis of selective-bundle tears.

Park et al. Comparison Between Arthroscopic Findings and 1.5-T and 3-T MRI of Oblique Coronal and Sagittal Planes of the Knee for Evaluation of Selective Bundle Injury of the Anterior Cruciate Ligament. Am J Sports Med. 2014;42(10):2359-2366.

## SCANPLAN vid ACL skador

ACL allmän diagnostik – antingen oblique sagittal eller coronal (1)

ALC-rekonstruktion – sagittal oblique (2)

ACLs två delar – koronal axial (3)

1. Park et al. Comparison Between Arthroscopic Findings and 1.5-T and 3-T MRI of Oblique Coronal and Sagittal Planes of the Knee for Evaluation of Selective Bundle Injury of the Anterior Cruciate Ligament: AJR 2014; 203:W199–W206

2. Moon SG, Hong SH, Choi JY, et al. Grading anterior cruciate ligament graft injury after ligament reconstruction surgery: diagnostic efficacy of oblique coronal MR imaging of the knee. Korean J Radiol 2008; 9:155–161

3. Ng AW, Griffith JF, Hung EH, Law KY, Yung PS. MRI diagnosis of ACL bundle tears: value of oblique axial imaging. Skeletal Radiol 2013;42:209–217

## ACL - MRT

### DIREKTA TECKEN

- Synlig ruptur av främre korsbandet
- Felaktig riktning på korsbandsfibrer
- Främre korsband saknas på både sagittala och coronala sekvenser
- Avulsion från eminentia intercondyloidea

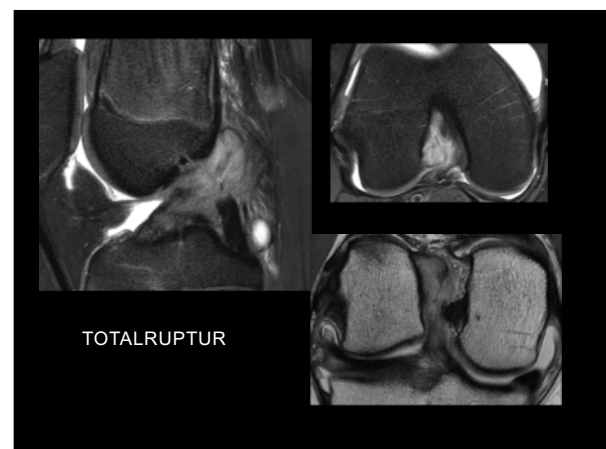
## ACL - MRT

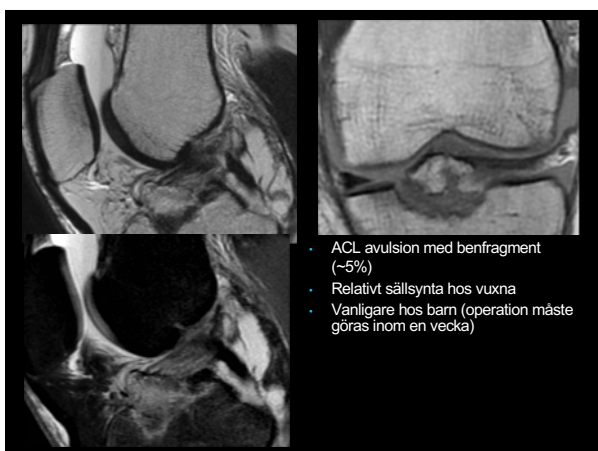
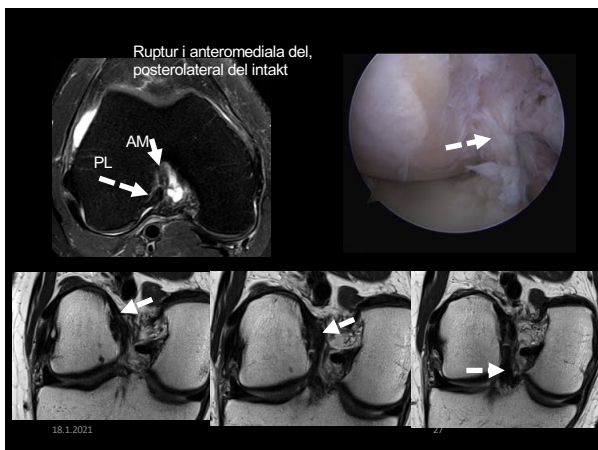
### INDIREKTA TECKEN

- Benkontusion i laterala femurkondylen och bakre tibiaplatån (pivotshift-skada)
- Deep sulcus sign (lateral femoral condyle notch sign) - mer än 2 mm djup impression i laterala femurkondylen
- Segondfraktur
- Kissing contusions - främre tibia och femur (hyperextensionsskada)
- Främre dragglåda - translation ventralt av tibia
- Ökad kurvatur av bakre korsband (ospecifikt)
- Hemartros (ospecifikt)
- Ödem på vattensensitiva sekvenser (PPV 90%)

## ACL - MRT

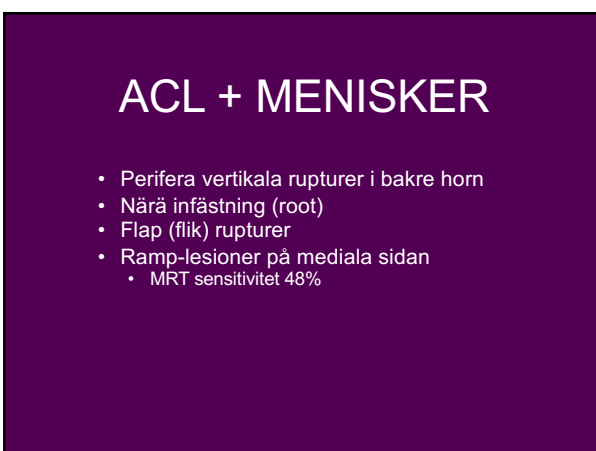
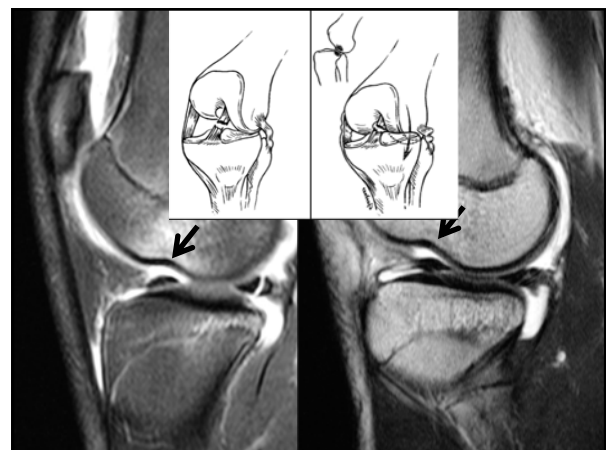
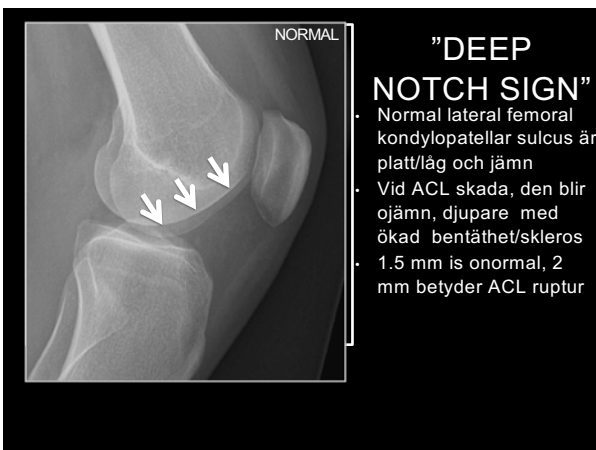
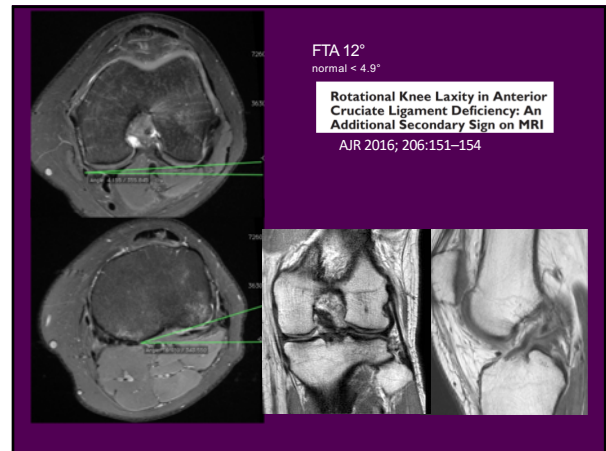
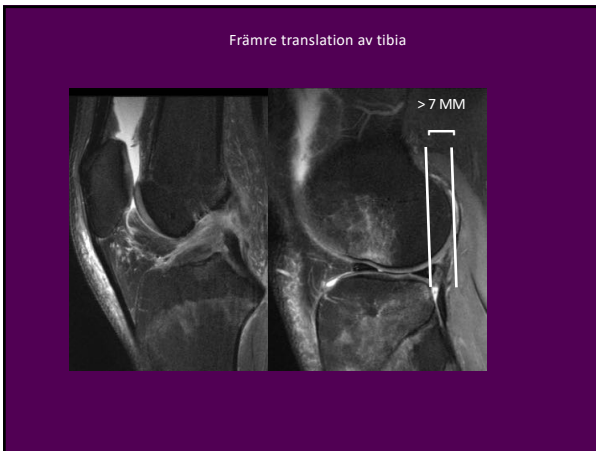
- G I - sträckning, ödem
- G II partiell diskontinuitet, ödem
  - om > 50 % av fibrerna rupturerade, tecken på instabilitet senare
- G III – totalruptur, komplett diskontinuitet
- Ruptur
  - midsubstans
  - proksimal 1/3
  - distal 1/3
  - vid infästning (femur-tibia) (avulsion utan/med benfragment)

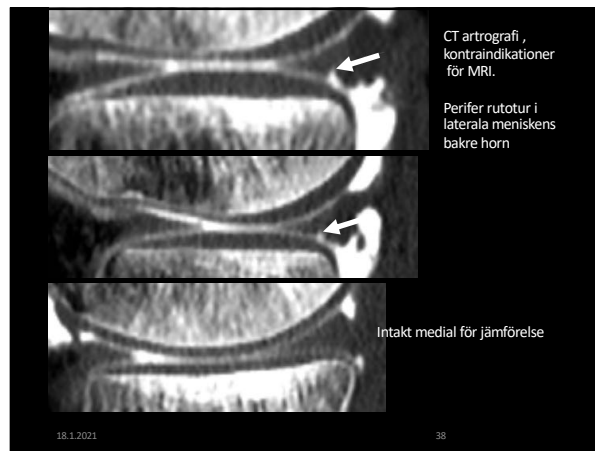
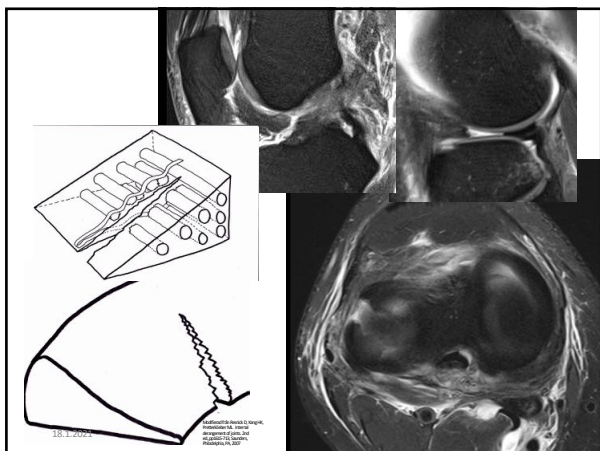




ACL – indirekta tecken på främre korsbandsskada.

- Lateral femoral & posterior tibial benkontusioner
- “Anterior Drawer” sign
  - Främre translation av tibia
- Rotational knee laxity -> LCL kan ses i ett koronalt snitt
- Deep notch -sign



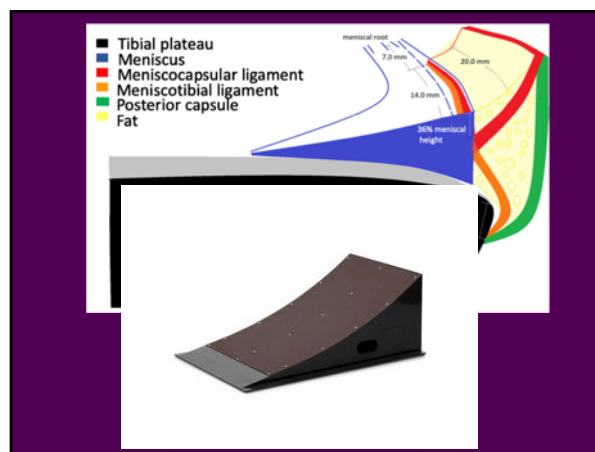


## RAMP-LESION

- Peripheral vertical longitudinal detachment of the posterior horn of the medial meniscus due to meniscocapsular ligament tears no greater than 2.5 cm in medio-lateral length, leading to meniscocapsular or meniscotibial separation with a concomitant ACL injury
- associated with increased anterior translation, dynamic rotational laxity, and excessive rotational knee motion, thus leading to increased biomechanical instability of the knee

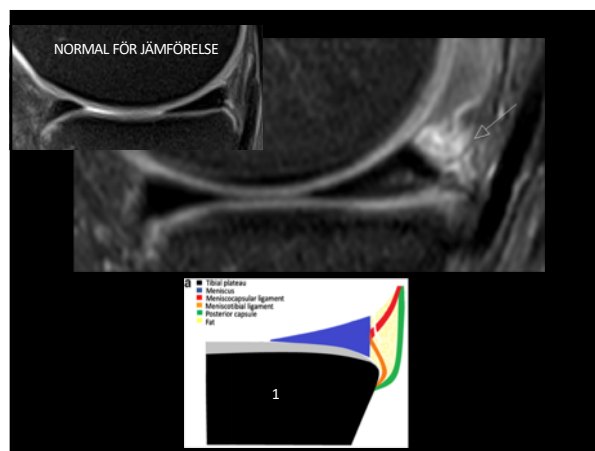
Chahla J, et al. Meniscal ramp lesions: anatomy, incidence, diagnosis, and treatment. Orthop J Sports Med. 2016;4(7): 2325967116657815

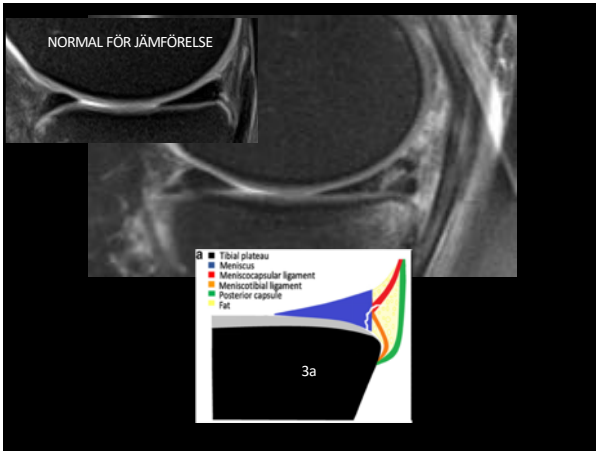
Balazs GC, et al. Ramp lesions of the medial meniscus in patients undergoing primary and revision ACL reconstruction: prevalence and risk factors. Orthop J Sports Med. 2019;7(5): 2325967119843509



**Table 2** Comparison of Theouat et al.'s and Geif et al.'s classification systems

Classification system	Ramp lesion type	Arthroscopic stability at probing	Classification system	Ramp lesion type	Arthroscopic stability at probing
Theouat et al.	1	Stable	Geif et al.	Type 1: Meniscocapsular ligament tear	Stable
	2	Stable		Type 2: Partial superior peripheral meniscotibial tear	Stable
	3	Unstable		Type 3A: Partial inferior peripheral anterior horn meniscotibial tear	Unstable
	4	Unstable		Type 3B: Meniscotibial ligament tear	Unstable
Geif et al.	3a	Unstable	Type 4A: Complete peripheral anterior horn meniscotibial tear	Unstable	
	3b	Unstable	Type 4B: Complete peripheral posterior horn meniscotibial tear	Unstable	
	4a	Unstable	Type 5: Partial anterior meniscocapsular tear	Unstable	
	4b	Unstable	Type 6: Partial posterior meniscocapsular tear	Unstable	

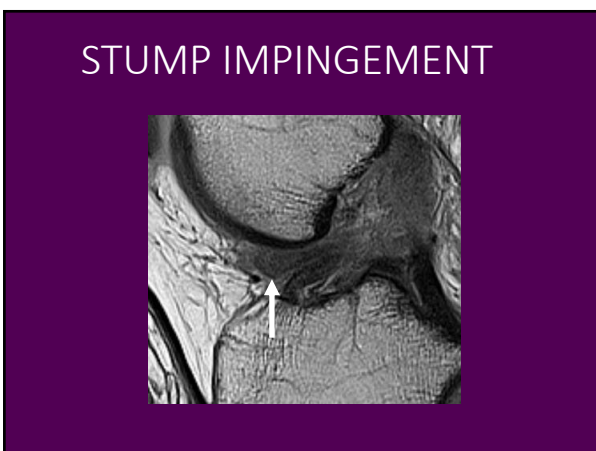
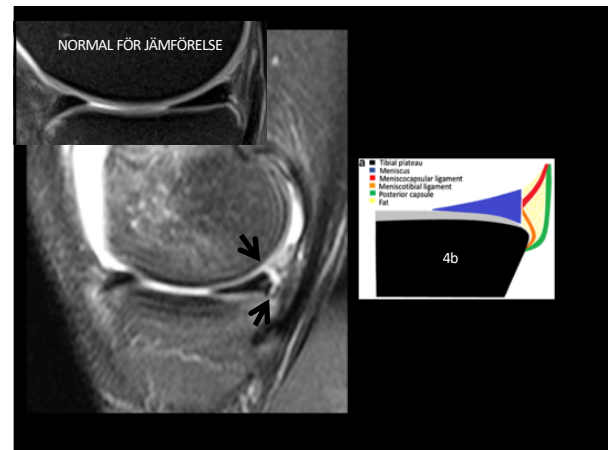
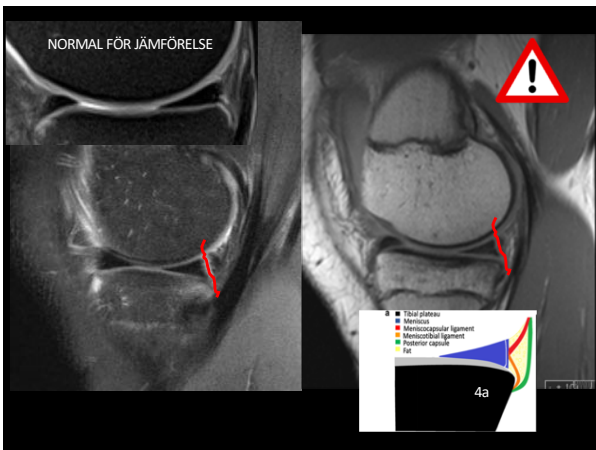




## RAMP LE

- MRT FYND
  - Vertikal perifer ruptur i
  - d.s.k. "red zone"

10-30 %  
Vaskulariserat  
"röda zonen"



## ACL efter ruptur? behandling)

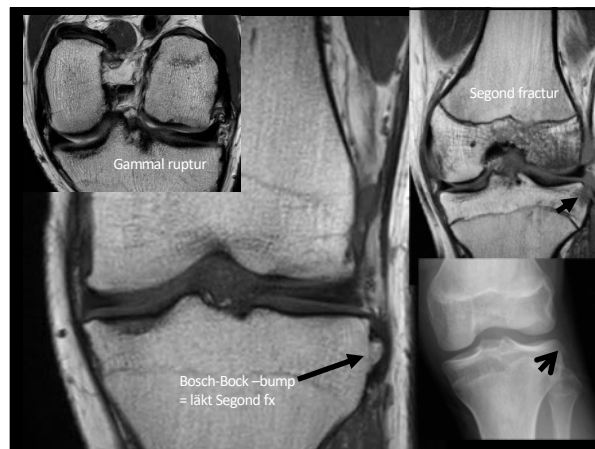
- Resorption
- Ärrformation
- Ärr vid synovial slida -> "synovialization"
- Utseendet kan vara som ett normalt korsband som har en begränsad funktion ang. stabilitet
- Stabiliteten kan dock inte bedömas med MRT

"It is difficult to speculate which patients presenting ACL rupture may have some healing potential, but we speculate patient age (average, 31 years), few fibers in continuity not shown in the MRI studies, and overlying synovial lining holding the ends in proximity might have influenced the spontaneous healing."

Costa-Paz et al. Spontaneous Healing in Complete ACL Ruptures. Clin Orthop Relat Res (2012) 470:979-985



# TECKEN PÅ GAMMAL ACL RUPTUR



LYCKA TILL!

