11th Advanced Course on Knee Surgery

Which PCL should be operated?

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Disclosures

- No relevant disclosures

PCL Anatomy

Blood supply:

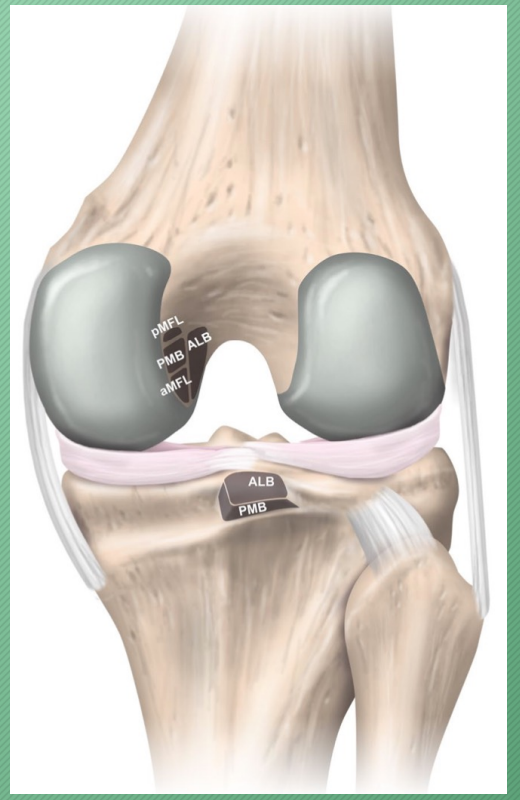
- Branches of medial geniculate artery

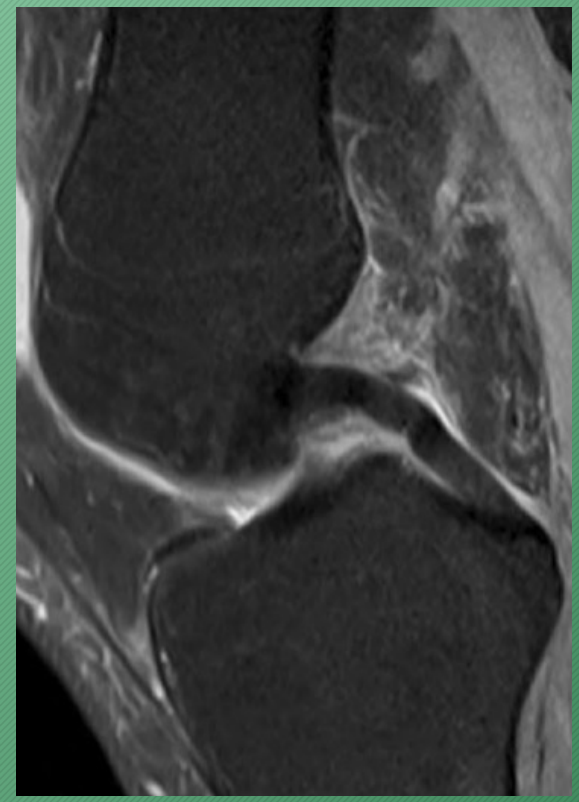
Femoral Insertion:

- AL bundle more vertical, on roof of notch
- Tight in flexion
- Most important for stability at 90°
- PM bundle tight in extension

Tibial Insertion:

- In posterior intercondylar fossa ~1.5 cm below joint line

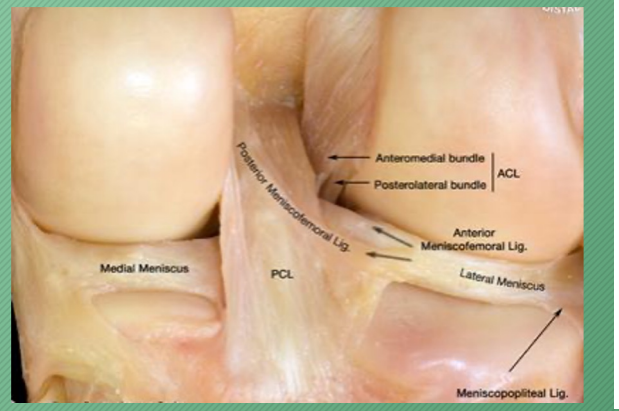


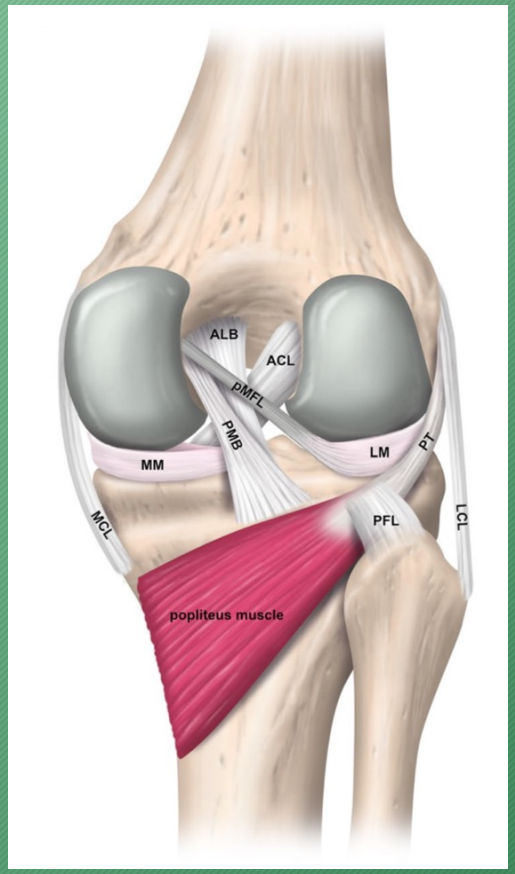


Amis et al., KSSTA 2006
Winkler, Zsidai, Samuelsson, Musahl et al., KSSTA 2021

PCL Tears

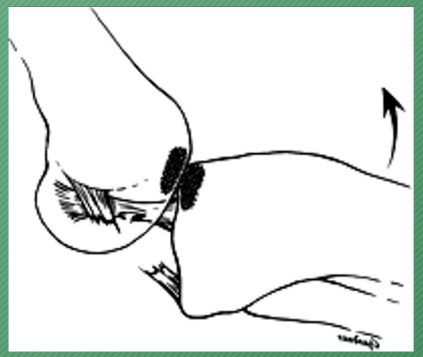
- Multiligament injury
- Direct blow or forced hyperflexion
- Isolated tears not common
- Chronic PCL deficiency (anterior knee pain, difficulty decelerating, difficulty descending stairs, pain with running)





Anatomic Classification – modified Schenck (N=773)

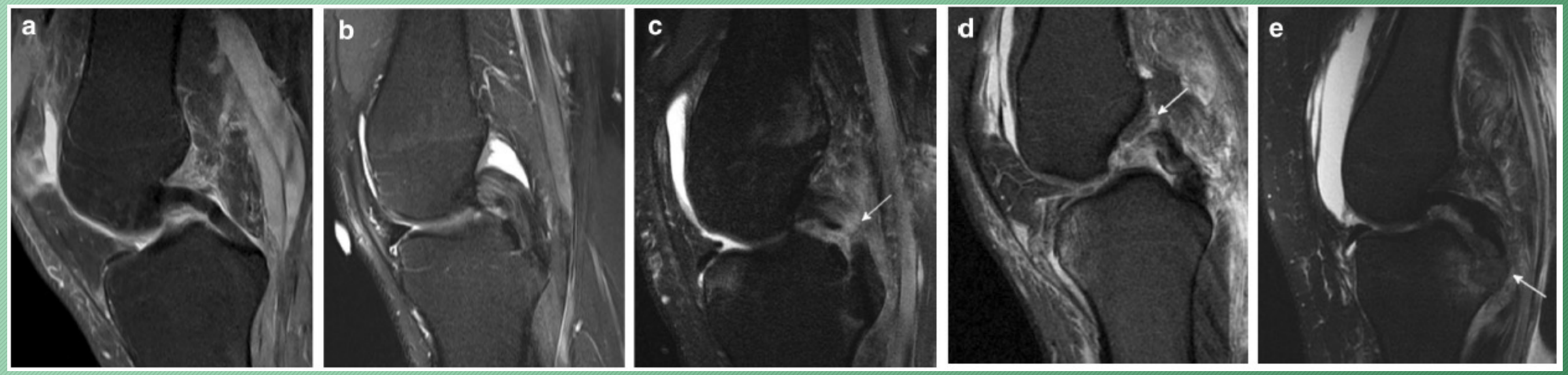
- MLK 1-PM: PCL & sMCL/PMC 5%
- MLK 1-PL: PCL & LCL/PLC 11%
- MLK 1-PML: PCL & sMCL/PMC & LCL/PLC 1%
- MLK-2: ACL & PCL 3%
- MLK 3-M ACL & PCL & sMCL/PMC 13%
- MLK 3-L: ACL & PCL & LCL/PLC 13%
- MLK-4: ACL, PCL, sMCL/PMC, & LCL/PLC 5%



Poploski, Musahl, Irrgang, STaR trial JBJS 2023

Injury Grade

- On MRI
  - Grade 1: partial (sprain)
  - Grade 2: partial tear
  - Grade 3: complete tear



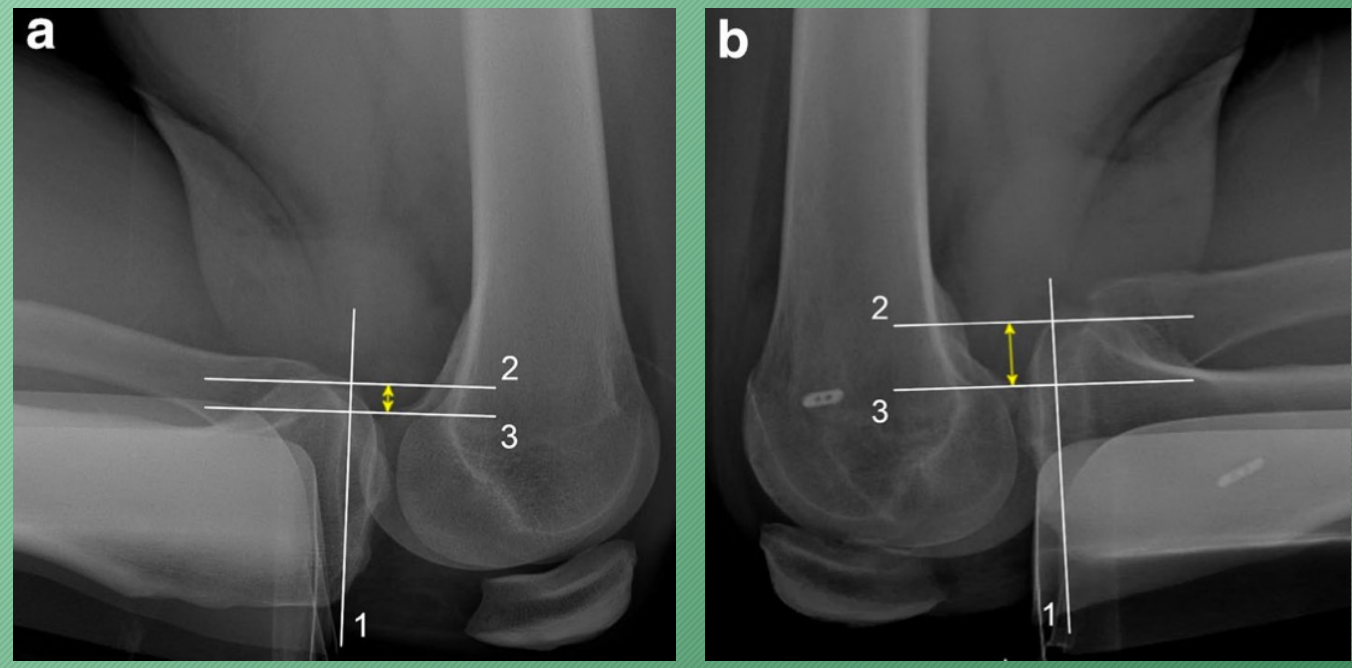
Winkler, Musahl, KSSTA 2021

Injury Grade

On stress radiographs

6-10 mm: Complete PCL injury

>10 mm: Complete PCL + PLC injury



Winkler, Musahl, KSSTA 2021
Sekiya, Miller, JBJS 2008

Injury Grade

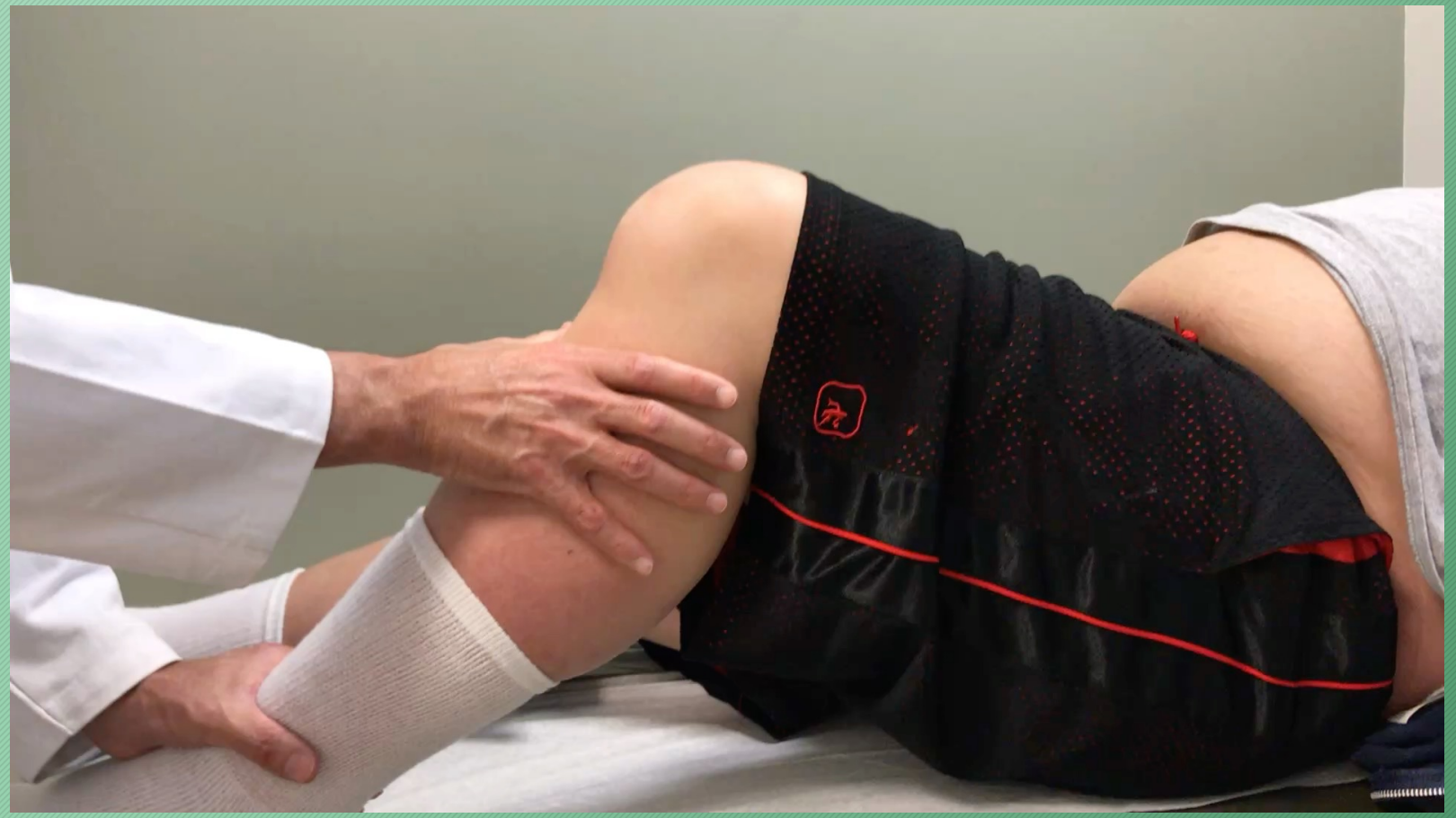
- On physical exam
  - Must reduce tibia prior to posterior drawer test
  - Tibial plateau 1cm anterior to femoral condyle

Posterior Drawer Test

Injury Grade	Posterior Translation of the Tibial Plateau (mm)	Position of the Tibial Plateau Relative to the Medial Femoral Condyle
I	0 to 5	Anterior
II	6 to 10	Even
III	>10	Posterior

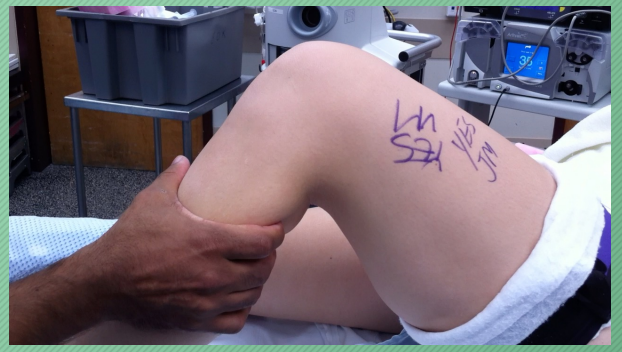
Mergheritini, Rihn, Musahl, Mariani, Harner, Sports Med 2002

Clinical exam

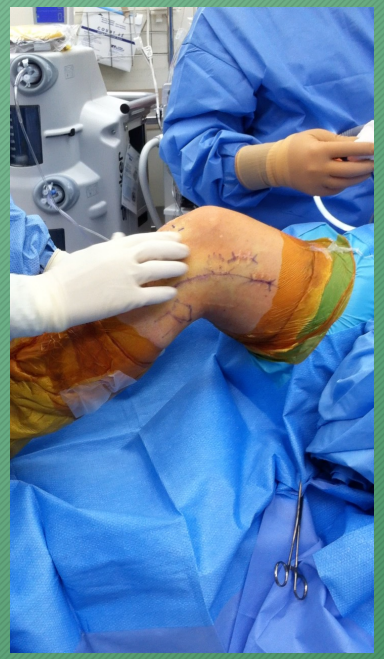


Injury Grade – CLINICAL DIAGNOSIS !

- Radiographs can help, Stress views and MRI can help
- Grade 1
  - Sprain/partial tear
  - Translation <5mm
- Grade 2
  - Complete tear
  - Translation 5-10mm
- Grade 3
  - Complete tear +
  - Translation >10mm
  - Watch out for associated PLC injuries



Complete tear (gr 2)



gr3PCL + gr3 PLC (LCL+)

What should you do?

- Grade 1
  - Non-op, rehab
- Grade 2
  - Non-op, rehab with a PCL protocol
  - Operate if inadequate functional improvement
  - In athletes --- ? (discuss timing)
- Grade 3
  - Operate and address associated PLC/rotational instability, LCL

Case S.F. – non op

- 20M defensive tackle
- Injury 1 week in August camp
- Landed on flexed knee
- Medial pain
- OE:
- 2+PD
- 1+ valgus opening
- TTP med joint line
- (+) effusion
- Pain with flexion

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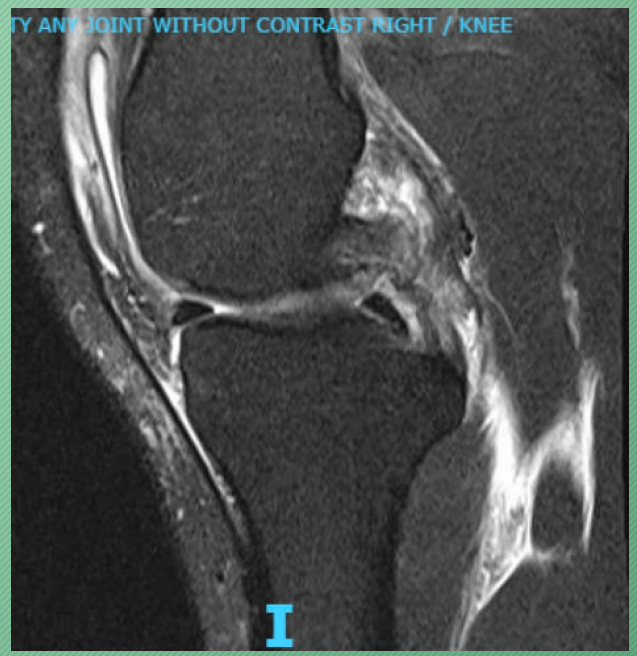
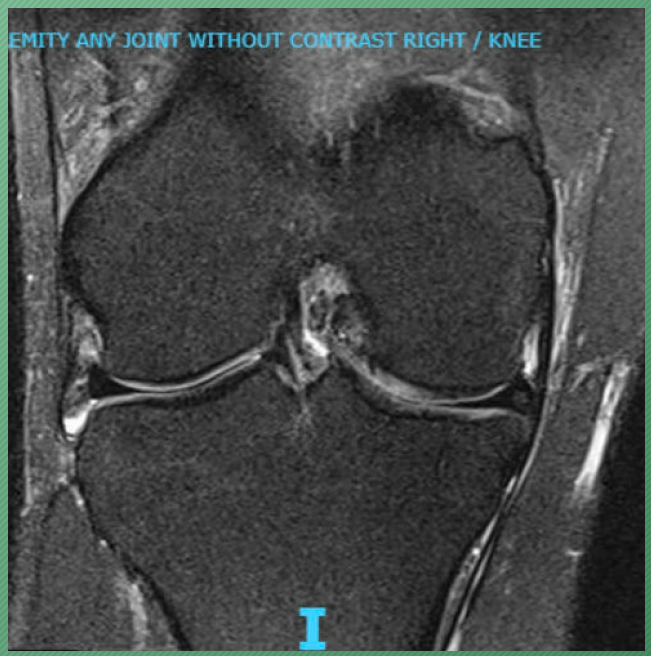
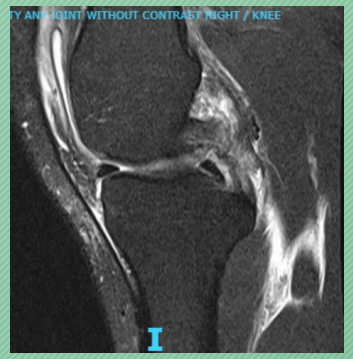
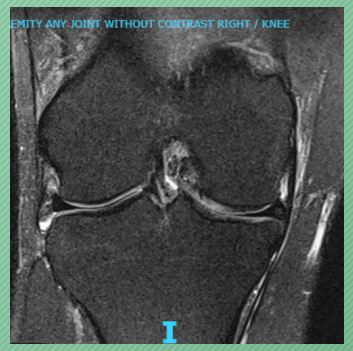


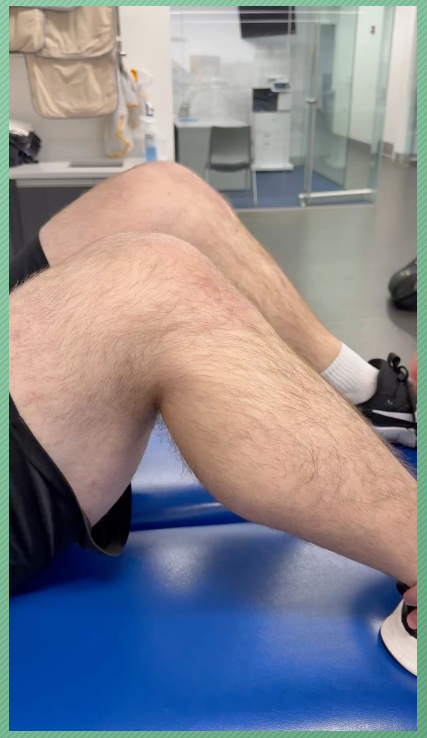


Case S.F.

- Plan: rehab
- 4 wks brace
- 4-6 wks accel rehab quad based
- RTP ~12 wks functional brace





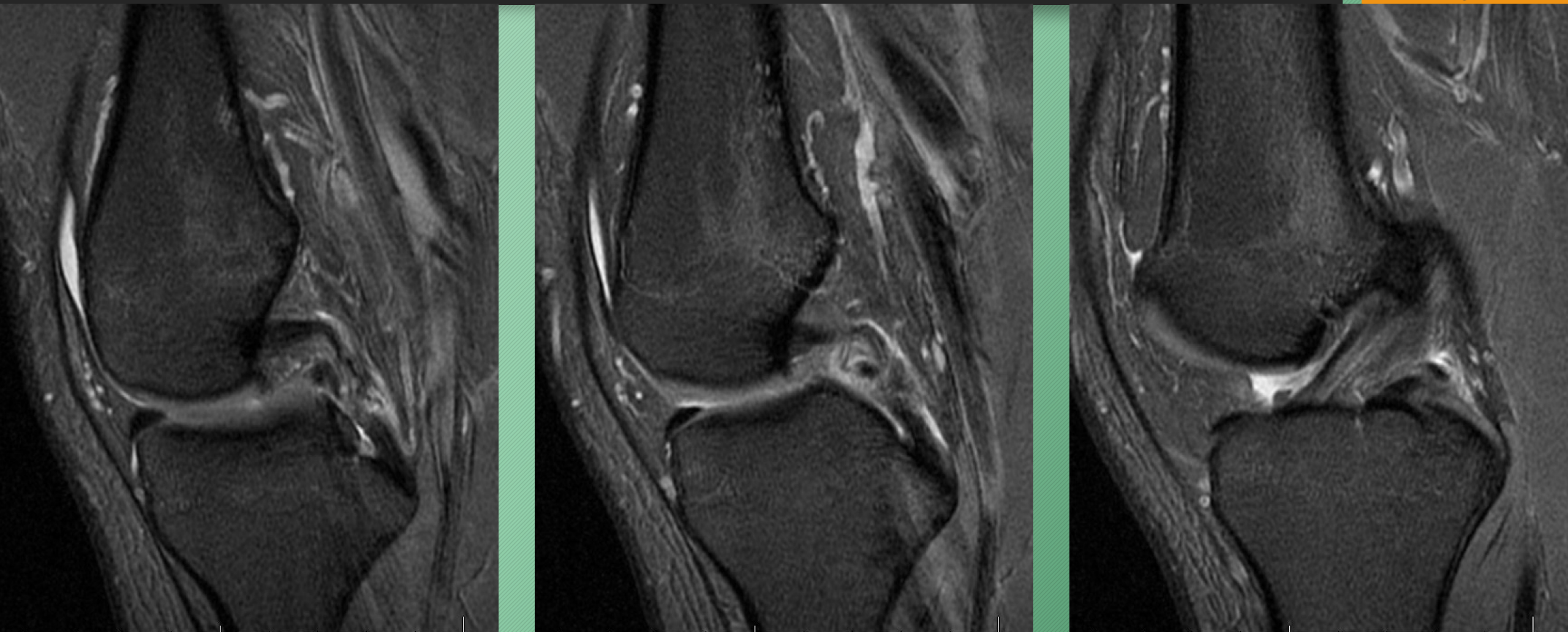


6 mos

Case 1 - H.B. – Isolated PCL Injury

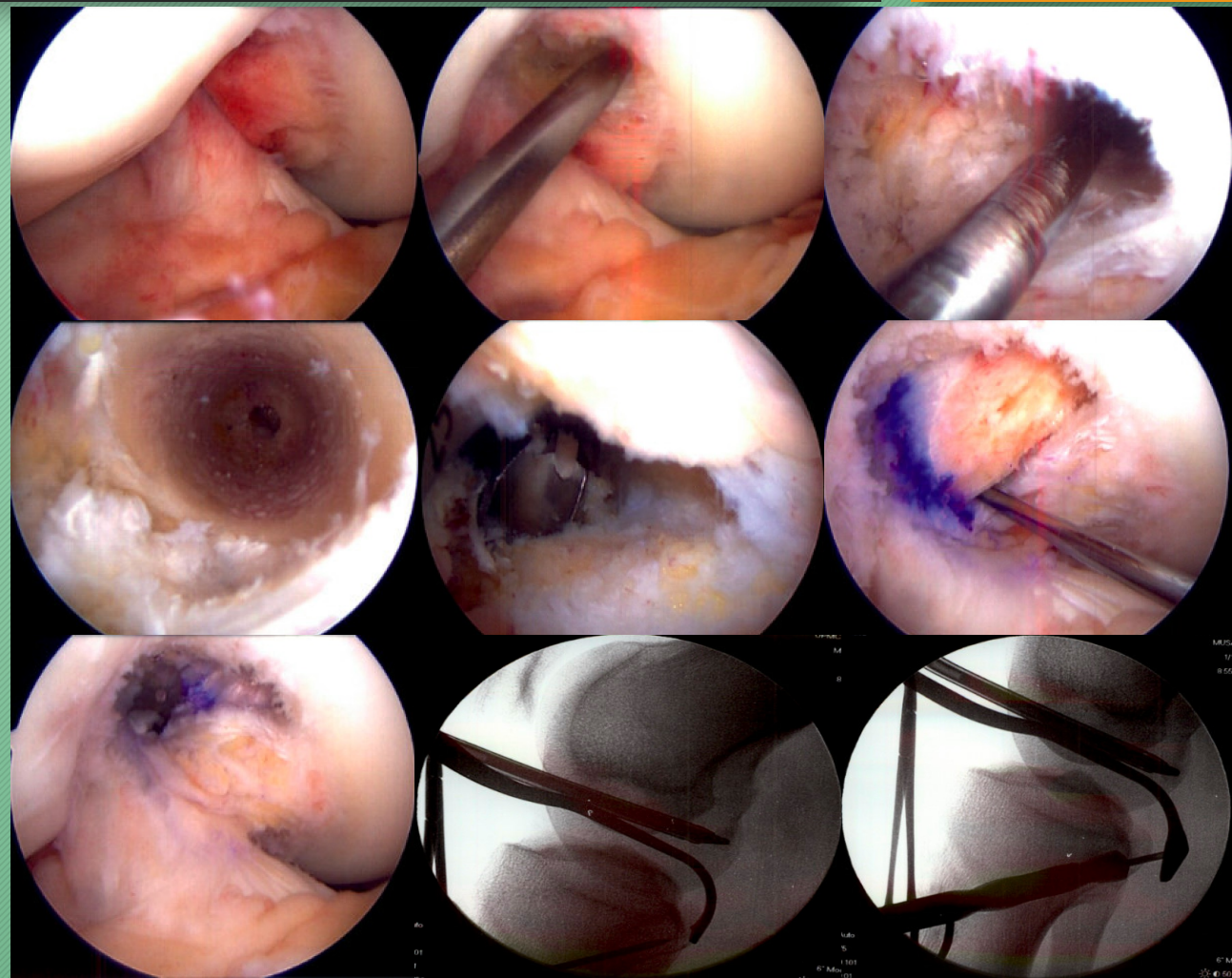
- 19M American Football DE w/ acute R knee injury, direct impact during tackle
- Immediate pain/swelling
- + Effusion
- ROM 5-90
- 2+ Posterior drawer (Grade 3)
- Stable varus/valgus

Case H.B.

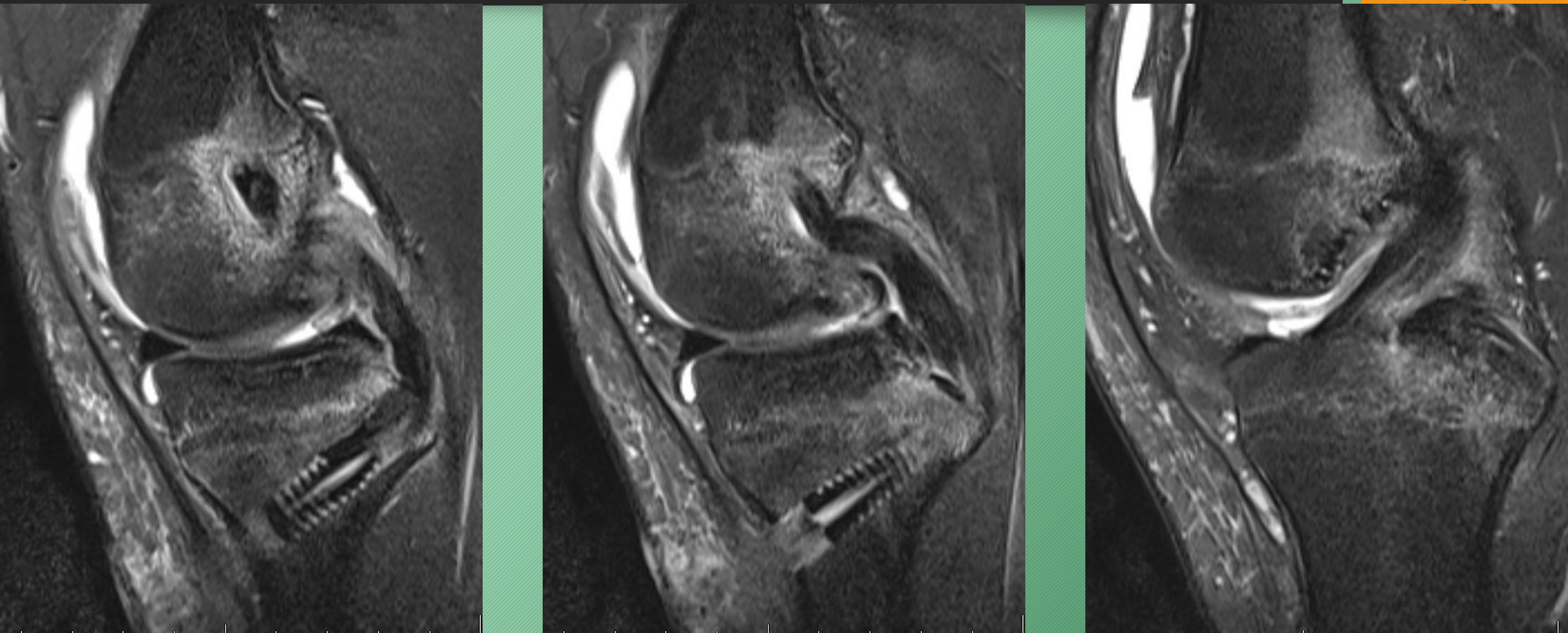


Case H.B. – Isolated PCL Injury

- Indication for surgery
  - Complete isolated tear
  - 192cm, 115 kg
  - Elite athlete (Junior, Defensive End)
  - Middle of season (wk 6)

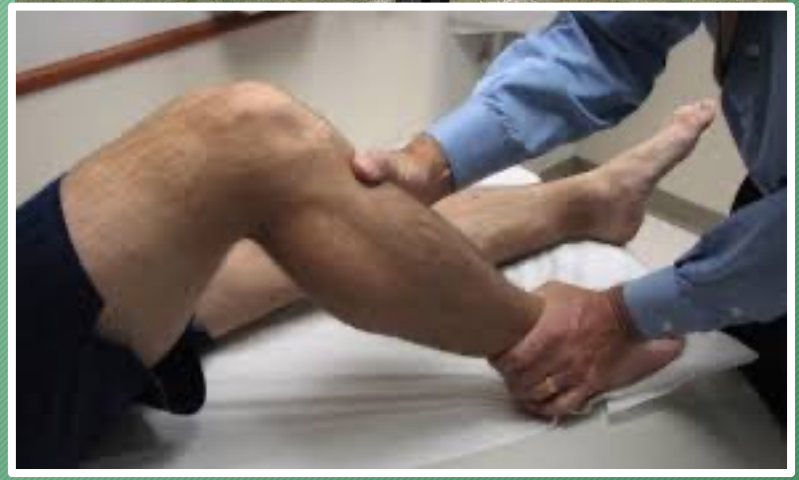


Case H.B. – 3mos FU QT PCL-R

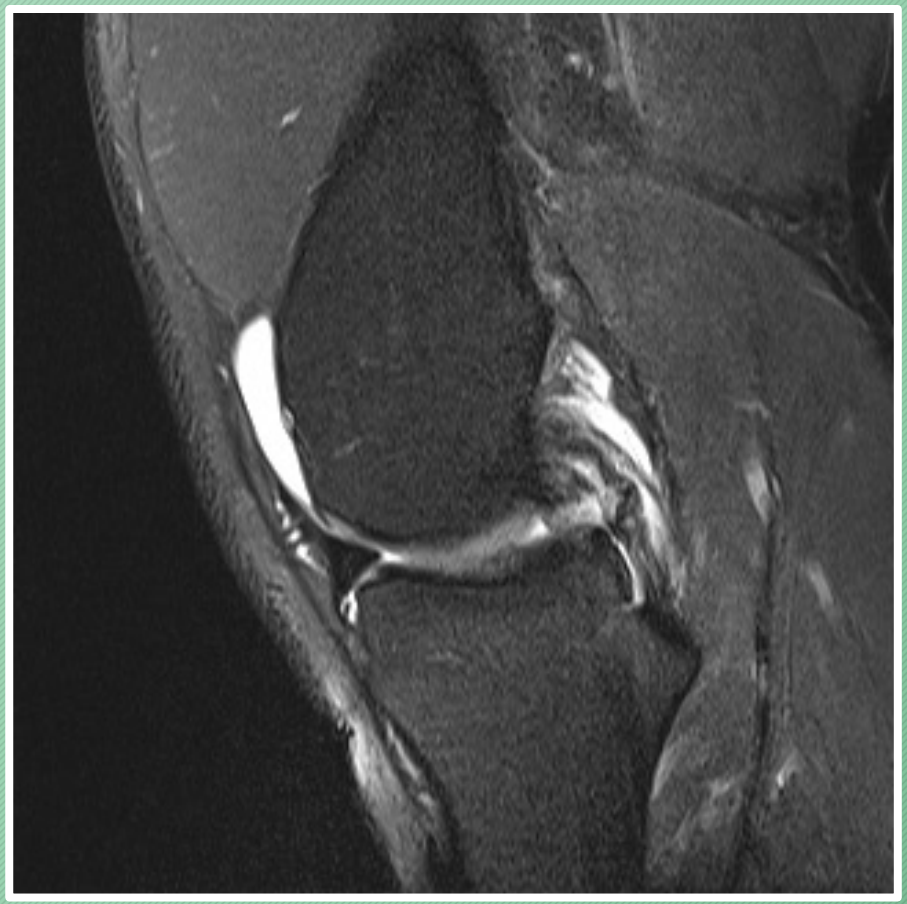


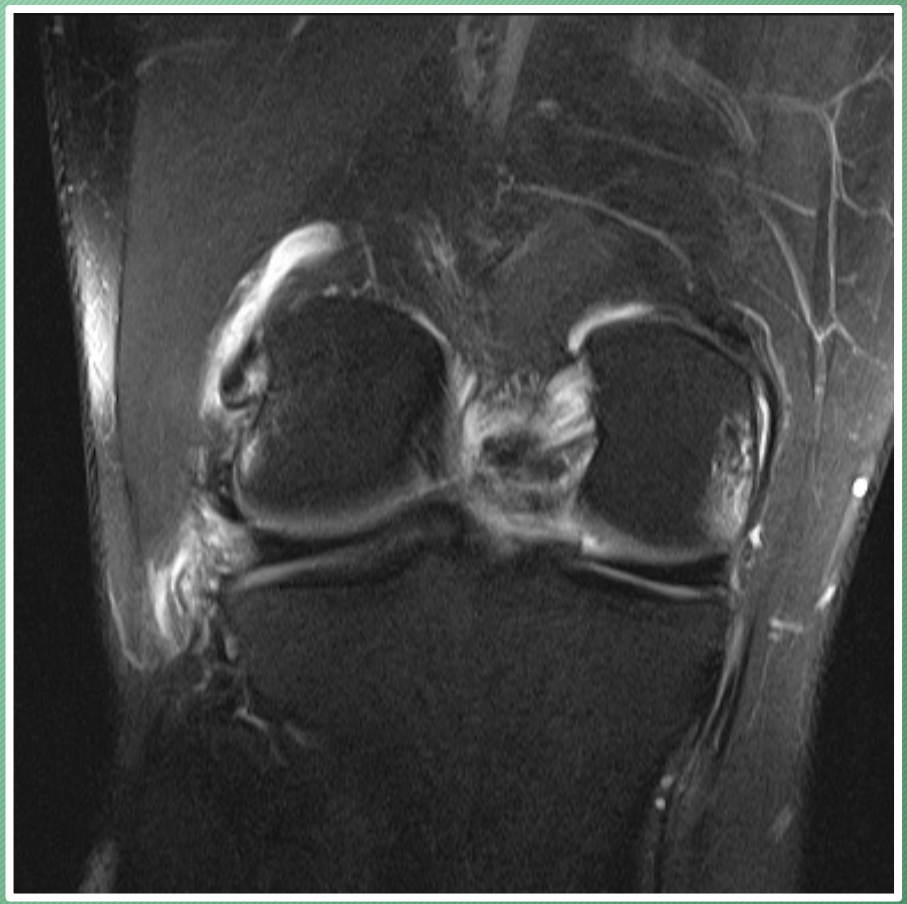
Case 2 C.L.

- 21M football player contact R knee injury during practice
- Immediate pain and difficulty ambulating
- Moderate effusion
- Grade 1+ PD with endpoint
- 1+ varus laxity at 30



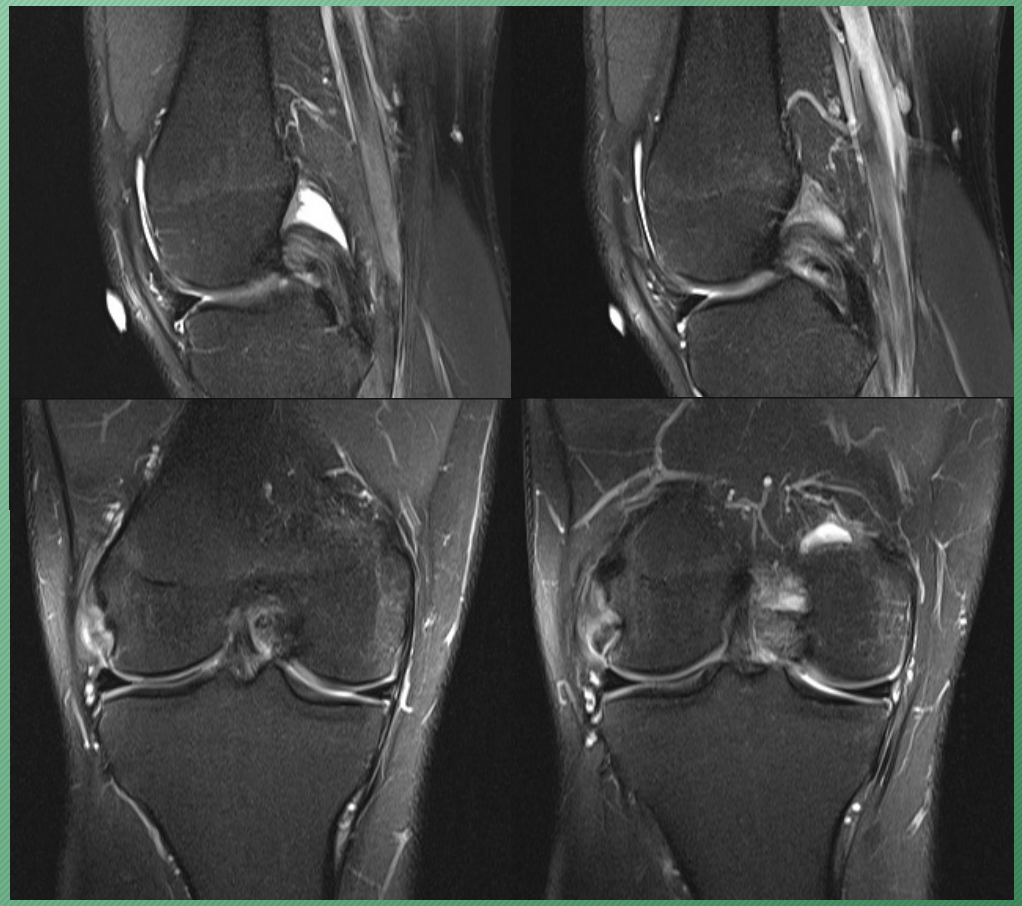
Imaging



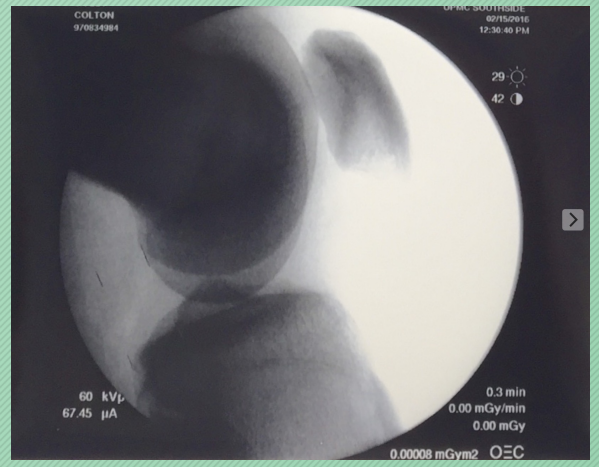


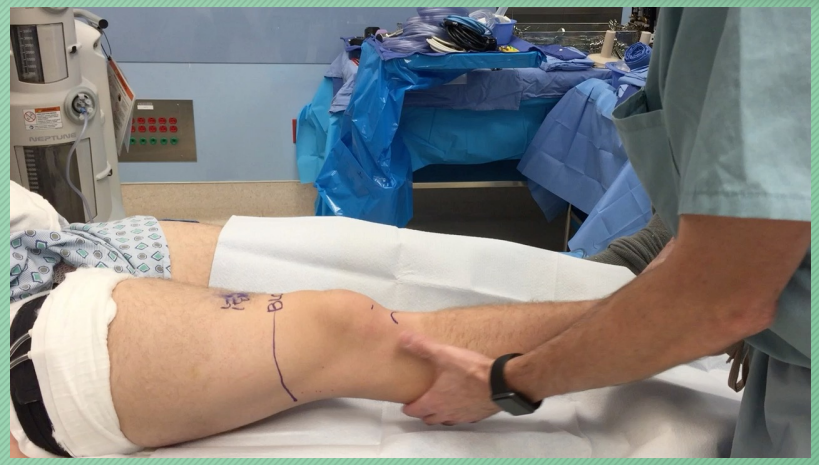
Clinical Course

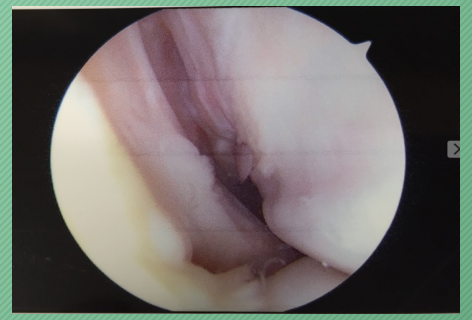
- Gr 2 PCL, Gr 1 pop, Gr 3 LCL
- Plan: hinged knee brace, quad strengthening, progressive RTP
- Was able to return to football. Developed secondary instability
- Repeat PE: grade 1 posterior drawer, grade 2 varus instability at 30 deg

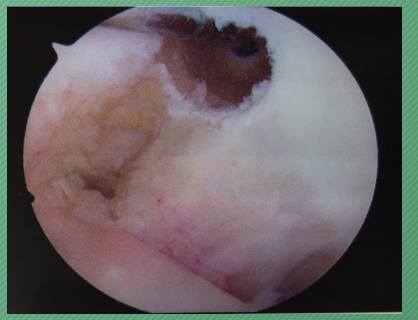


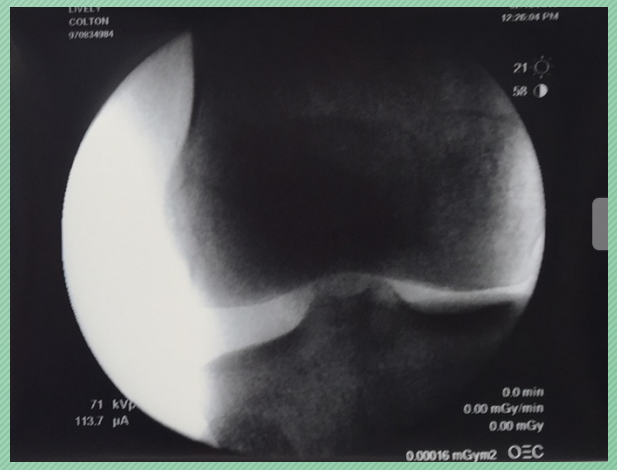
3 mos later to OR

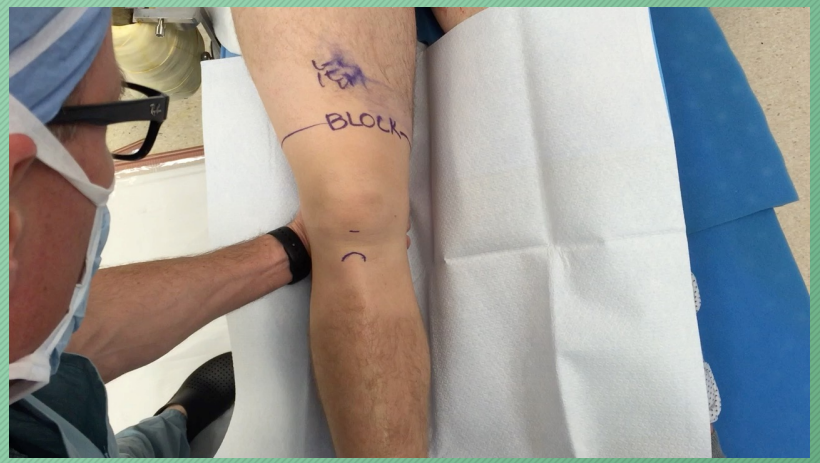


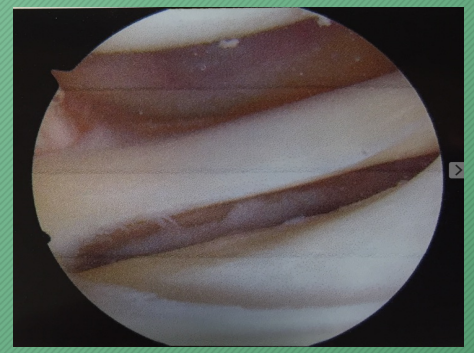


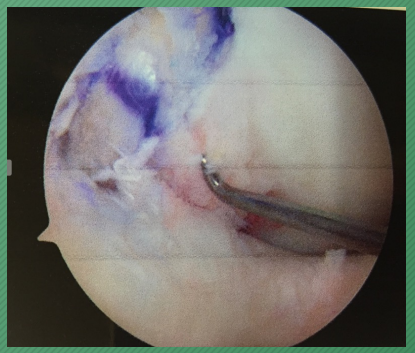












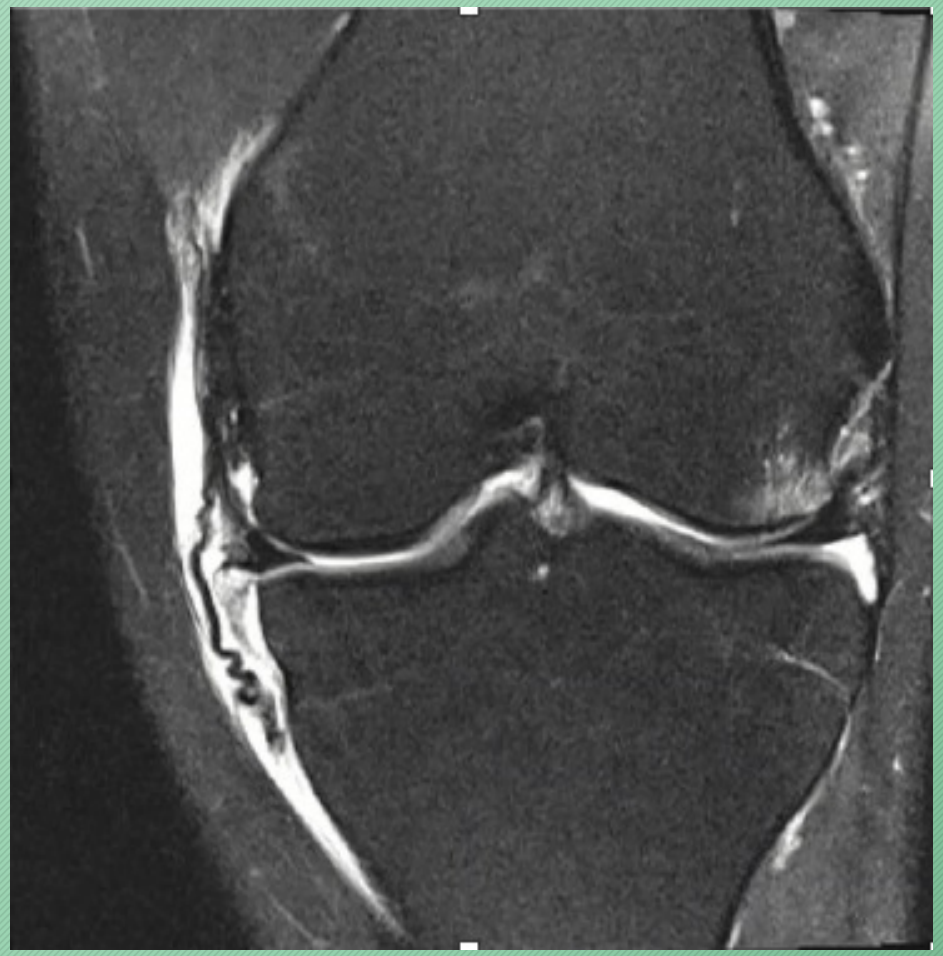
Follow up

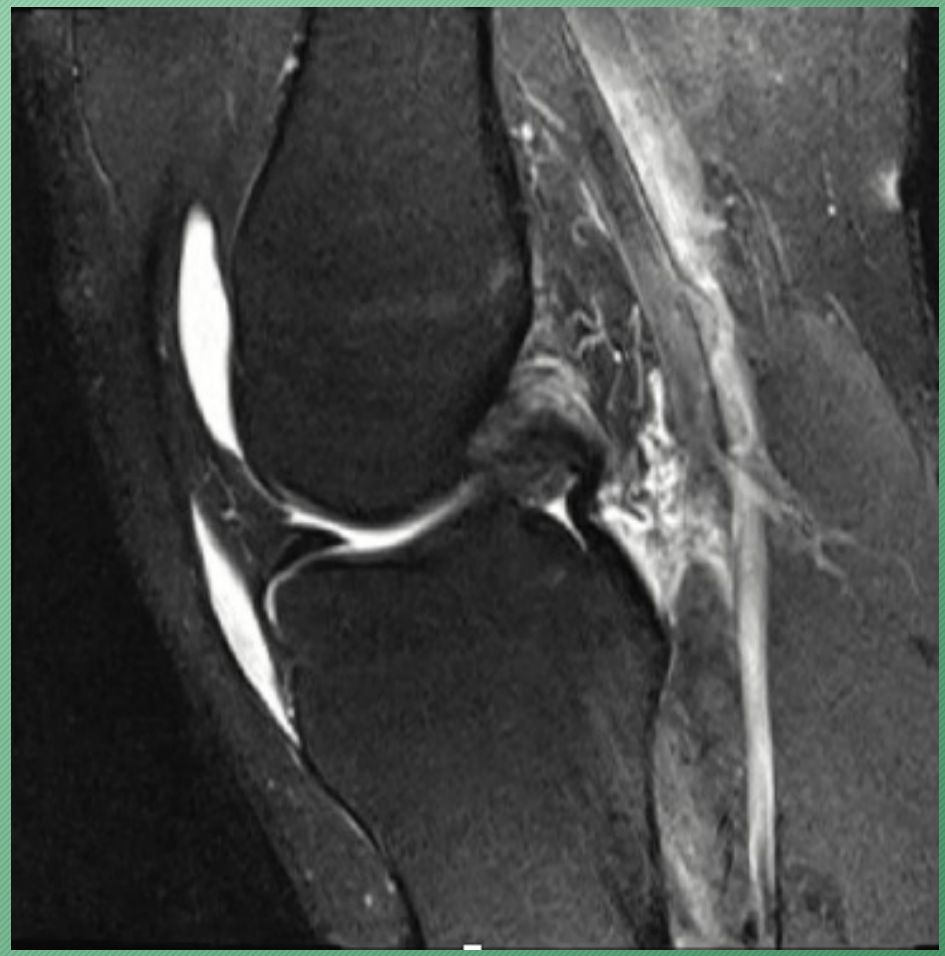
- Practicing at 7m
- No instability
- PD gr 1
- Varus 1
- ROM 0-130
- RTP 10m
- First game back complete rotator cuff tear

Case 3 R.J.

- 22 M Am football player, offensive lineman
- Direct blow to lateral aspect of left knee
- Immediate pain and instability
- Exam
  - 6’5”, 305 lbs
  - Neurovascular intact
  - Neutral alignment, moderate effusion
  - Good quad set, SLR intact
  - ROM 0-90
  - Stable anterior drawer
  - 2+ Posterior drawer
  - 3+ valgus opening at 0° & 30°

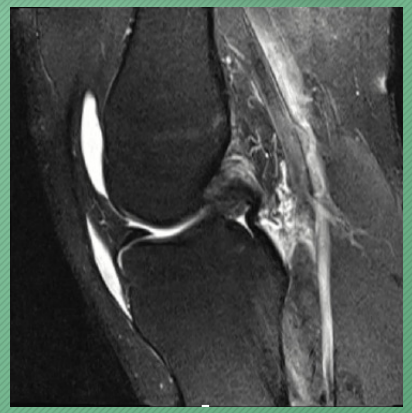
Case R.J.

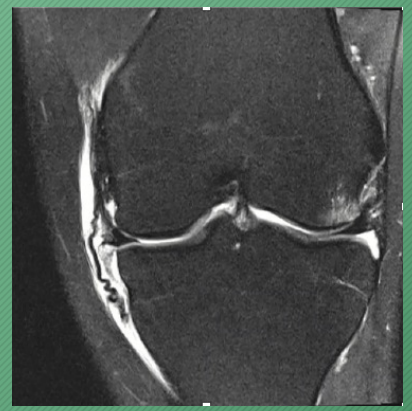




Case R.J.

- Indications for surgery
  - Unstable multi-ligamentous knee injury
  - High level athlete
  - Grade 3 tear of MCL
  - Grade 3 tear of PCL
- Indications for PCL repair
  - Avulsion





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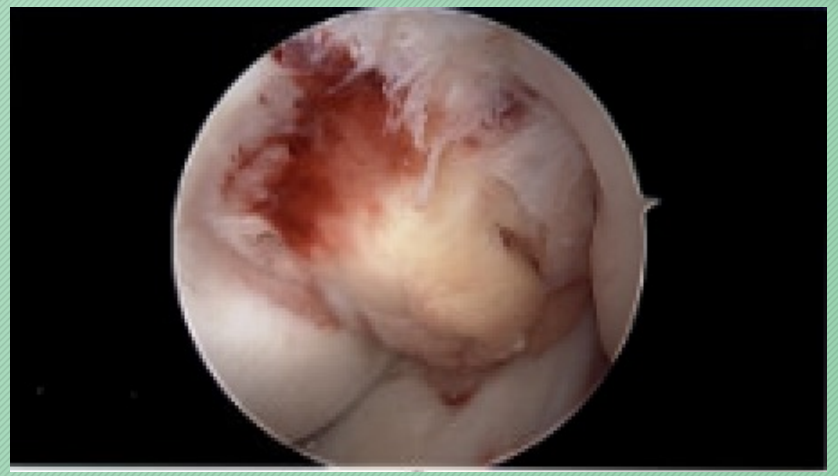
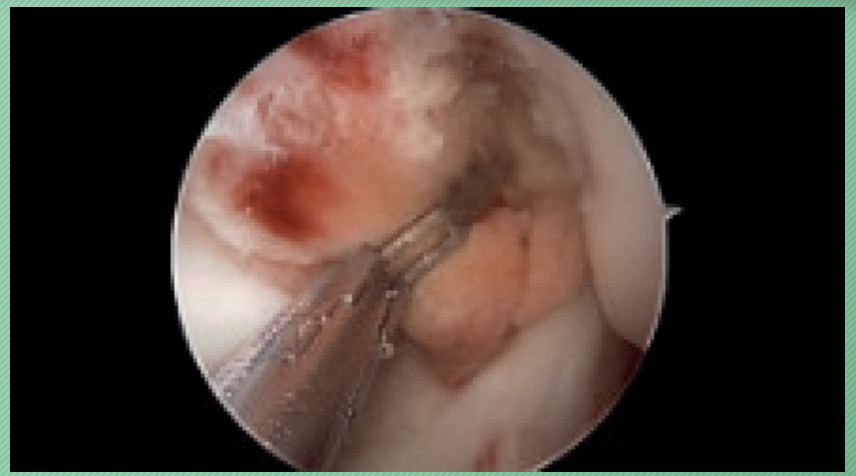
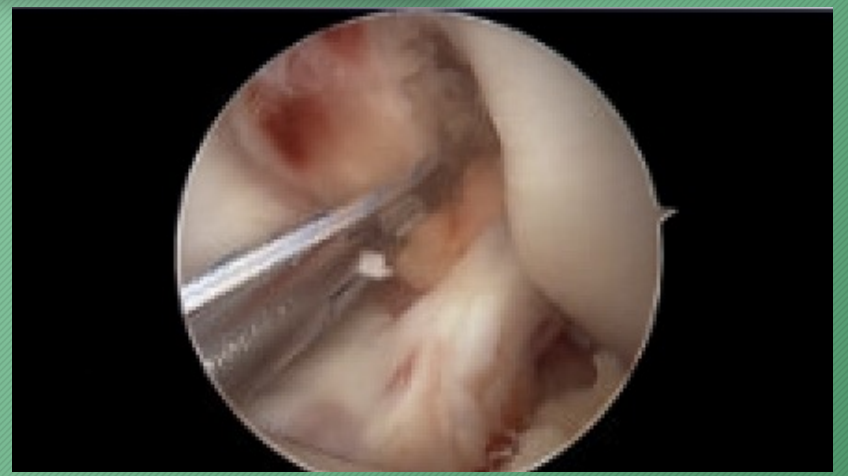
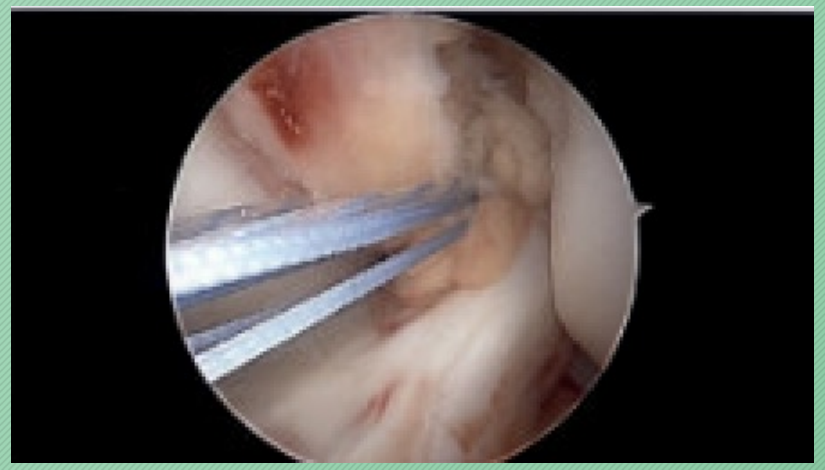
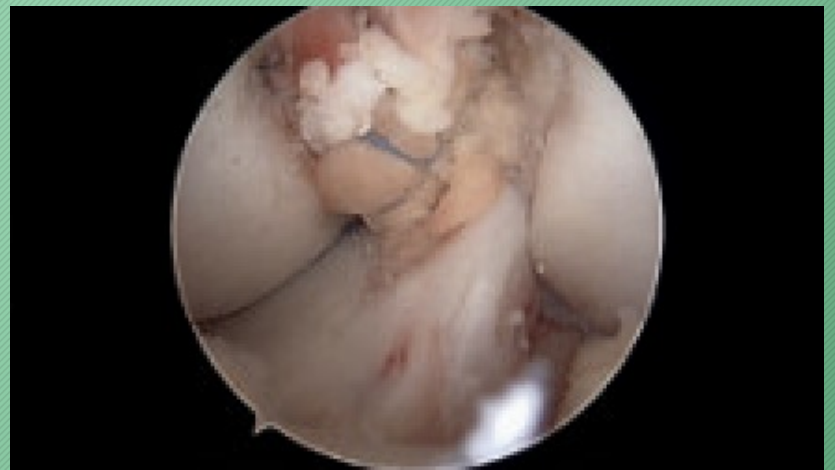
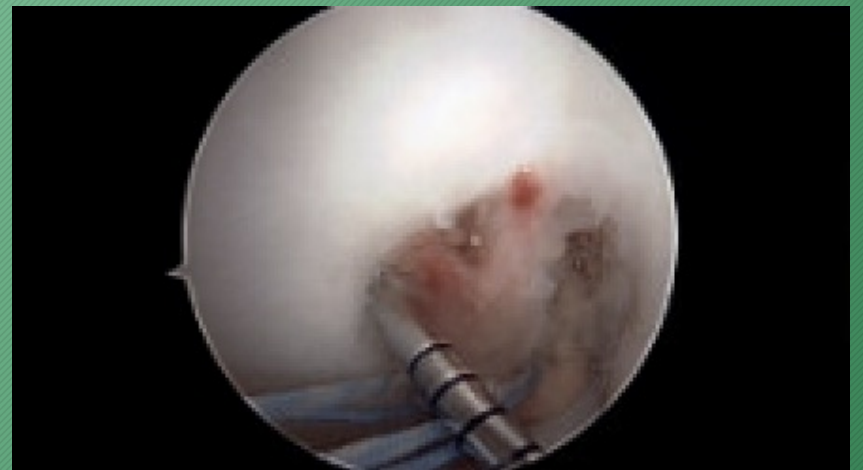

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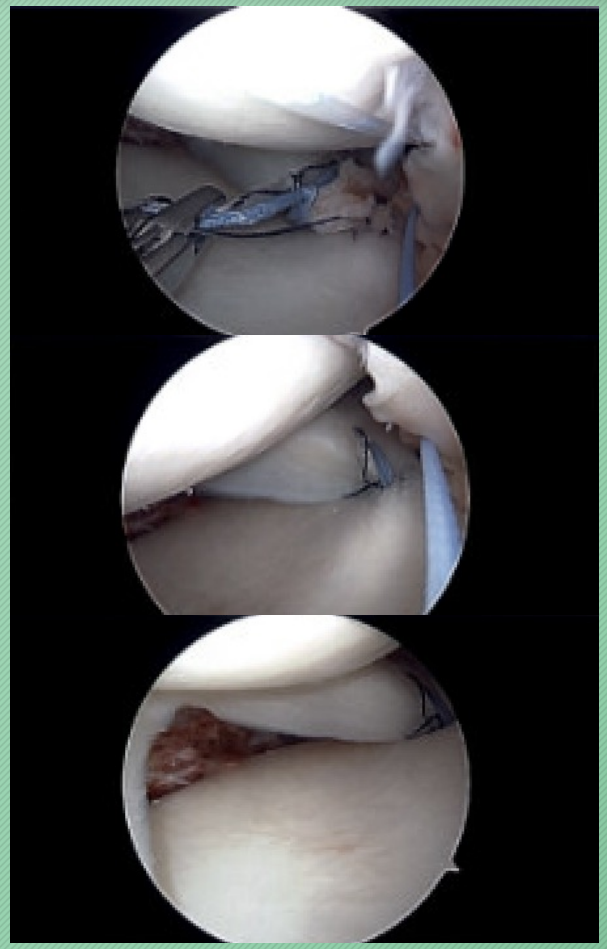
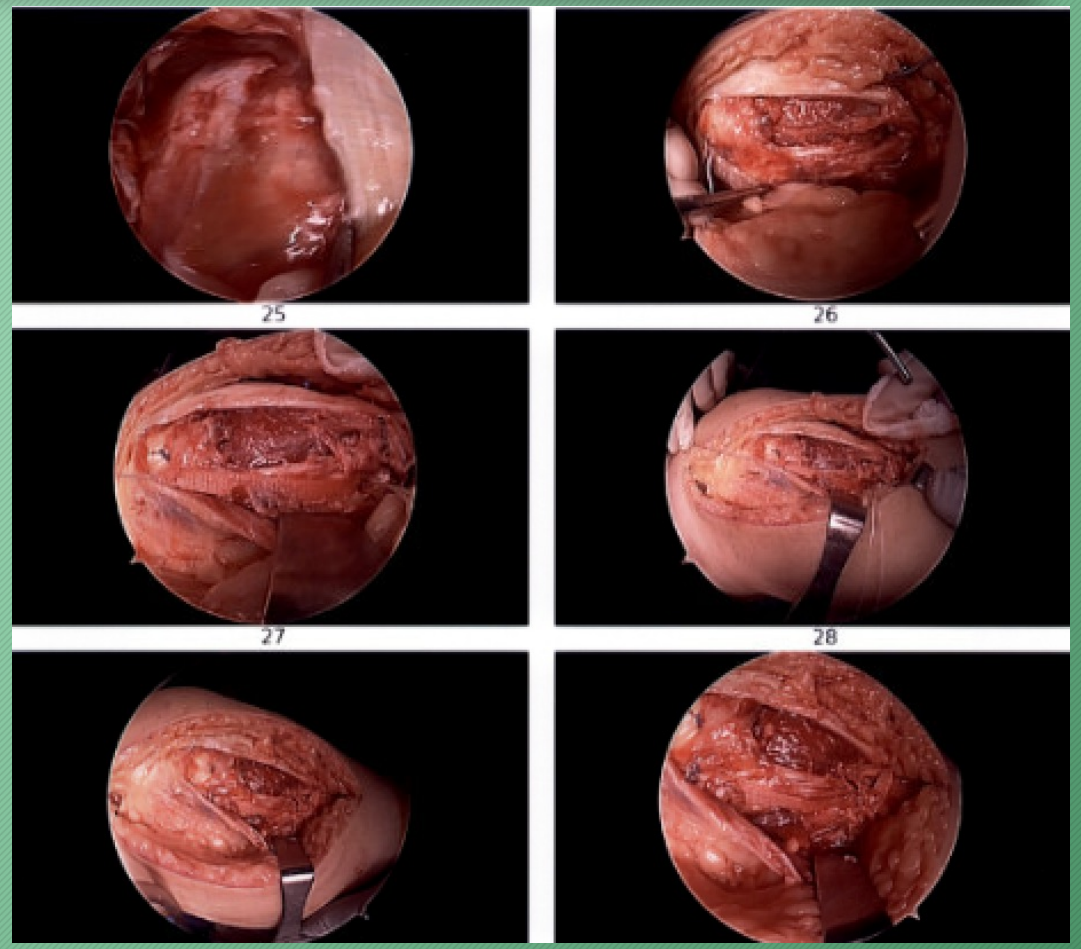
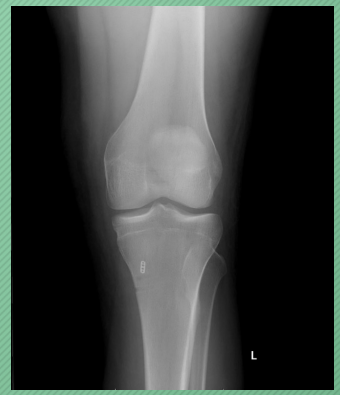
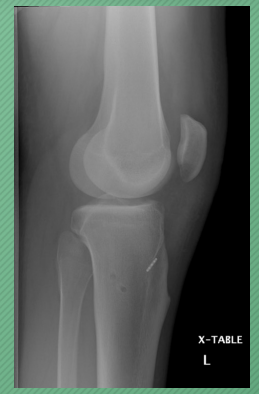




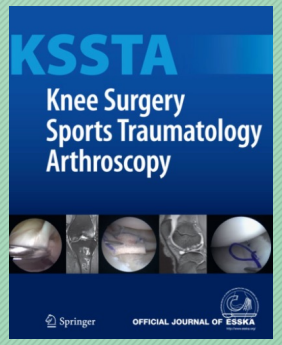
Case R.J. - 15 mos post op, starting OL

- Initially NWB x2 weeks, then WBAT x6 weeks with brace in extension
- ROM initiated after week 2, prone 0-90
- Cleared to return to play at 11 mos





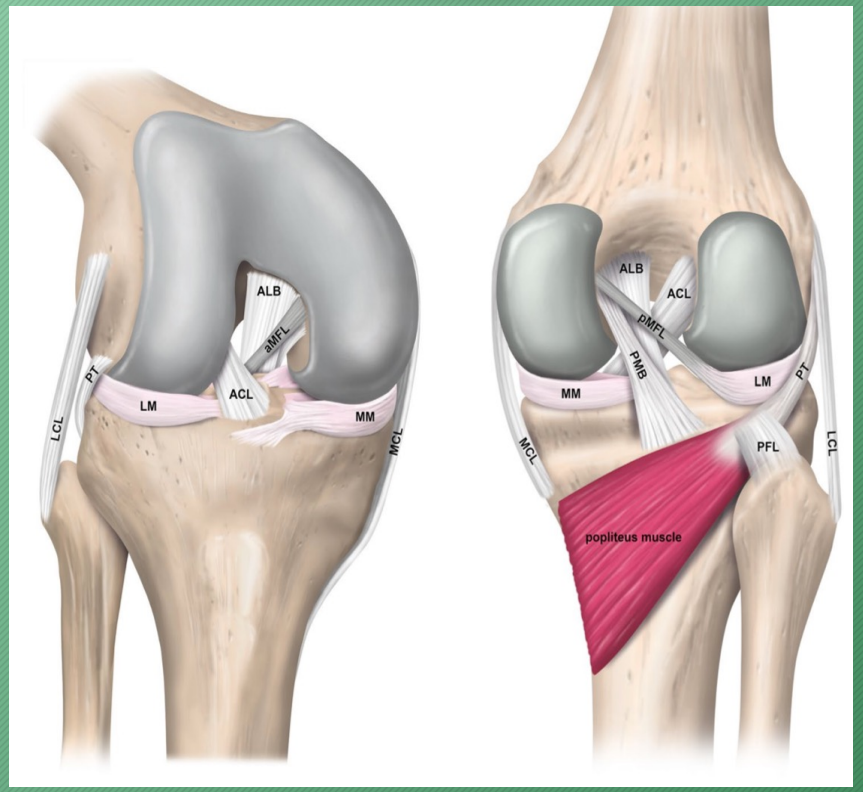
PCL-R - Evolving Evidence



Evolving evidence in the treatment of primary and recurrent posterior cruciate ligament injuries, part 1: anatomy, biomechanics and diagnostics

Evolving evidence in the treatment of primary and recurrent posterior cruciate ligament injuries, part 2: surgical techniques, outcomes and rehabilitation

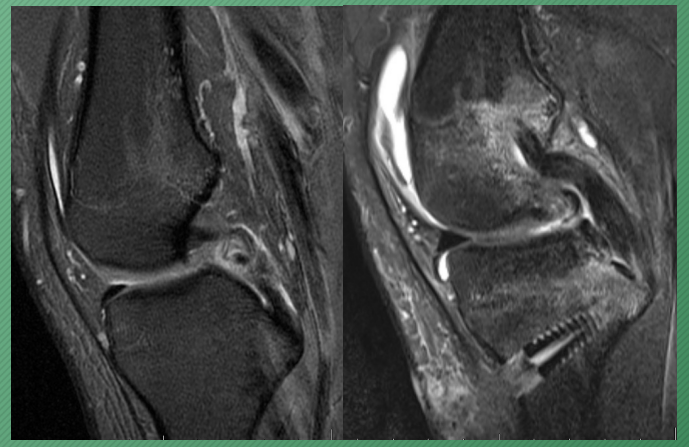
- Anatomy and biomechanics key for decision-making
- Different surgical techniques
- Indications for operative vs. non-op treatment
- Risk factors, complications, outcomes



Winkler, Zsidai, Samuelsson, Musahl KSSTA 2021

Summary

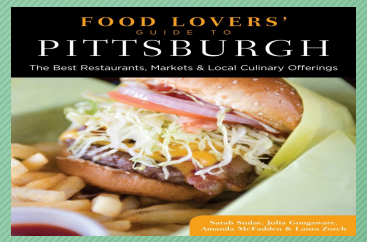
1. Low grade PCL injuries will heal without surgery
2. Use physical exam and stress XRs to grade instability and injury severity
3. PCL injury patterns that can benefit from surgery
    1. Isolated Grade 3 injury (failed non-op)
    2. Grade 3 injury with another ligament involved
    3. Isolated grade 3 injury in an elite athlete



Thank You!






PITTSBURGH
OPERA


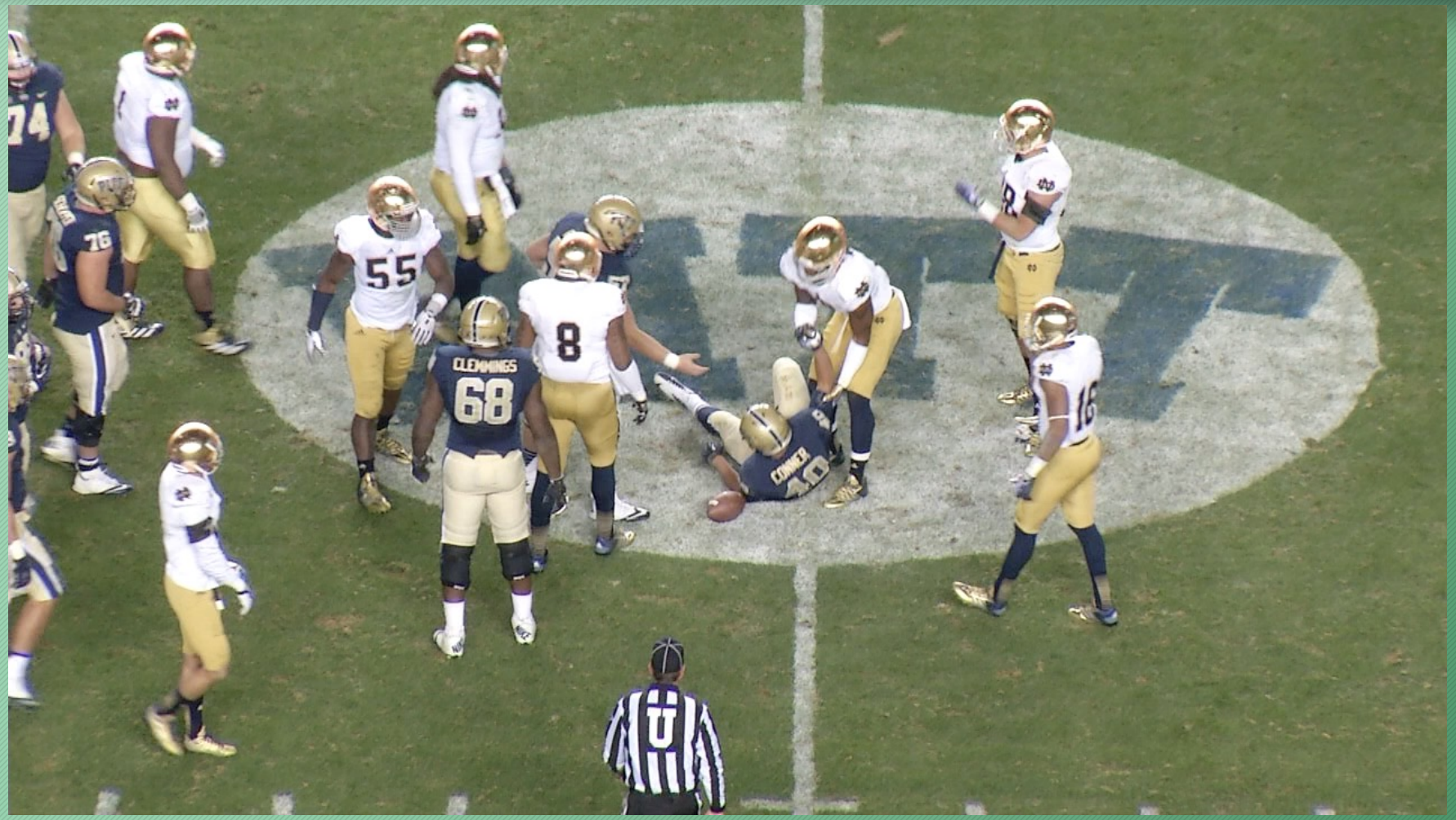






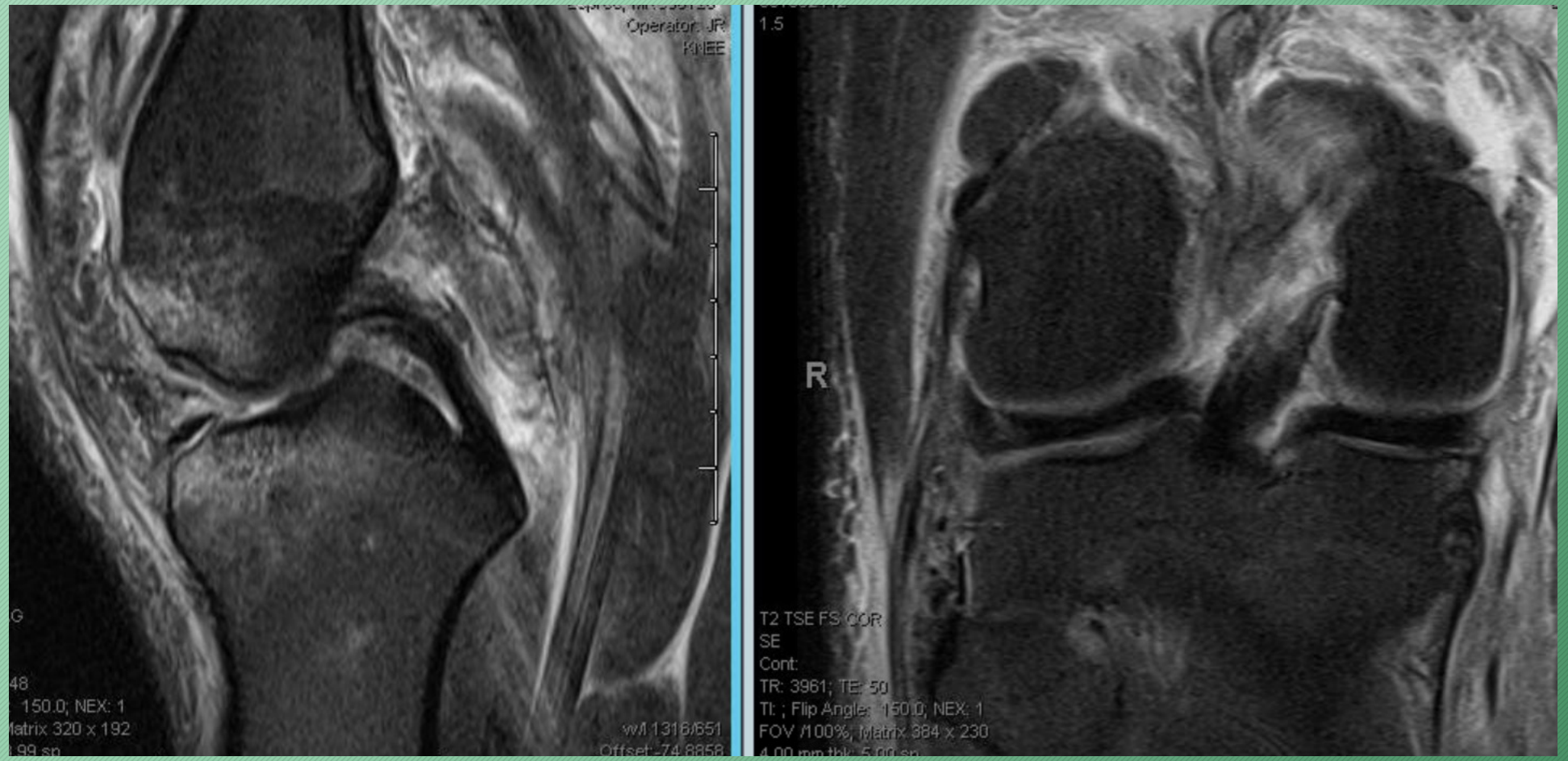

Mattress Factory
art you can get into


Case 1: S.O. (2015)



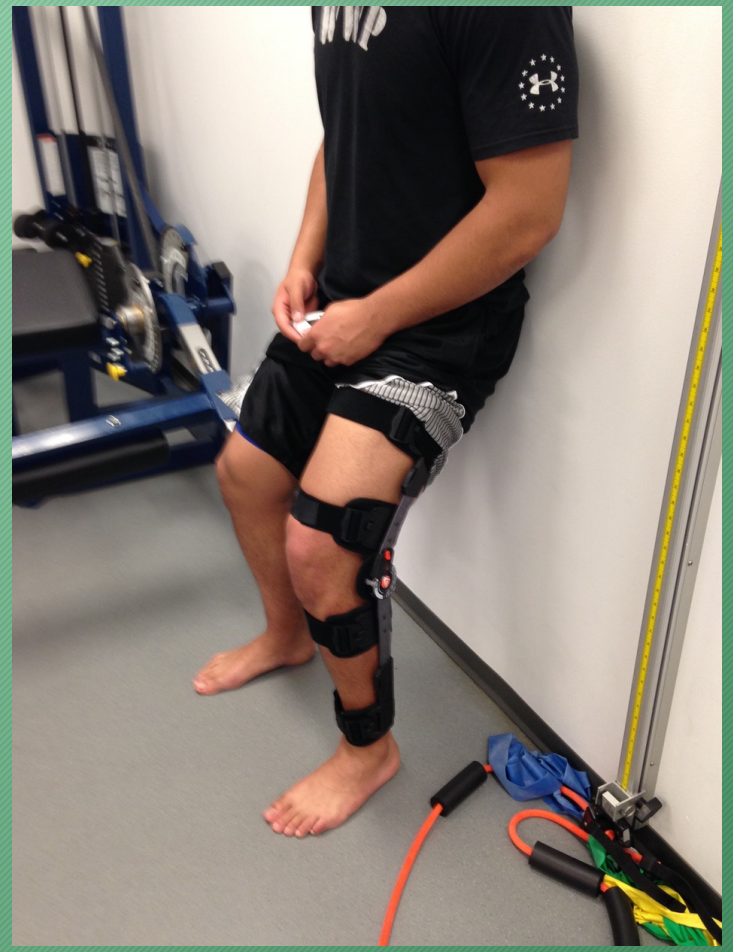
S.O. – varus hyperextension injury

S.O. – Grade 2 PCL (fem), grade 2 LCL (mid)



S.O. – non-op treatment

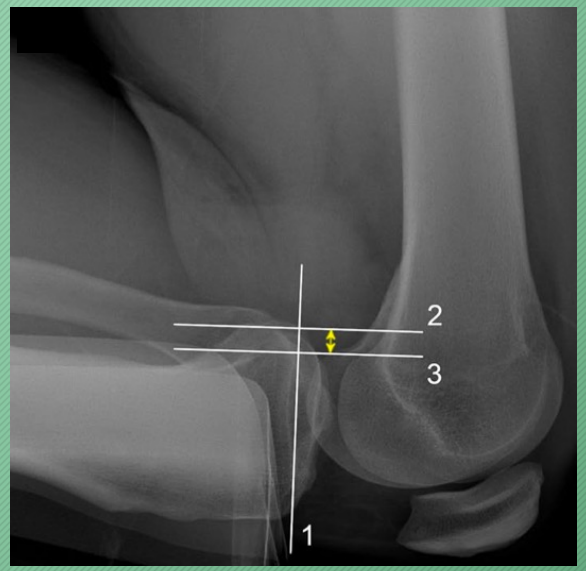
- Brace locked in extension x 3 weeks
- ROM 0-90 x 4 weeks (prone)
- WB mini squats (slope)
- Gradual return to functional in 8 weeks
- Individual training at 12 weeks
- RTP ~ 4 months

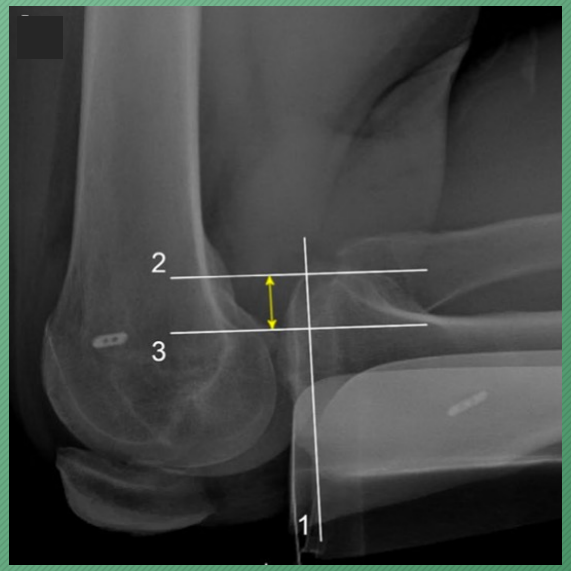


S.O. – RTP (2016 at Clemson, 2TD)

Surgical Indications – PCL Reconstruction

- Grade II symptomatic tears with no functional improvement after non-op. treatment
- High grade laxity and multiligament injury
- Stress-XR: >8 mm side-to-side difference in PTT
- Patient demands → athletes!





Spiridonov, LaPrade et al, JBJS 2011
Schulz, Strobel et al, JBJS 2007
Winkler, Zsidai, Samuelsson, Musahl et al., KSSTA 2021

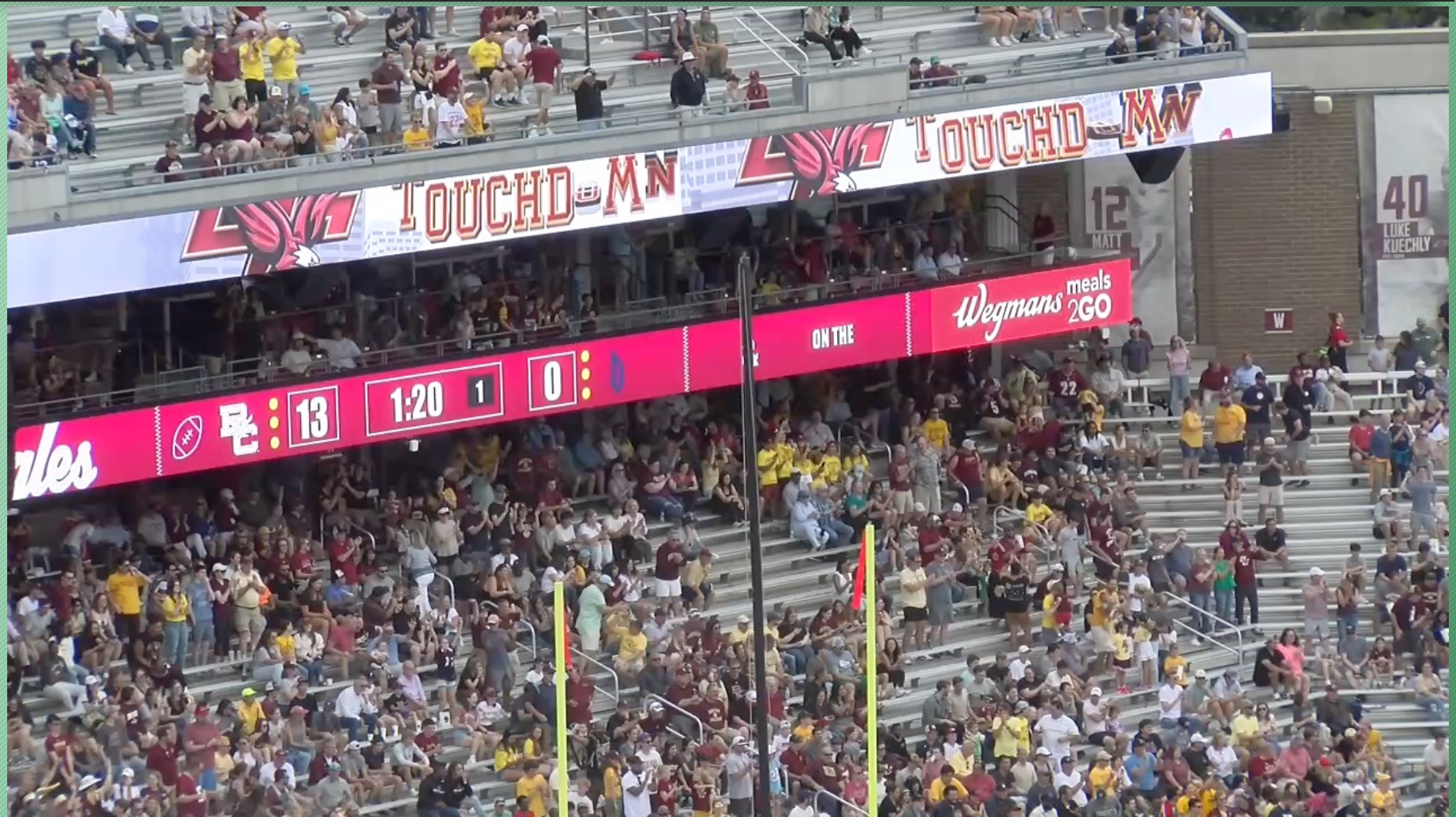
Graft Choice

Graft		
Hamstring auto	long	thin
Quad auto	Thick, can include bone	short
BTB auto	long	Hard to pass 2 bone blocks
Achilles allograft	Long, thick, bone attached	allograft

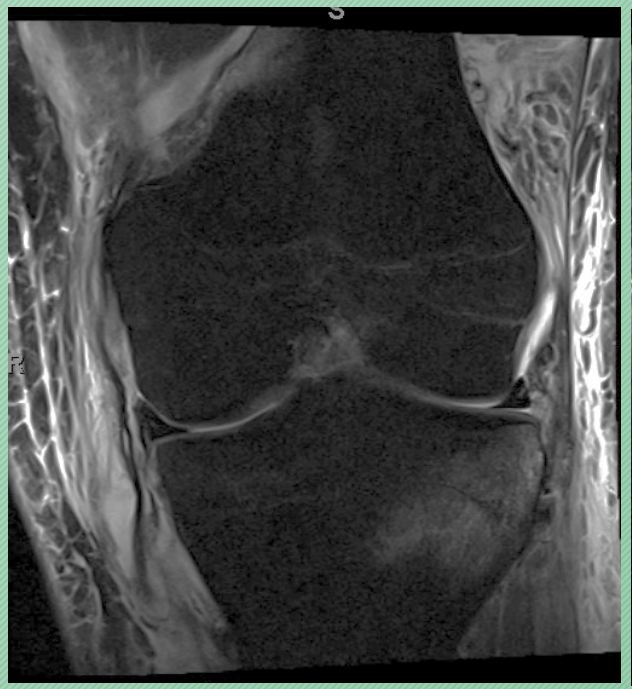
Case3: N.C. (2024)

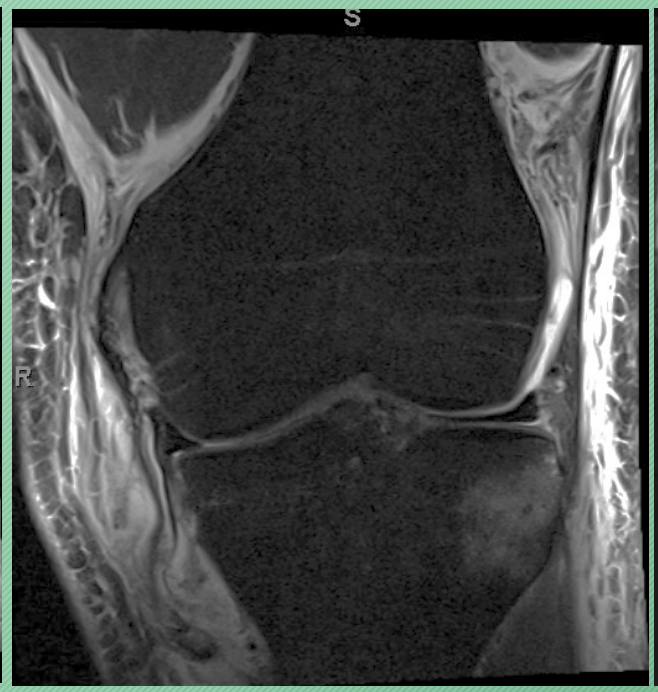
- 22M college football WR/TE, injured by blow to the knee from behind on a kickoff return. “pop”, “pop”
- OE
- ++ Lachman, ++ anterior drawer
- (+) posterior drawer
- ++ opening to valgus in FE and at 30

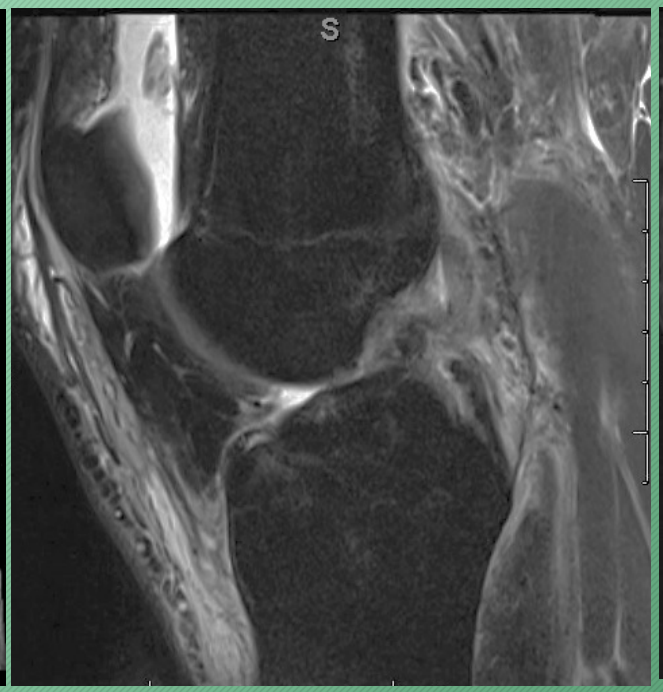
Case N.C.

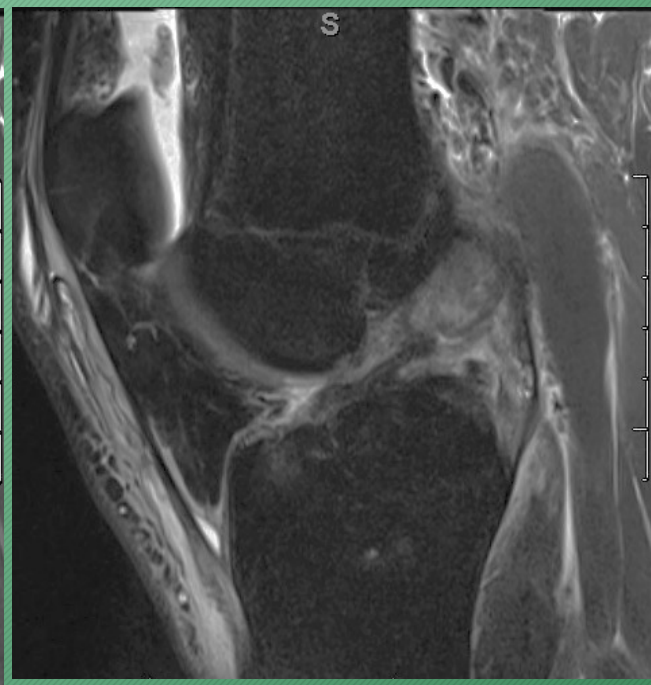

TOUCHD-MN
TOUCHD-MN
13
1:20
1
0
ON THE
Wegmans meals 2GO
12
40
LUKE KUECHLY

Case N.C.





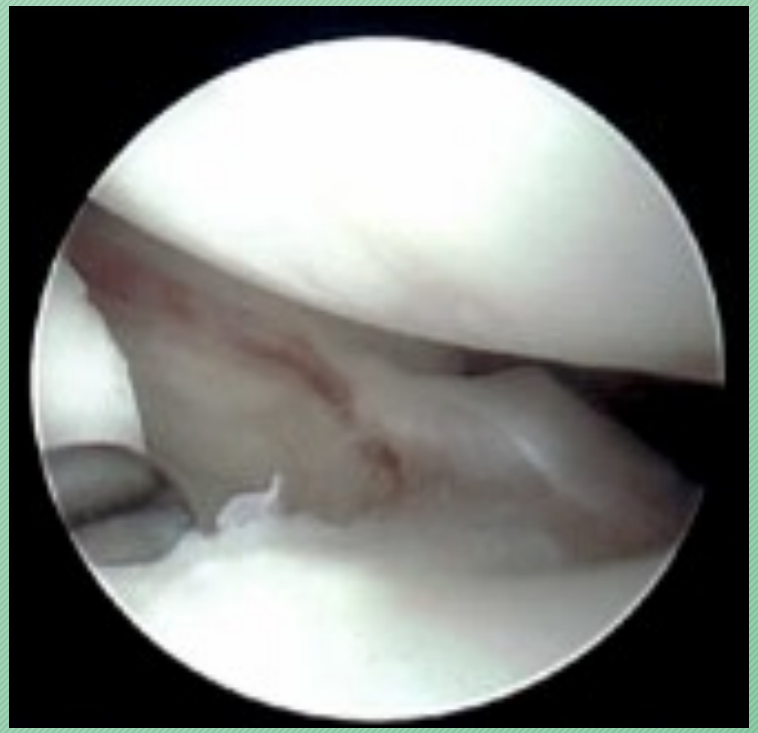


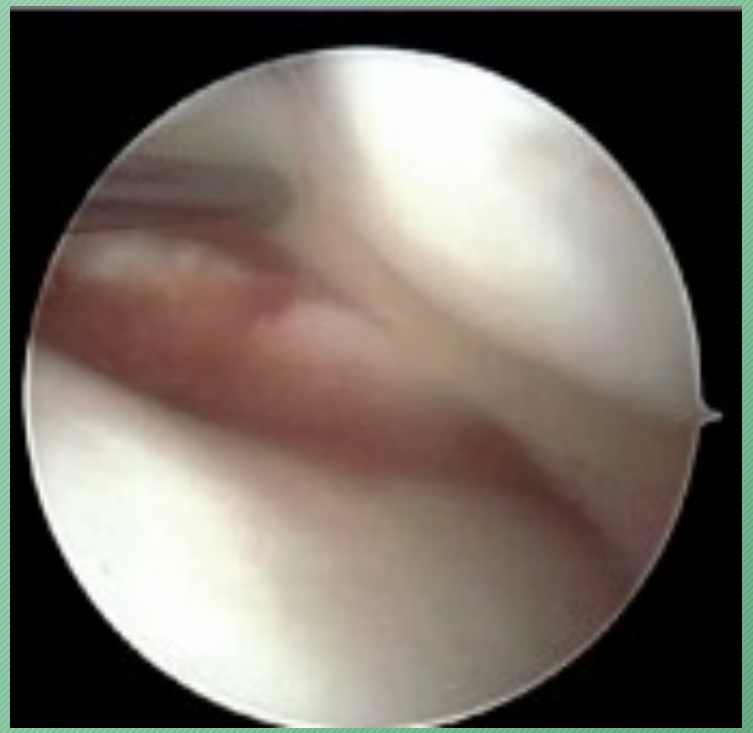


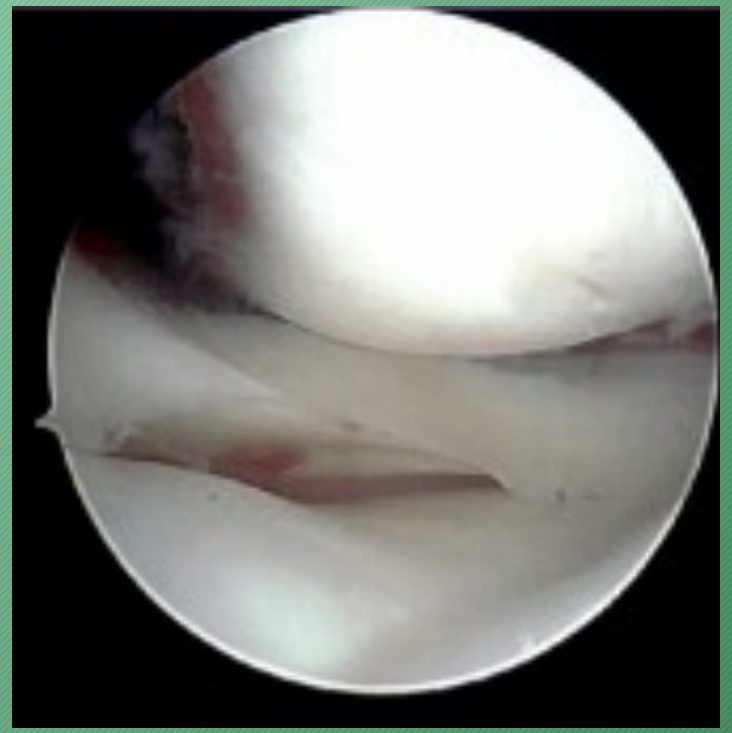
Case N.C.

- KDIIIm
  1. Mid-substance grade 3 ACL
  2. Mid-substance grade 1-2 PCL
  3. Tibial sided completed sMCL and dMCL
  4. Lateral meniscus tear (posterior horn vertical in red-red zone)
- Plan
  - QT-ACL, repair s/dMCL, heal response PCL

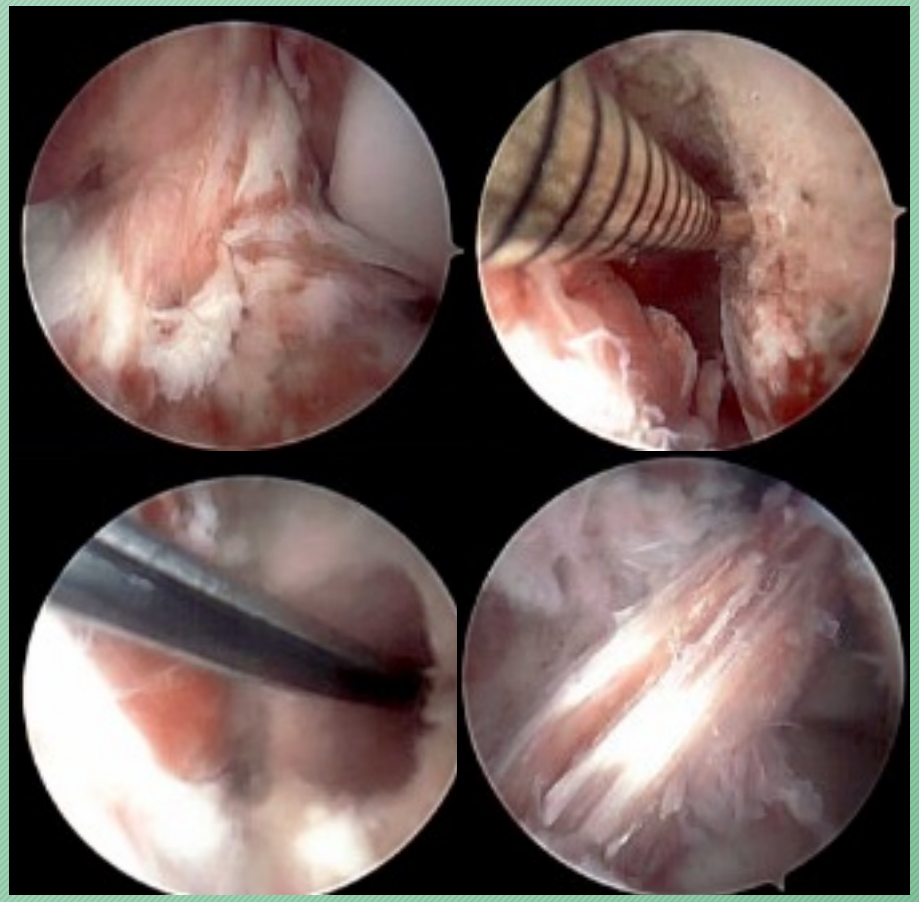
Case N.C. - Lateral meniscus repair

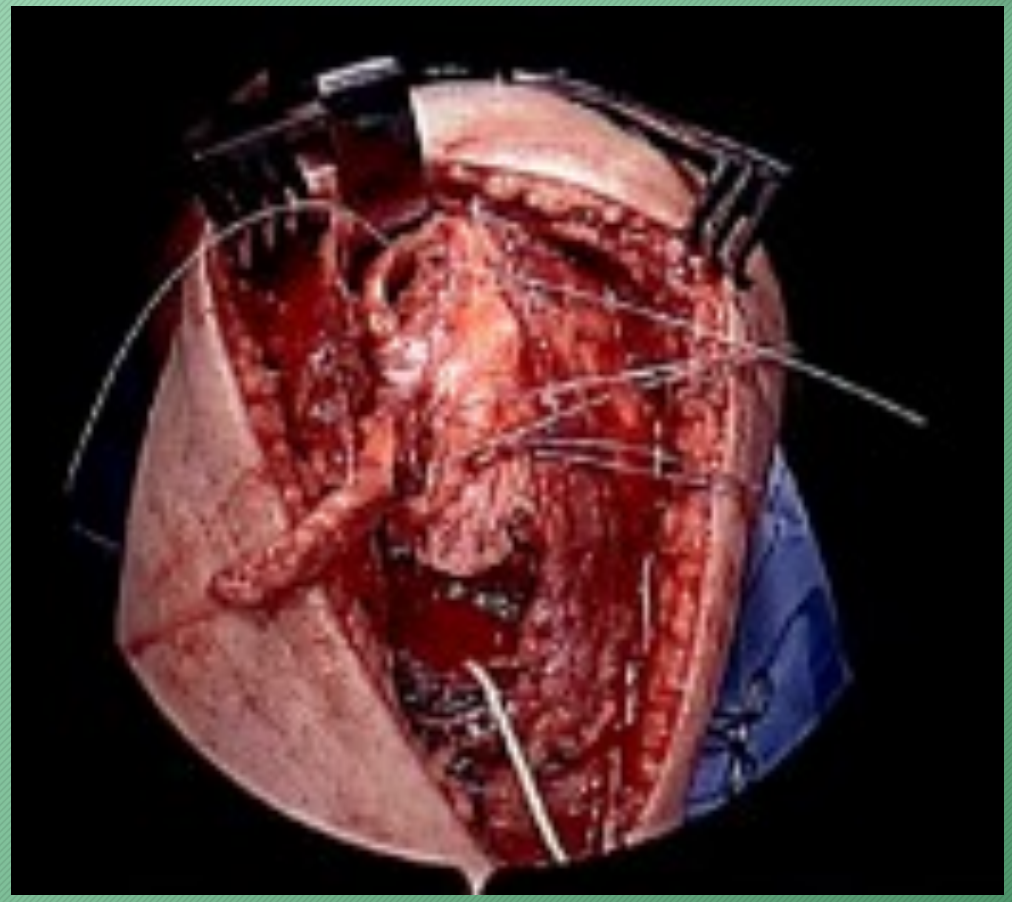






Case N.C. - ACL reconstruction





Case N.C.

- Operation
  - ACL recon with quad tendon autograft
  - MCL repair
  - Lateral meniscus repair
- Follow up
  - 3 months post op
  - Eager to take therapy ”to the next level”
  - 1A Lachman
  - Stable anterior and posterior drawer
  - 1+ opening to valgus stress