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## The Anterior Cruciate Ligament

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[www.kneedoctor.com.au](http://www.kneedoctor.com.au)

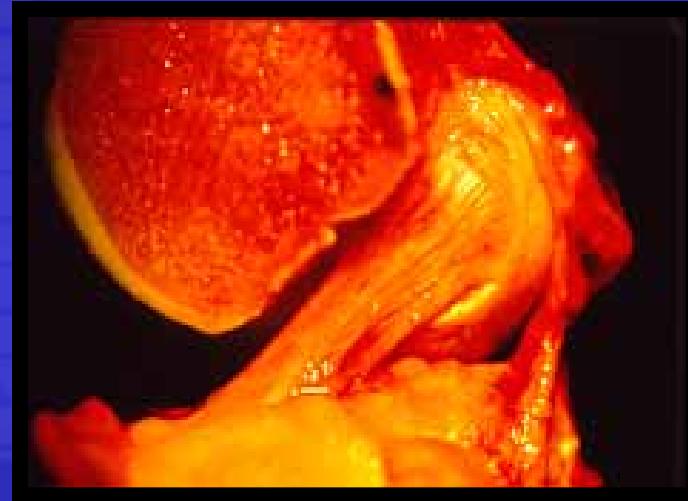
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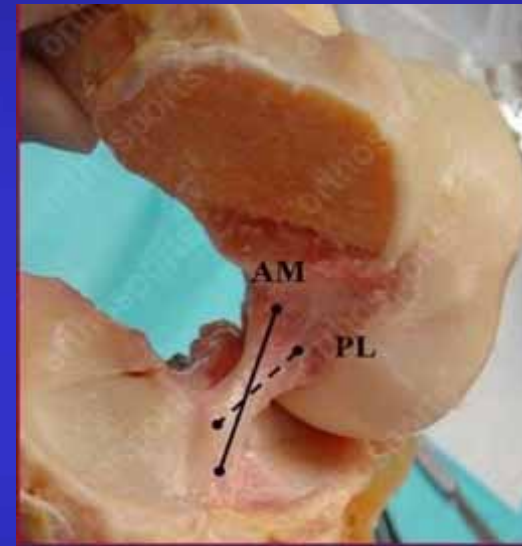
# What's New in ACL Reconstruction



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- History
- Examination
- Investigations
- Repair
- Graft Choice
- Age
- Bracing
- Timing
- ALL
- Rehabilitation



# Incidence

- 0.38/100 people per year
- 1.2 ACL tears per 1000 skier-days
  - Feagin et al. CORR 216, 1987
- 61,000 Reconstructions in 1993
- **Estimated to be > 250, 000 now**

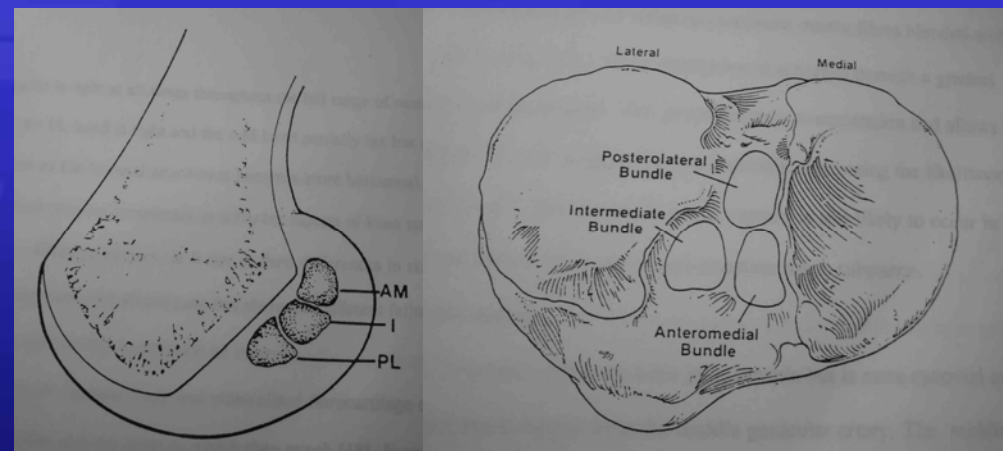


# History – nothing new

- Valgus external rotation injury over planted foot

Or

- Quadriceps active mechanism





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# Clinical Examination

- Anterior Drawer
- Lachmann
- Pivot shift (8 different descriptions)
- Lelli / Lever Sign Test
  - Probably doesn't work
- Beware of the varus knee
  - HTO Required



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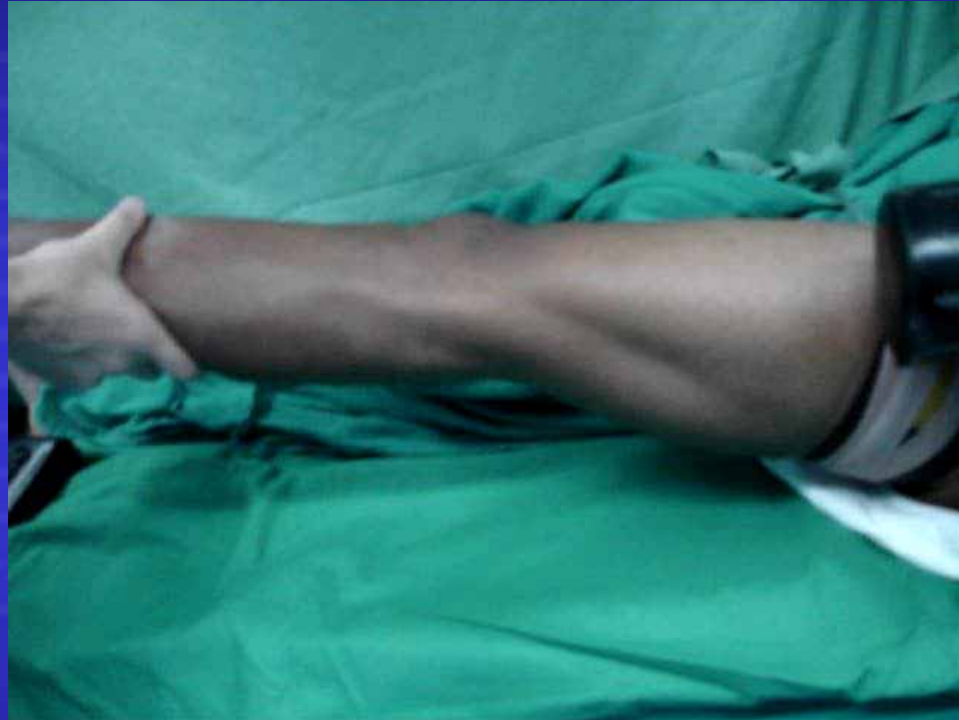
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# Investigations

- Xray
  - Dislocation
  - Intra articular fracture
  - Segond fracture
  - Alignment
  - Other changes
- MRI still the gold standard



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# MRI



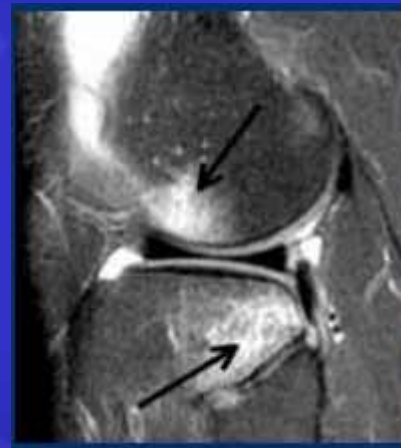
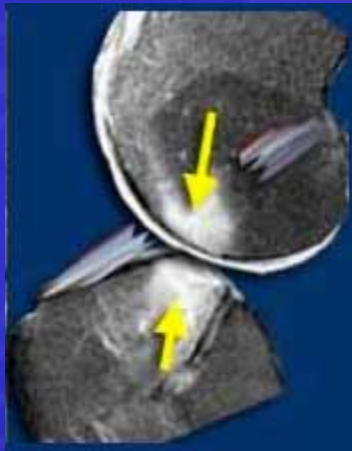
Sagittal



Coronal



# Bone bruising from dislocation



# ACL Repair

- Not New

- Mayo Robson AW. Suture of the crucial ligaments. Lancet. 1902;160:1722.



- BEAR

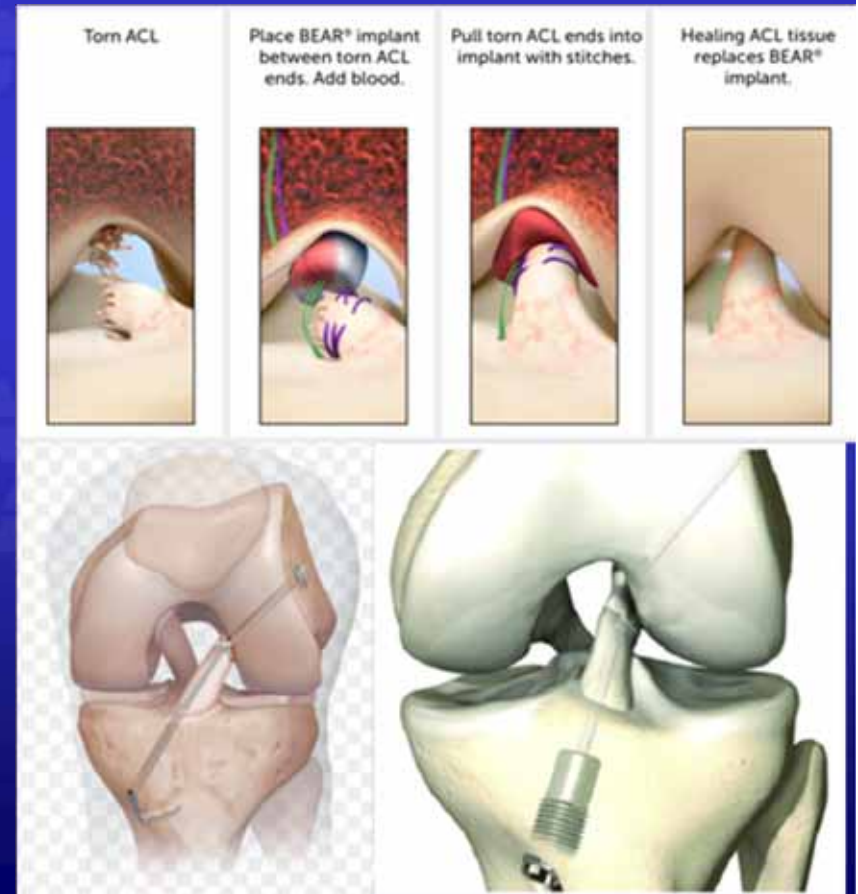
- Bridge Enhanced ACL Repair

- Internal Brace

- Fibre tape run behind the ACL

- Non isometric

- Internal Spring



# Graft sources – a bit new

- Autograft
  - HT, PT, Quads, Contralateral leg
- Allograft
  - But irradiated in Australia
  - MUST use non irradiated
    - Possible infection risk
- Augmentation Devices
  - LARS
  - DON'T use inside the knee



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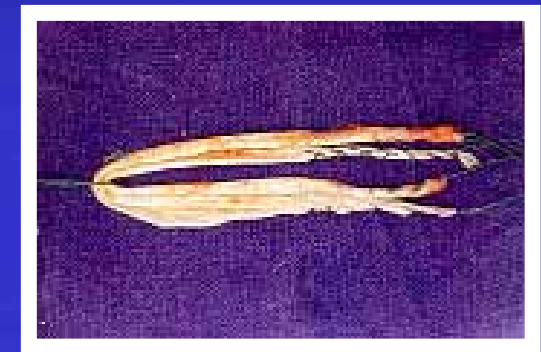
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# Hamstring Autograft


- Strength loss <10%
  - Ant knee pain 6-30%
  - Faster recovery
  - Fewer stable knees for high level
  - Females more laxity
- 
- Men recover HT strength, Females DO NOT



# Allografts - Inferior outcomes

- < 25 years
- Highly active patients
- Irradiated
- Chemically processed grafts are used
- Might be OK if >40yrs old

## The use of allograft tendons in primary ACL reconstruction

Christophe Hulet<sup>1</sup> · Bertrand Sonnery-Cottet<sup>2</sup> · Ciara Stevenson<sup>3</sup> · Kristian Samuelsson<sup>4,5</sup> · Lior Laver<sup>3</sup> · Urszula Zdanowicz<sup>6,7</sup> · Sjoerd Stufkens<sup>8</sup> · Jonathan Curado<sup>1</sup> · Peter Verdonk<sup>9</sup> · Tim Spalding<sup>3</sup> 

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# What About No Surgery?

- Sedentary individuals
- Rare high level
- Willing to modify
  
- Do NOT trial the knee
- Do NOT delay to end of season



# Age of the patient

- Mean Age 29
- 200% increase >40 yrs

Review Article

Management of Anterior Cruciate  
Ligament Injuries in Adults Aged  
>40 Years

*J Am Acad Orthop Surg* 2018;26:  
553-561

DOI: 10.5435/JAAOS-D-16-00730

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# Healing related to Age

- Stem cells in the ACL decrease with age
- 40yrs
  - Disoriented collagen fibres
  - Ligament sheath inflammation
  - Altered tissue water/collagen content

**Table 2**

**Effect of Age on ACL Biology**

ACL Biology	Effect of Age
Healing potential	↓
Mesenchymal stem cells (number of)	↓
Growth factor receptors (number of)	↓
Cellular metabolic activity	↓
Collagen production and organization	↓
Apoptotic rate	↓
Ligament sheath inflammation	↑
Muroid degeneration	↑
Cyst formation	↑

ACL = anterior cruciate ligament



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# Patients aged >40 yrs

- Menisci / Cartilage more susceptible to injury
- Higher risk of:
  - Subsequent meniscal tears
  - Arthritis
  - TKR
- Do not 'trial' non surgical treatment if returning to sport
  - Probably at even higher risk.



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# Patients aged >40 yrs

- Allograft re-tear rate
  - 2% > than autograft
  - (15% higher risk for 14 year old)
- Higher risk of patella fracture
- Higher risk of PT rupture
- Lower KOOS preop but improved ++ post op



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# Braces – Conflicting results

- Rehab more important than bracing
  - Thigh atrophy at 3 months
  - Quads weaker with long term use
  - Braced skiers less injuries



Research Article

Functional Bracing After Anterior  
Cruciate Ligament Reconstruction:  
A Systematic Review

*J Am Acad Orthop Surg* 2017;25:  
239-249

DOI: 10.5435/JAAOS-D-15-00710

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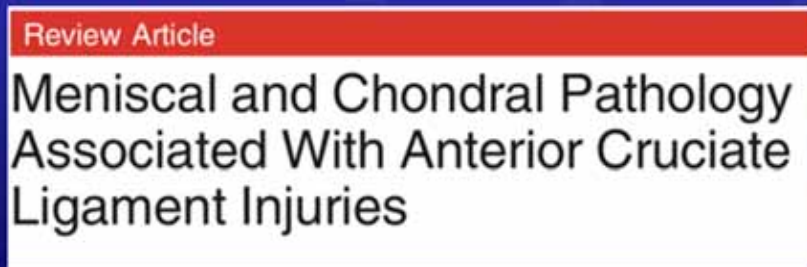
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# Timing of Surgery

- 'Safer' to wait for quiescent joint
- 50-90% cartilage or meniscal injury with delays
  - Increase by 1% per month
- 12wk delay leads to 8-19% more medial meniscal tears
- 52 wk delay more and worse chondral injuries



*J Am Acad Orthop Surg* 2019;27:  
75-84

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# Bone bruises matter more than isolated chondral defects

- 21% of lateral contusions associated with “clinically significant” chondral defect
- Resulted in markedly worse outcomes at all measured time points

**Table 2**

**Summary of Conclusions (Levels of Evidence)**

Lateral meniscal tears are more often associated with acute, primary ACL tears and occur less frequently in chronic ACL tears and failed reconstructions (III)

Increasing time from injury and increasing episodes of instability result in higher rates of chondral defects and medial meniscal tears (II, III)

Meniscal tears and previous partial meniscectomies have higher associations with corresponding compartmental chondral defects in both primary and revision ACL reconstructions (II)

Failed ACL reconstructions have higher rates of chondral injury than primary cases, which partially depends on meniscal integrity. Rates of patellofemoral chondrosis are higher in revision cases (II)

Benign neglect of stable meniscal tears in association with ACL reconstruction leads to generally acceptable outcomes; however, medial meniscal tears left in situ are associated with higher revision surgery rates than lateral tears (9.5%–18.3% versus 3.0%–5.8%).<sup>3,4</sup> Detailed outcomes comparing treatment modalities in specific tear subtypes are generally lacking.

Success rates for repair of unstable, nondegenerative meniscal tears is high, with better survival rates with inside-out techniques compared with all-inside techniques (III, IV)

Emerging biomechanical and clinical data suggest that meniscal deficiency negatively affects graft integrity after ACL reconstruction; however, this area needs further long-term clinical validation (II, IV)

Successful patient-reported outcomes have been demonstrated with multiple treatment modalities for chondral defects,<sup>6</sup> as well as benign neglect,<sup>7</sup> when performed in conjunction with ACL reconstruction. However, the current level of evidence and volume of literature are insufficient for clear treatment recommendations (II)

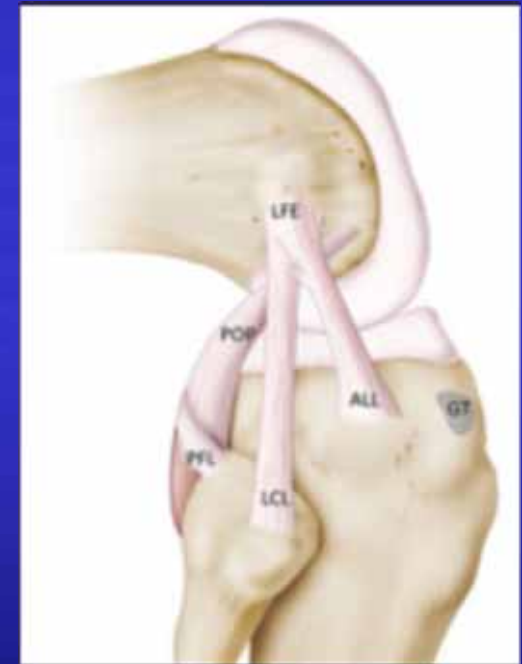
The presence of chondral defects consistently results in lower intermediate-to-long-term patient-reported outcomes. Lateral meniscal tears in general have less negative effect on outcomes than do medial meniscal tears. (I, II)

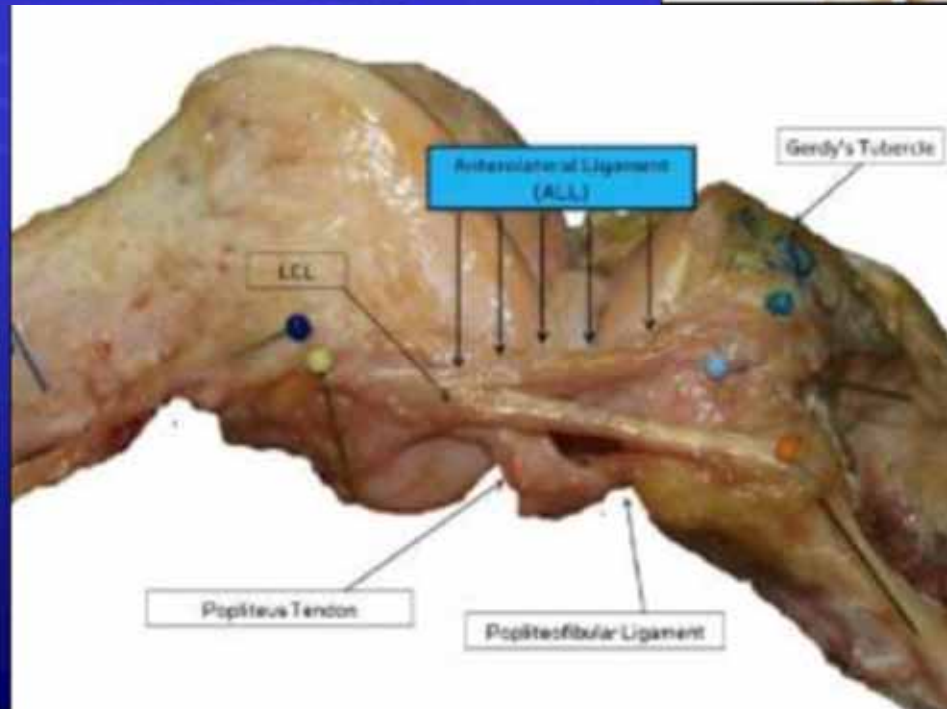
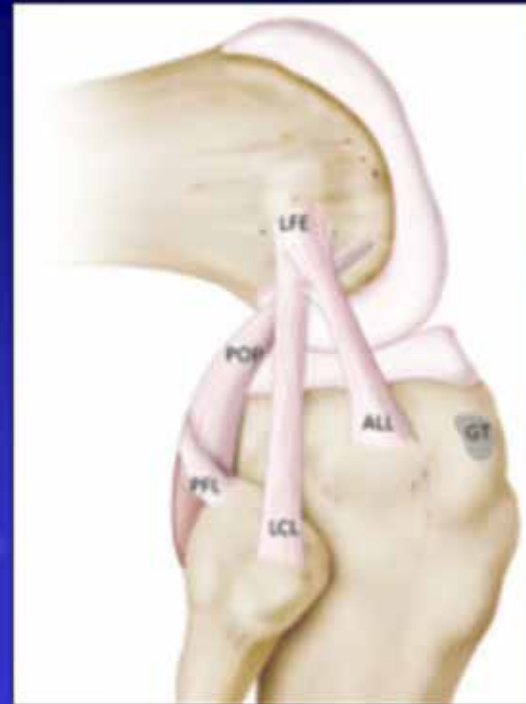
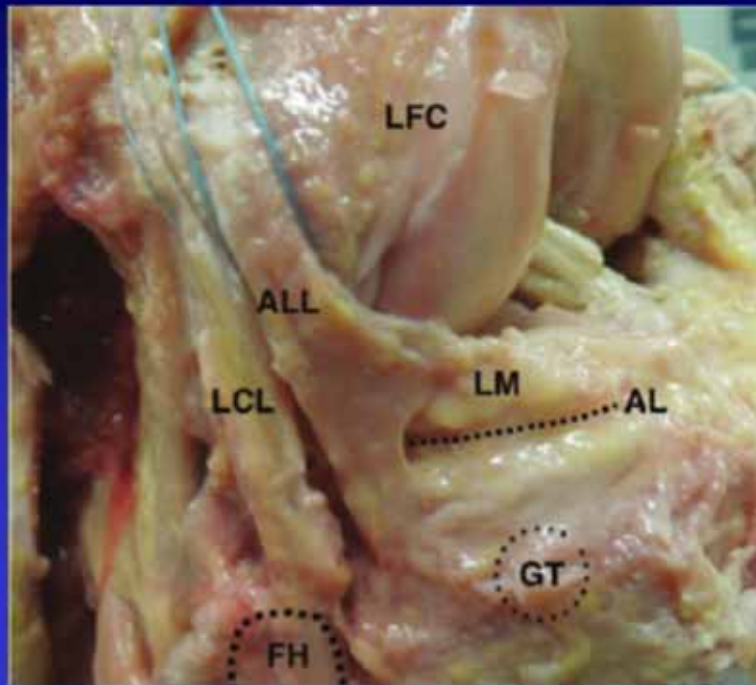
ACL = anterior cruciate ligament



# What is the ALL?

- Band of tissue running from lateral epicondyle to anterolateral tibia
  - Inserts midway between Gerdy's tubercle and fibula head
  - Not part of the ITB
- Important rotatory stabiliser of the knee between 30 -90°





# Pivot shift after surgery

- Poorer patient-reported outcomes after ACL reconstruction
- Can happen without failure of the ACL
- In some patients an intra-articular reconstruction is not sufficient to completely restore rotational knee stability



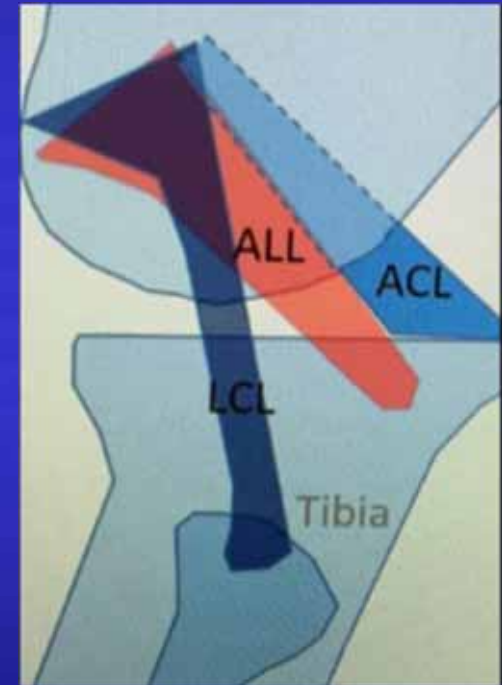
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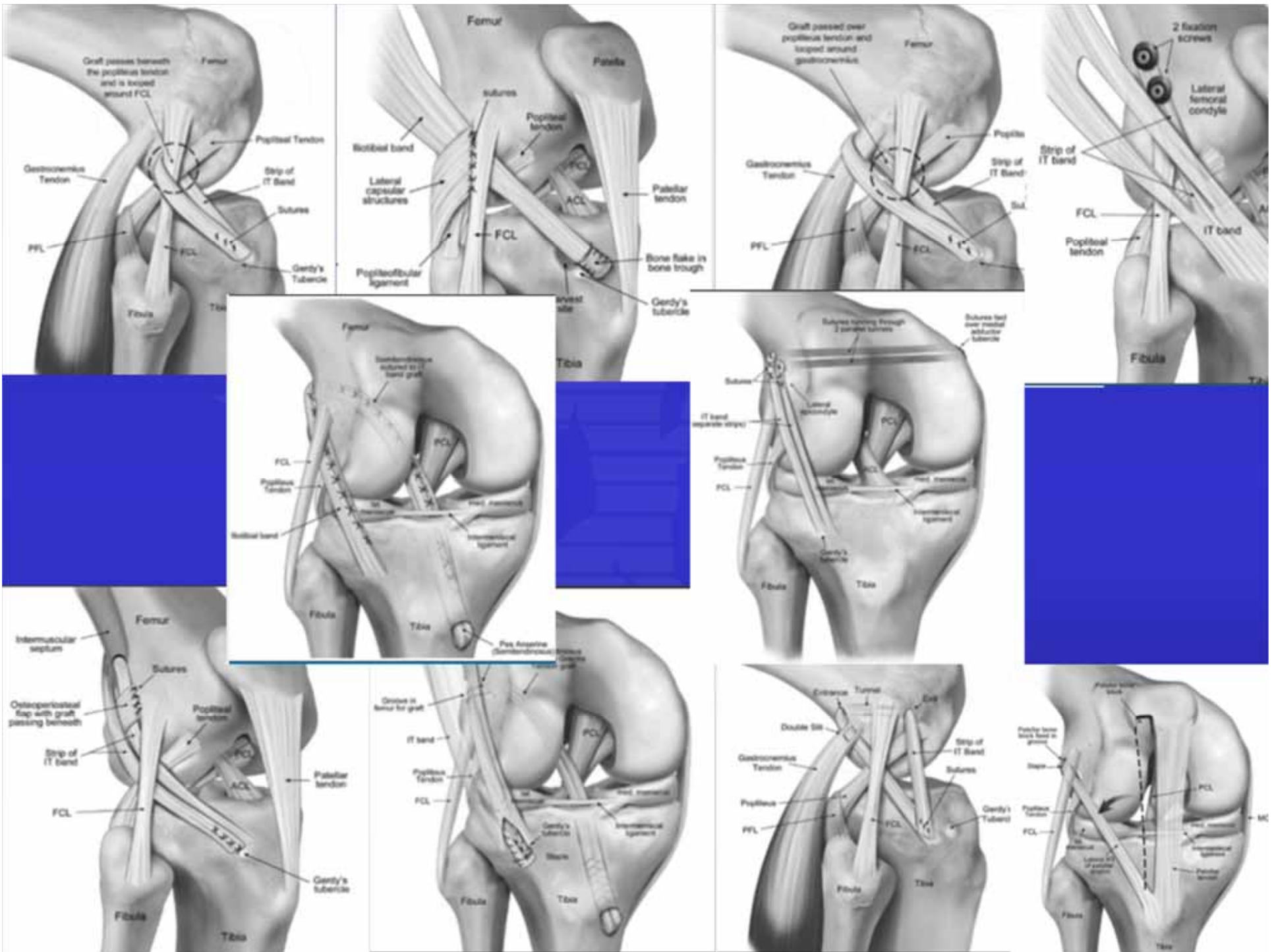
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# Explains why:

- Pivot shift gets worse with time
- Reconstructed knees can still have a pivot
  - Even with good tunnel position





# 'Indications' for adding ALL surgery to ACL surgery

- 1. Injury to the ALL substance seen on MRI
- 2. Second fracture
- 3. Pivot-shift grade III
- 4. Lateral femoral notch sign
- 5. Ongoing instability with a technically successful ACL reconstruction
- 6. Hyperlaxity
- 7. Revision surgery





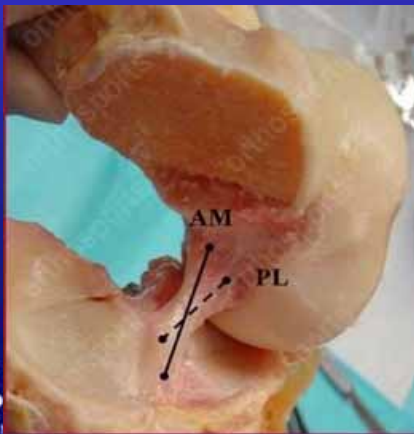
# Return to Sport Criteria

- No effusion
- No pain
- Full range of motion
- Good proprioception (hop and turn)
- 90% quads strength
  - HT to Quads Ratio???
- Minimal wasting (no more than 1 cm)
- Complete 2 consecutive training sessions
- Confidence
- Time



# Summary

- ~~History~~
- ~~Examination~~
- ~~Investigations~~
- Repair ?
- Graft Choice ?
- Age ✓
- Bracing ?
- Timing ✓
- ALL ✓
- Rehabilitation ✓



# Thank you



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