ACL Update

The Quad is Cool and the Bone is Important

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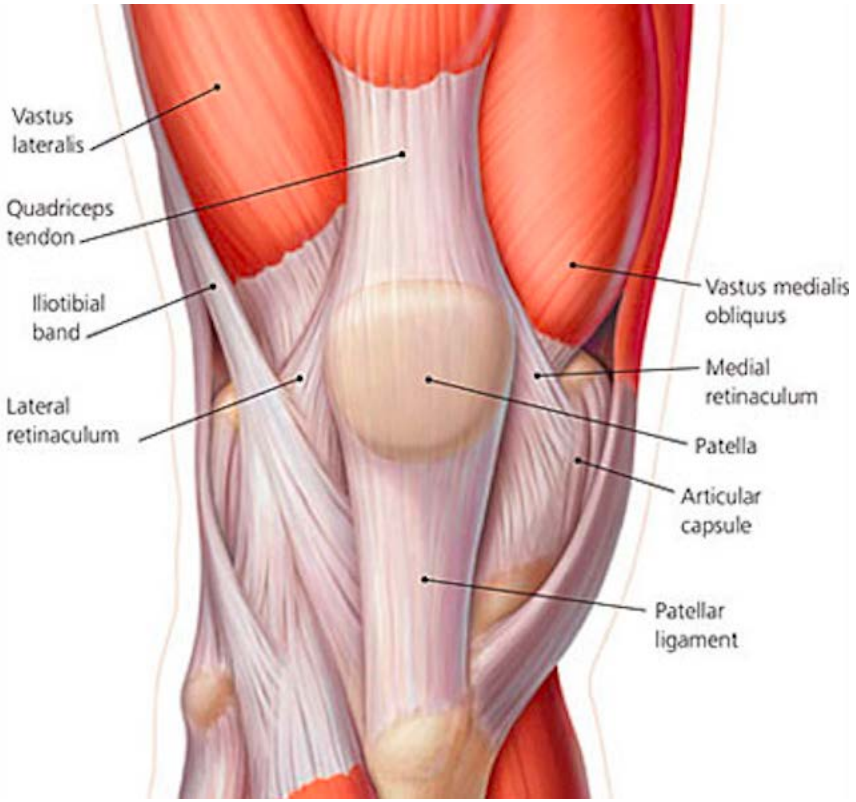
Disclosures

- Arthrex Consultant

Objectives

- Discuss the Quad as an alternative ACL graft
- Tibial slope as a cause of instability
- Role of extra-articular tenodesis in ACL surgery

The Quad

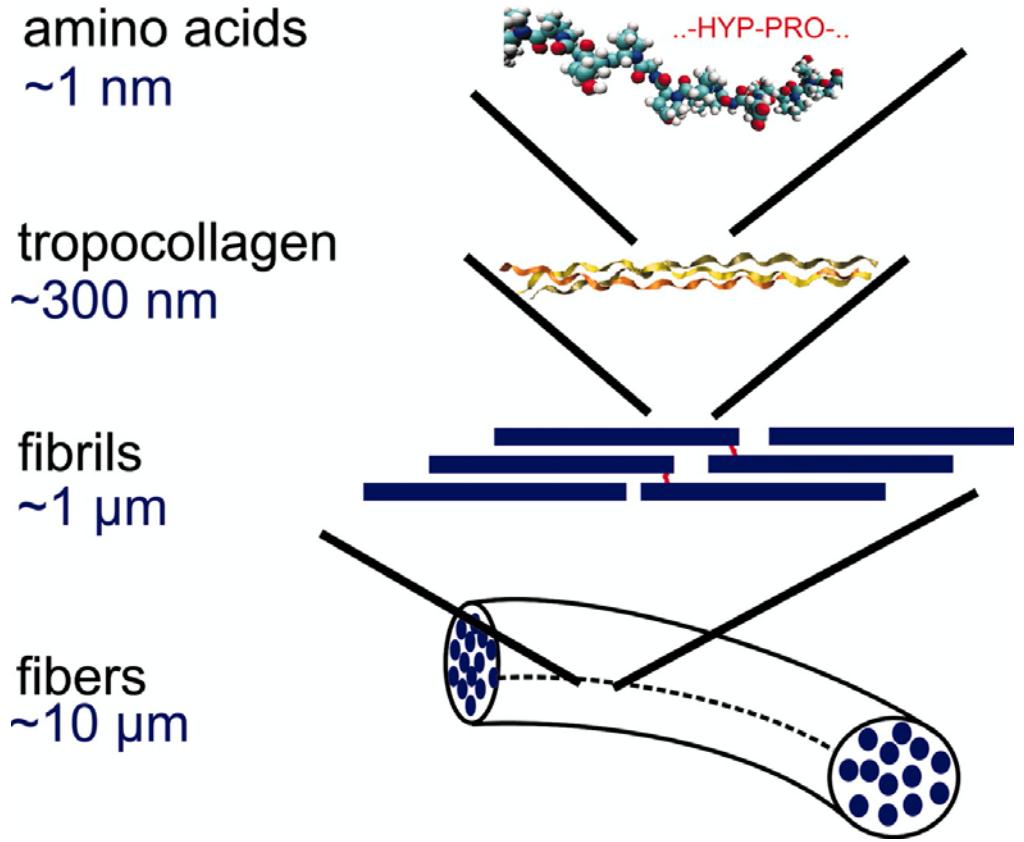


Top 10 Reasons the Quad Tendon is the Future of ACL Grafts

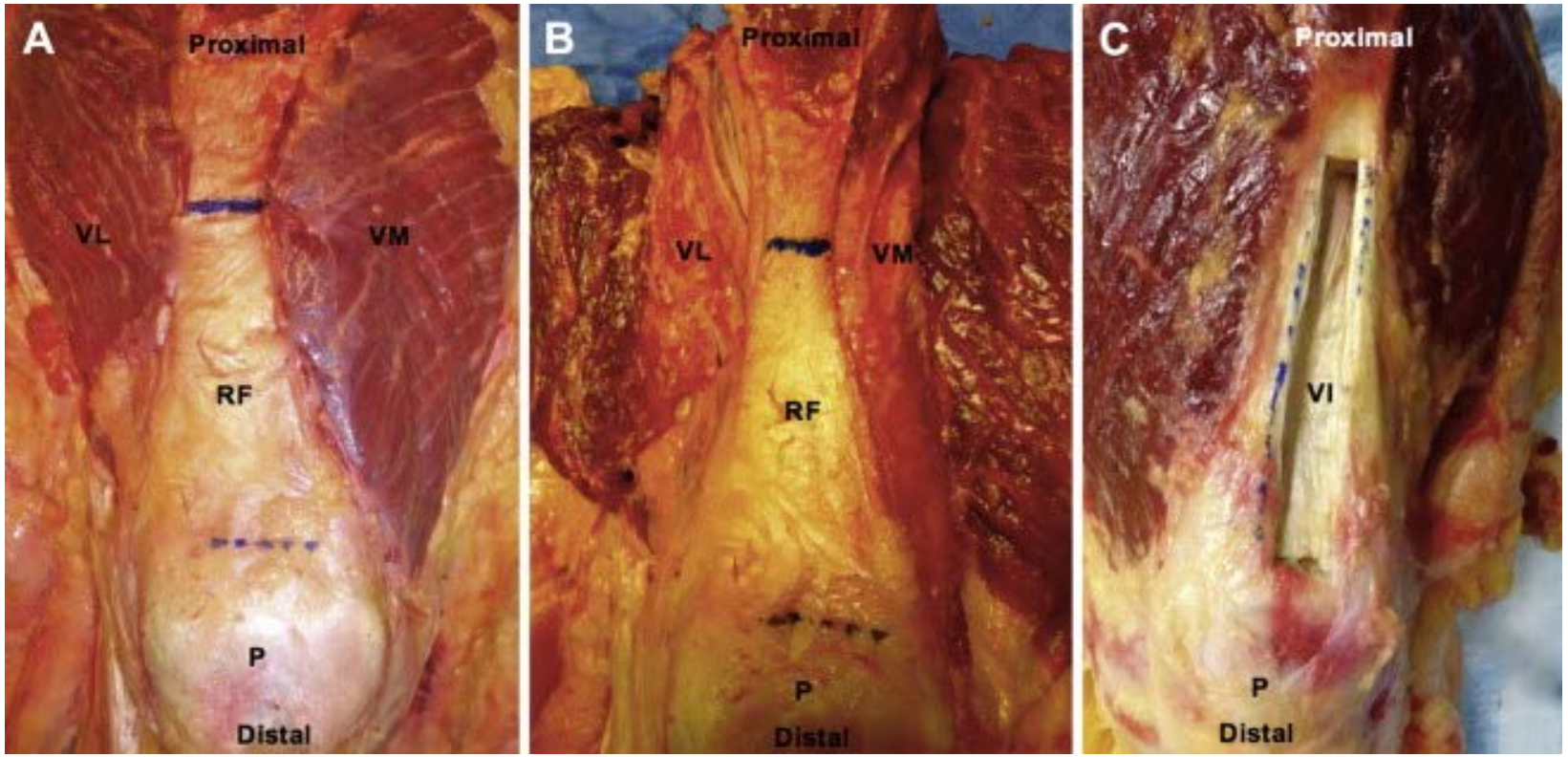
#1. Collagen

- Quad compared to Patellar Tendon (PT) Autograft:
  - Higher ultimate strength
  - Higher fibril:interstitium ratio
  - Higher fibroblast density
  - 20% more collagen

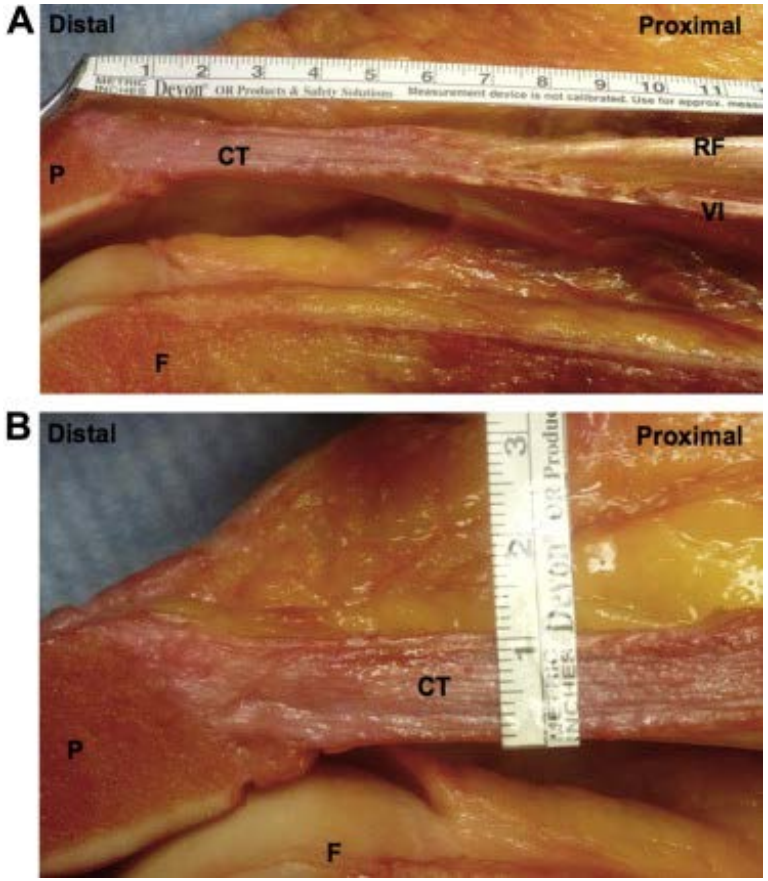
Harris et al. AJSM 1997



2. Massive



Quadriceps Anatomy



- 1.8x thicker than patellar tendon autograft

#3 Predictability

Hamstring Tendon Size Varies

QT Size Easily Predictable

- Quad Graft Length
  - 73.5 mm in females
  - 81.1 mm in males
  - People over 5 feet
    - Graft >7cm 90% of time
- Thickness 6-10 mm

#4 Good For All Ages

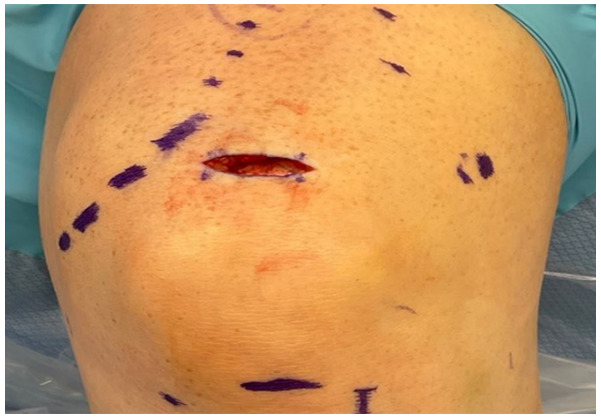
- Average 6 year old
  - 5.5 cm in length
  - 3.2 mm thick
- Same as PT thickness
- Hamstring size is unknown in kids

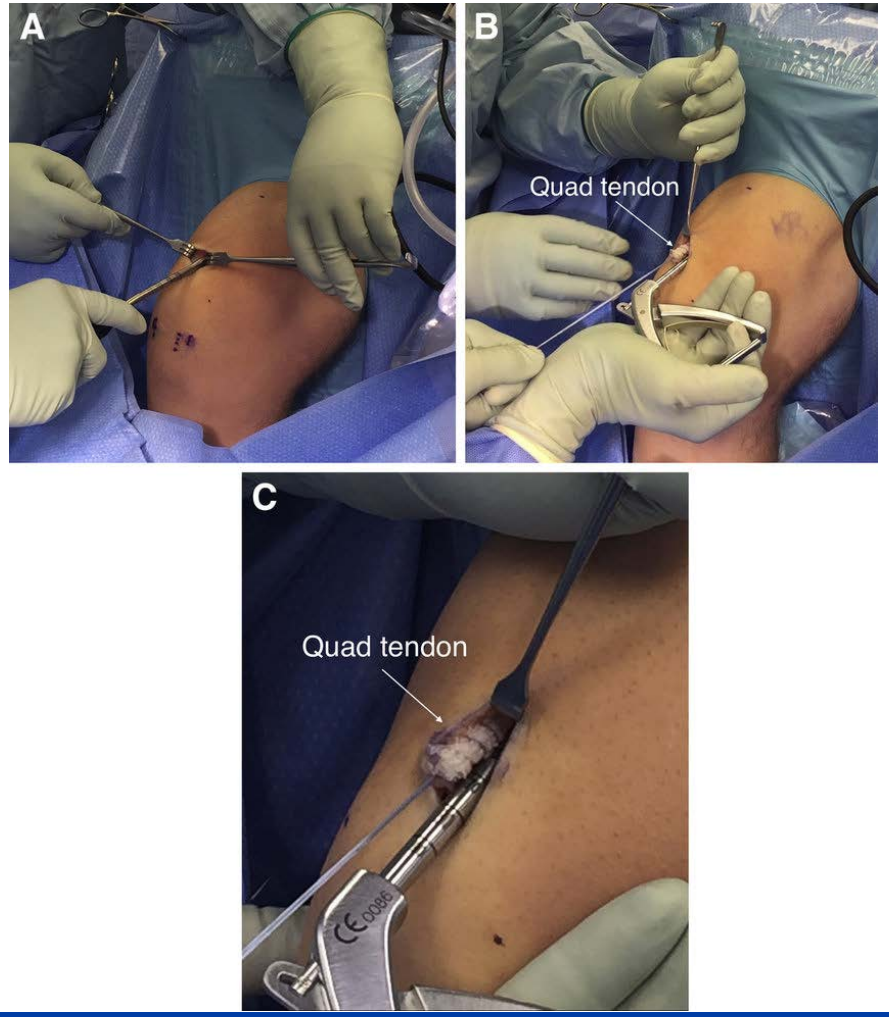
#5 Morbidity of Graft Harvest

- Weakness
  - Residual Weakness
    - Hamstring
      - Sig weakness>2 years
    - Quad Muscle Weakness
      - Similar to PT ACLs at 6 and 12 months
      - By 1 year most <10% LSI
- Numbness
  - 74% of HS ACL patients had sensory deficits >4 years post op (saph nerve defecit)

#6 Harvest Time

- Patella Tendon = 25 minutes
- Hamstring = 13 minutes
- Quad Tendon <7 minutes





#7 Infection Rate

- Hamstring
  - Moon Group 1.27%
  - Maletis et al 0.61%
- Quad 0.28%

#8 Re-Tear Rate

- Prospective study of 875 pts
- Experienced surgeons
- Anatomic technique
- HS 2.7 x failure of QT

Fink et al. AJSM 2020

#9 Good For Revision Surgery

- PROs increased significantly
- No difference in side to side laxity
- About 13% recurrent tear rate at 42 month follow up
- Recurrent tear rate similar to PT data

Hunnicutt et al Arthroscopy 2021

#10 Flawed Interpretation

Arthroscopic Versus Conservative Treatment of First Anterior Dislocation of the Shoulder in Adolescents

Ioannis Gigis, MD, Roderich Heikenfeld, MD,† Arion Kapinas, MD,* Rico Listringhaus, MD,† and Georgios Godolias, MD†*

- Fist Study
  - Recruited 2005-12
  - Non-anatomic ACLs
  - Quad harvest technique vastly different
  - Gov't Database

- Second Study
  - 100/year 2.9% failure rate
  - <100/year 6.4% failure rate

Quad vs BTB

- No difference in laxity (KT-1000)
- Lachman and Pivot shift similar
- Lysholm and IKDC scores similar

Mouarbes et al. AJSM 2019

Quad vs. BTB in Cutting and Pivoting Athletes

- Cutting and pivoting athletes with 2 year follow up
- 32 QT and 36 BTB autograft
- Lysholm and IKDC similar at 2 years
- RTP 90.6% in QT vs 86.1% BTP
- **RTP at 7.1 months in QT group vs. 9.6 months in BTB group**
- Re-tear in BTB and none in QT

Economopoulos et al. Accepted to AJSM

Quad vs. Hamstring Autograft

- 50 QT and 45 HA
- 3.6 year follow up
- PROs (Lysholm, KOOS symptoms, KOOS sport) improved in the QT group
- Side to side QT 1.1mm vs. 3.1mm in the HA group with KT-1000
- 90% neg Lachman vs 46% in the HA group

Cavaisnac et al. AJSM 2017

Quad vs. Hamstring Autograft

- Systematic Review
- HA greater pivot shift laxity
- HA higher failure rates
- QT with less anterior laxity (KT-1000)

Nyland et al. Knee Surg Sports Traumatol Arthrosc 2020

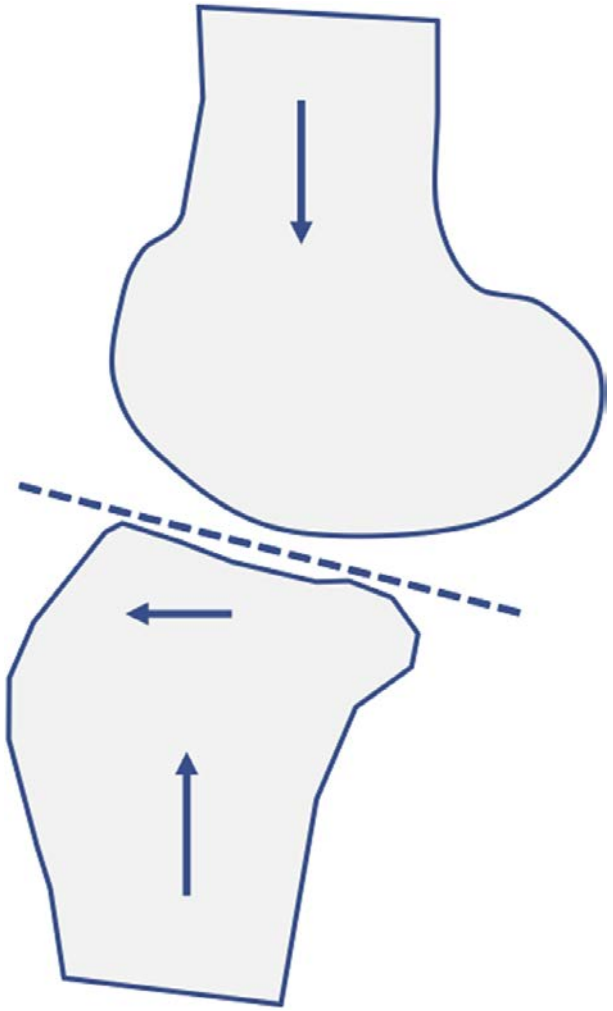
My Approach

- Quad for primary and revision ACLs
- BTB in cutting and pivoting high level athletes
- Allograft in patients over 40 years old

What Else is New in ACL surgery?

- Posterior Tibial Slope
- Extra-articular tenodesis

Posterior Tibial Slope



Posterior Tibial Slope Sex Differences

- Cross-sectional study
- Adolescent females with ACL tears had steeper lateral tibial slopes than age-matched males
- Female grafts may experience higher torsional forces

Hosseinzadeh et al. AJSM 2020

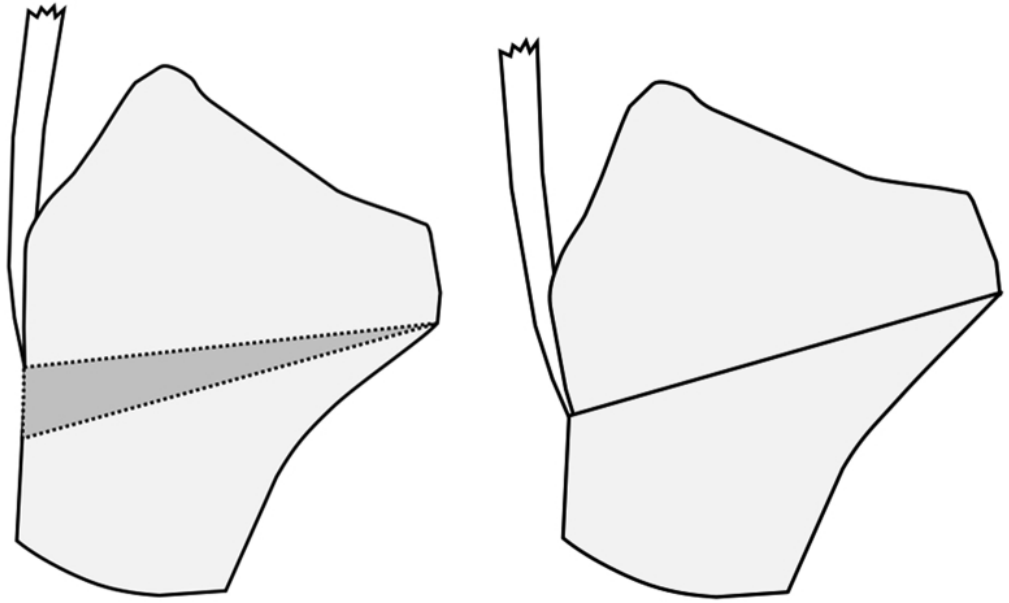
Posterior Tibial Slope in Graft Failure

- 43 patients with ACL graft failure
- Both males and females
- 2 year follow up
- Tibial slope >12 degrees
- Re-tear
  - Sensitivity 88%
  - Specificity 84%

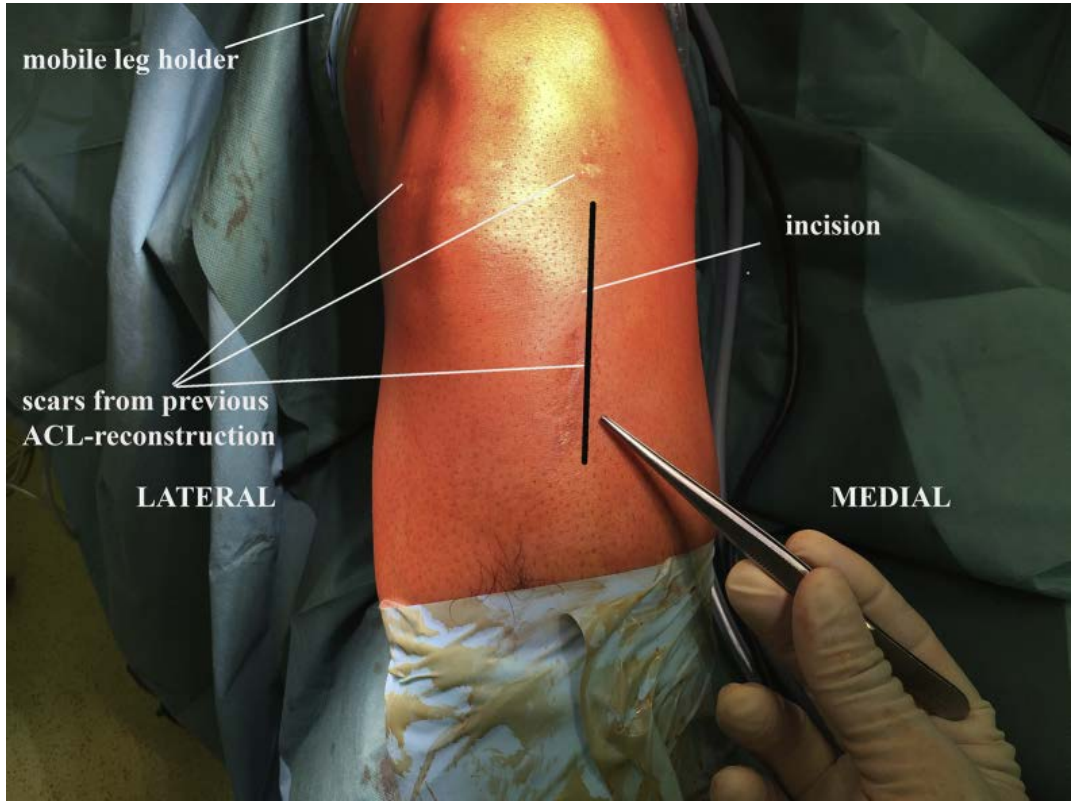
Grassi et al. Arthroscopy 2019

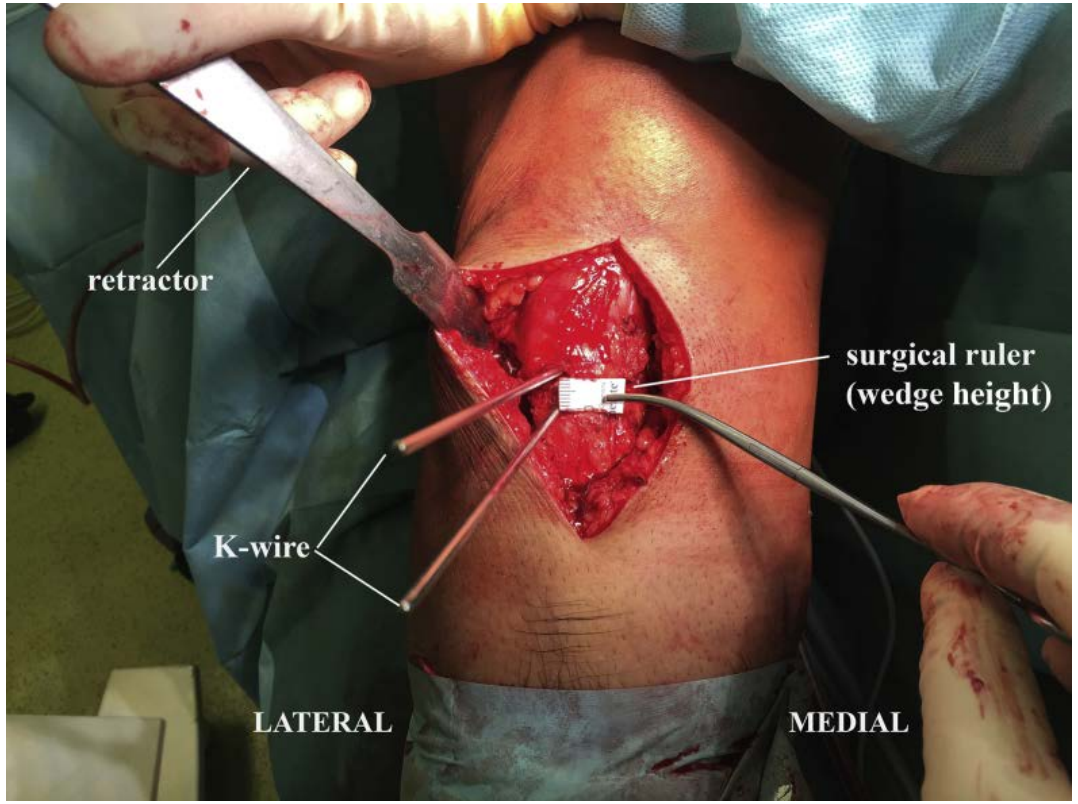
Posterior Tibial Slope Correction Indications

- Recurrent ACL tear
- Neutral or slightly varus knee
- Posterior tibial slope of 12 degrees or more



Posterior Tibial Slope Correction





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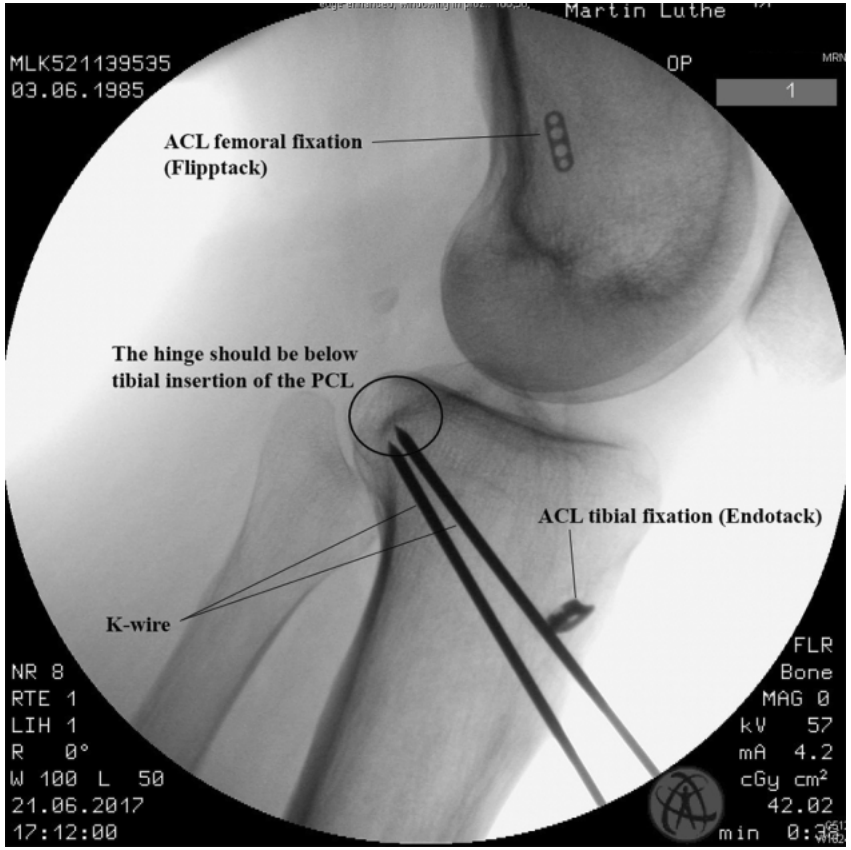

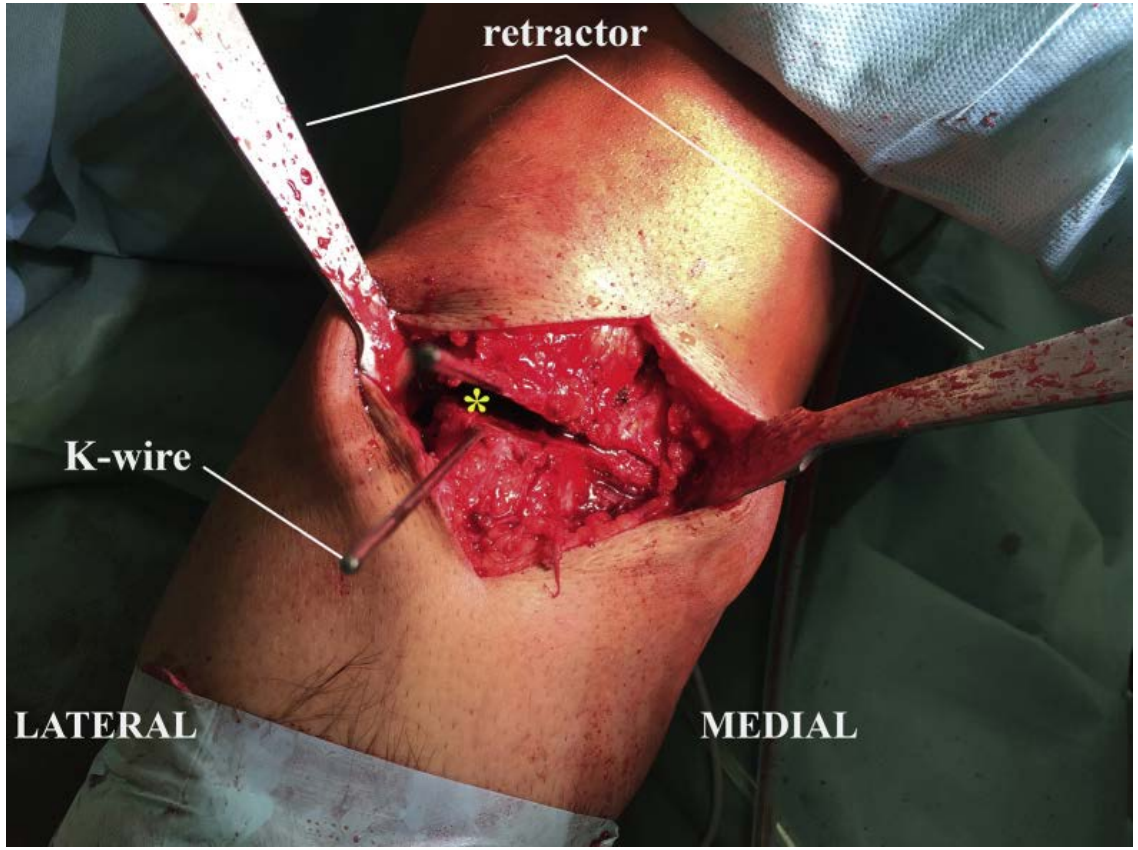

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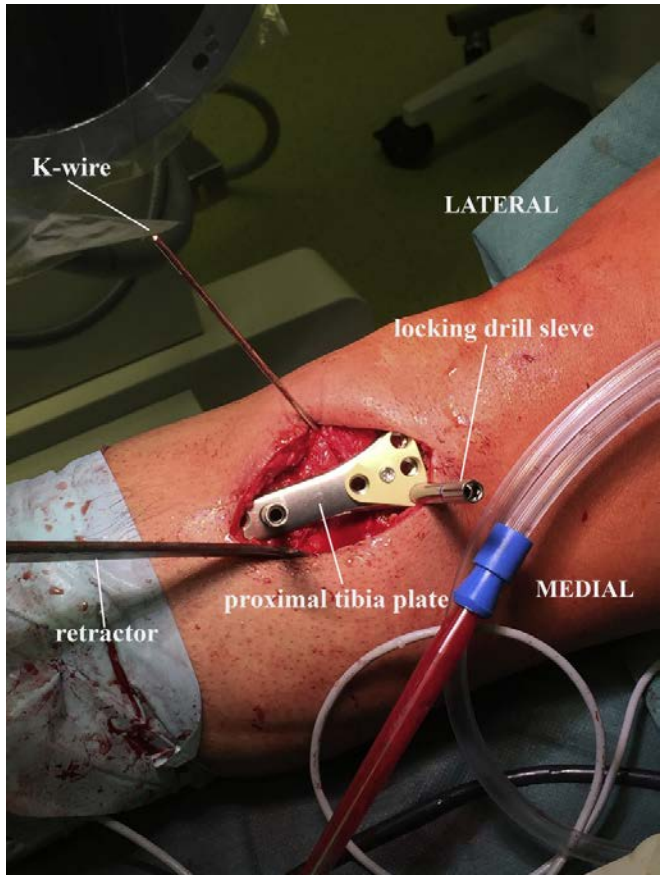

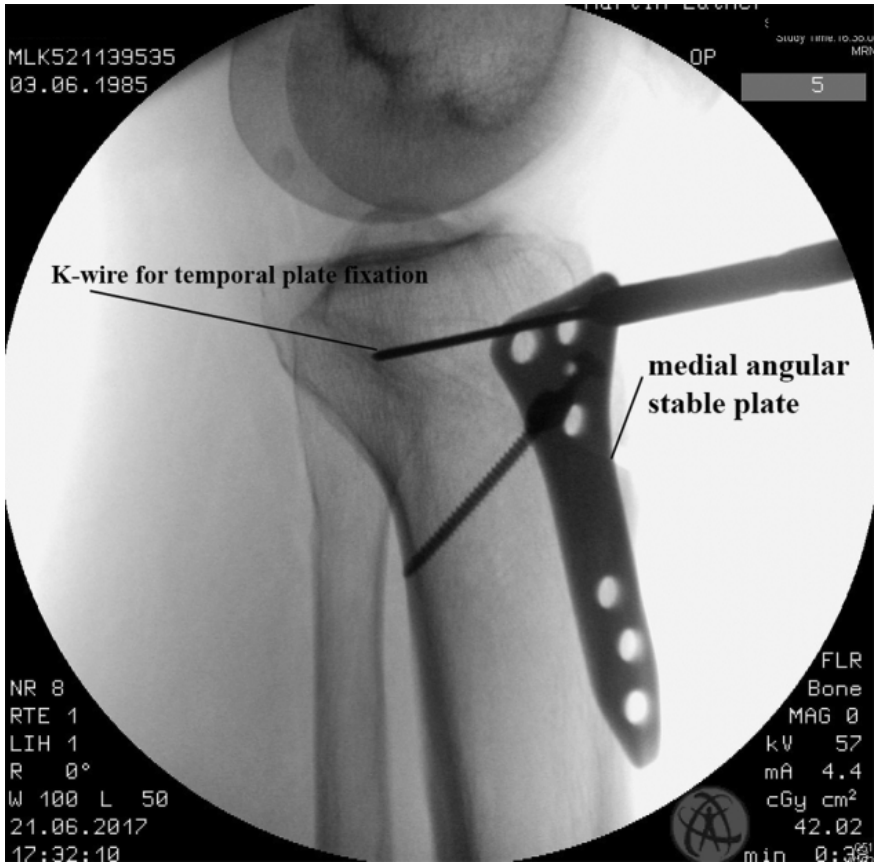

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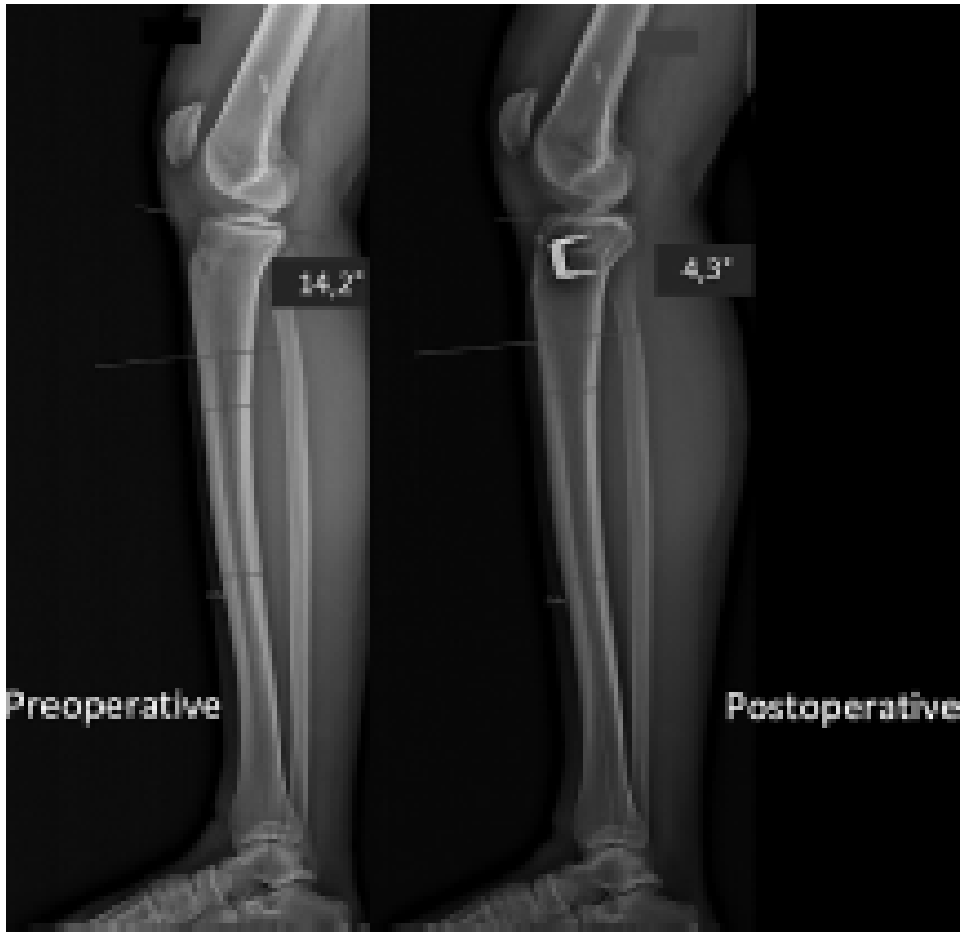
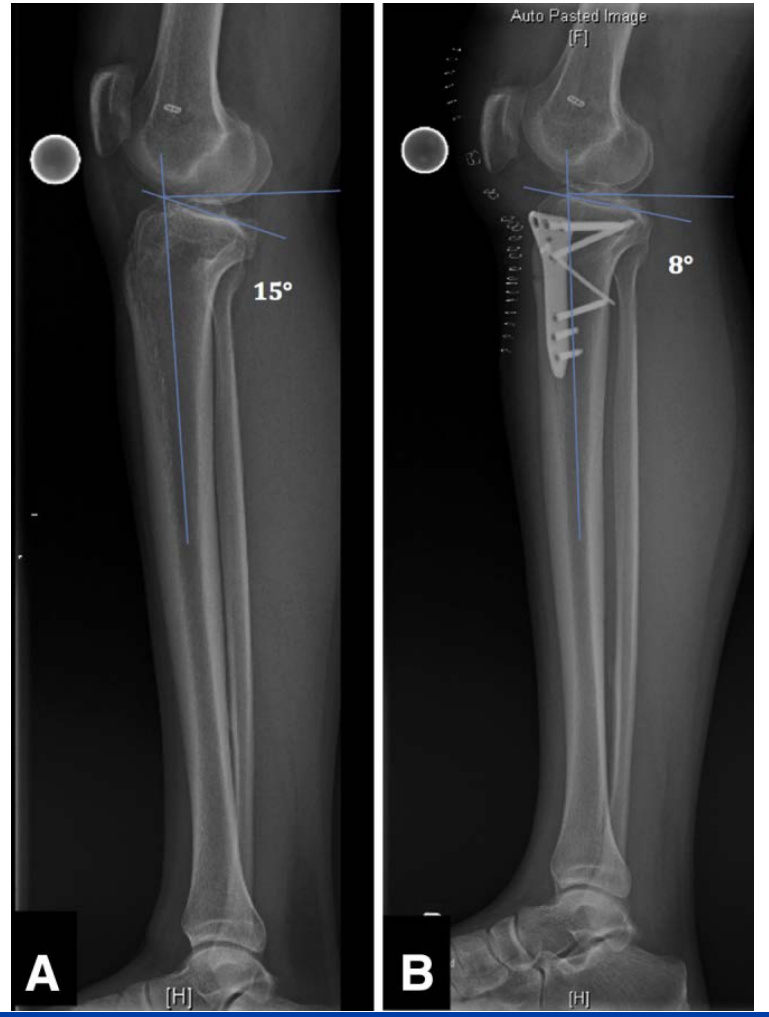




Posterior Tibial Slope Correction Outcomes

- 9 patients with recurrent ACL tears after reconstruction
- Average PTS was 13.2 degrees which was reduced to 4.4 degrees with revision ACL
- All osteotomies healed with no complications
- At 4 year follow up, no recurrent tears

Dejour et al. Knee Surg Sports Traumatol Arthroscop 2015

Long Term Outcomes

- Update to previous study
- 7 patients available with 10 year follow up
- 3 pts with previous sigs of osteoarthritis
  - 1 progressed one stage (2 to 3)
  - 2 no progression
- No re-tears
- Slope correction protects revision ACL grafts from re-tears

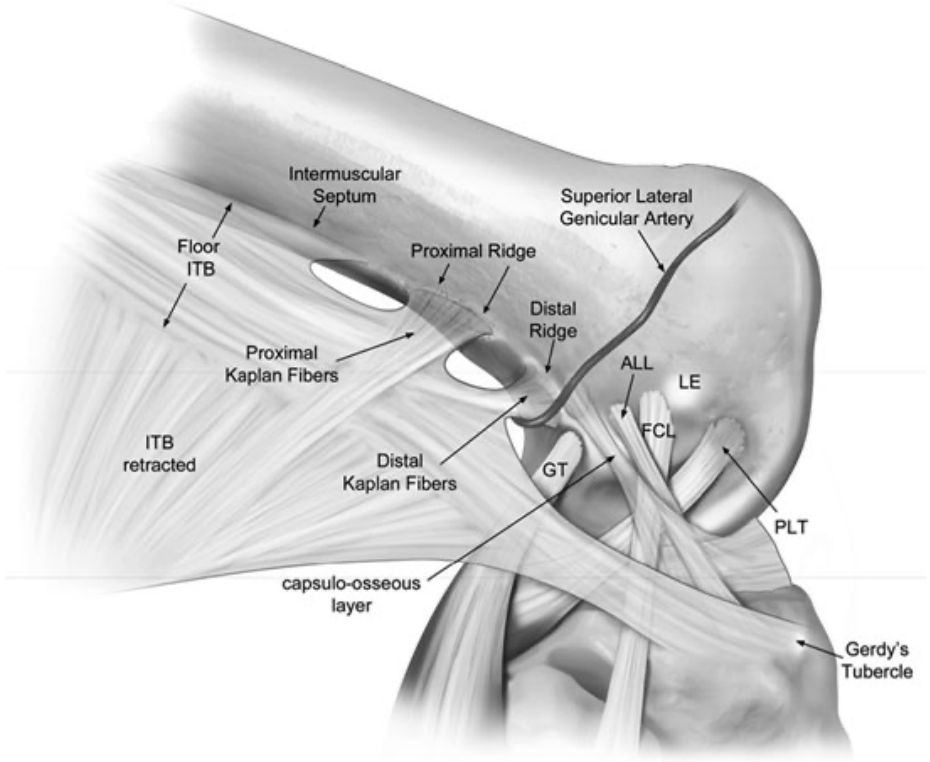
Rozinthe et al. Knee Surg Sports Traumatol Arthrosocp 2021

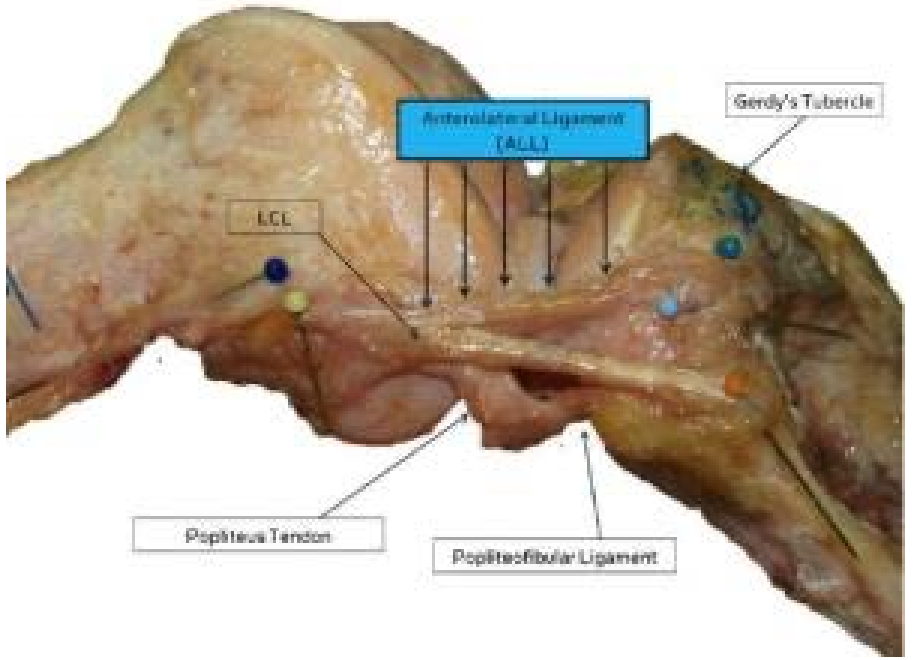
Tibial Slope Correction in Primary ACLs

- Primary ACL + Slope Correction
- Slope >13 degrees and Anterior Tibial Translation of 10mm
- Mean slope pre op 18 deg to 8.1 deg post op
- Lateral compartment translation: 12.1mm to 1 mm
- Medial compartment translation: 11.9mm to 1.5mm
- PROs significantly improved over preop
- No graft re-ruptures

Song et al. AJSM 2020

Anterior Lateral Ligament

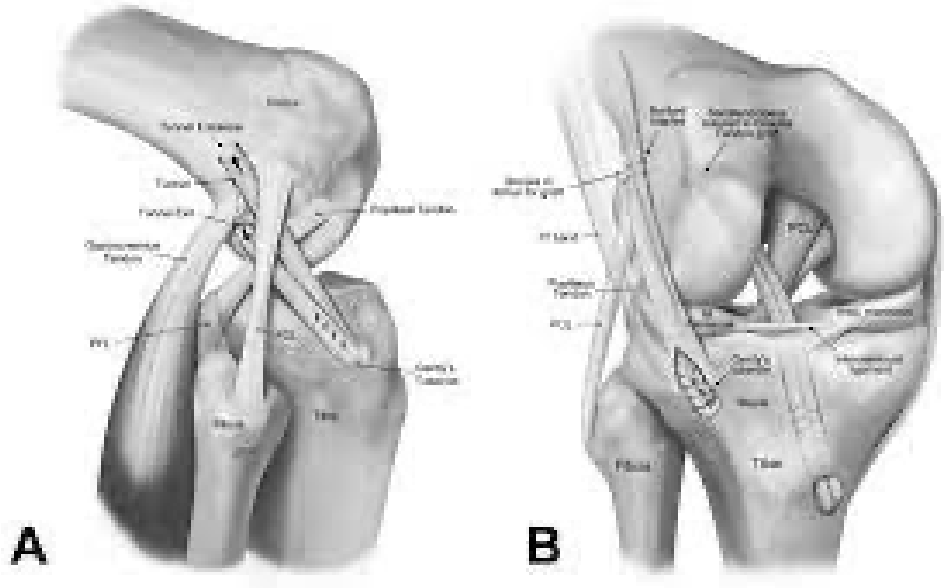


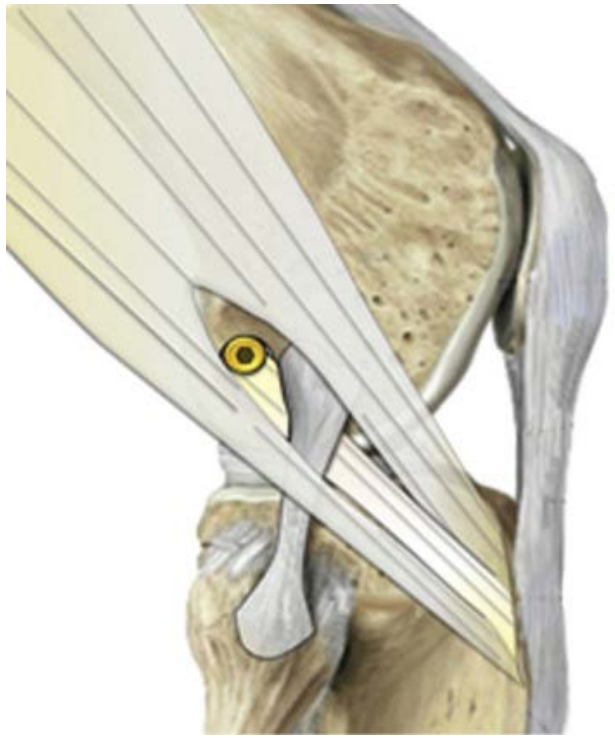


Effect of Anterolateral Injury

- Increased pivot shift
- Increased tibial internal rotation
- Increased stress on ACL or ACL graft

ALL Reconstruction vs. Lateral Extraarticular Tenodesis (LET)





Biomechanics of LET

- Restricts internal rotation
- Reduced anterior tibial translation
- Reduced intra-articular graft stress
- Over constraint of the knee

Primary ACLR with and without LET

- Prospective, randomized and multicenter study
- 2-year follow-up
- 618 pts ACL vs. ACL+LET
- 11% re-tear rate in ACL group
- 4% re-tear rate in ACL+LET group
- No difference in PROs

Getgood et al. AJSM 2020

Primary ACL vs ACL+LET Long-term Outcomes

- Retrospective review
- 43 patients with 19 year follow-up
- BTB vs BTB+LET
- BTB 29% failure rate
- BTB+LET 13% failure rate
- Equal PROs

Castolodi et al. AJSM 2020

Revision ACL vs ACL+LET

- Retrospective study
- 75 pts with revision ACLR
- 59 pts with revision ACLR + LET
  - ACL 21% graft failure
  - ACL+LET 5% graft failure
  - Decreased pivot shift
  - Improved PROs with LET

Miller et al. Clin Sports Med 2018

Indications for LET

- Revision ACL
  - Where no other significant pathology needs to be addressed
- Primary
  - All young patients who want a hamstring autograft
  - High risk individuals with grade 2 or 3 pivot
    - <25 years old
    - Ligametnous laxity
    - Recurvotum
    - Pivoting sports
    - Tibal slope >10

Conclusions

- Quad tendon is an effective and versatile graft for most situations
- A posterior tibial slope of 12 degrees or more should be treated with a correcting osteotomy
- LET should be considered in high-risk patients with a large pivot, especially in revision setting

Thank You