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Pediatric ACL Reconstruction

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I have no disclosures

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Typical day in the office…

- 11-year-old male 'elite' soccer player
- Collided with another player and twists his knee 1 week prior.
- Immediate knee swelling and pain.
- Reports feelings of knee instability
- On exam
  - Moderate effusion
  - Positive Lockman's and Pivot Shift
  - Negative Dial test
  - Negative McMurray test
- Next steps
  - Radiographs
  - MRI

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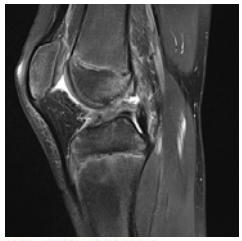
Radiology

Plain films- rule out osseous injury

MRI- evaluate ACL and possible additional injuries

Bone Age film



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Operative Treatment-

- High level athlete
- Participates in sports that require pivoting and cutting
- Reports feelings of instability
- Decreases risk of additional knee injuries

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Decision making driven by age…

Skeletal age (Bone Age Film)

- Immature
  - Open physes with significant growth remaining
  - Girls <12
  - Boys <14
- Transitional
  - Girls 12-14
  - Boys 14-16
- Mature
  - Girls >14
  - Boys >16

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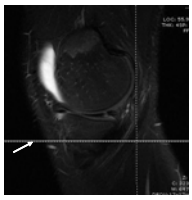
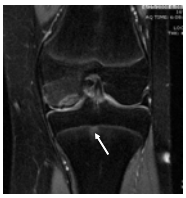
And associated Injuries.

- Meniscal tears



- Osteochondral injury



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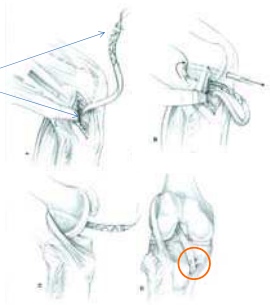
ACL Immature- Physeal Sparing Approach

Iliotibial band technique

A. Harvest iliotibial band proximally leave attached distally
B. Redirect graft around lateral femoral condyle
C. Pull graft posterior to anteriorly through the femoral notch
D. Sow graft under intermeniscal ligament

No Tunnels!



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Pediatric and Adolescent Knee Surgery Technique the Modified McIntosh Sachleben and Kocher 2015

ACL Immature- Physeal Sparing Approach

Soft Tissue Graft Technique

Tibial tunnel

- Steeper anteriorly
- Shallower angle on lateral to avoid physis
- More vertical on AP

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ACL Immature- Physeal Sparing Approach

Soft Tissue Graft Technique

Femoral tunnels

- Horizontal tunnel in femur
- Avoid physes on AP and lateral views
- Exit in notch
  - Left 2-3 o'clock
  - Right 9-10 o'clock

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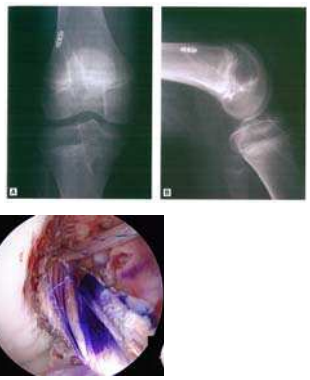
ACL Transitional-Technique

Bone Age

- Girls (11)12-14
- Boys (13)14-16

Soft tissue graft

- Most common hamstrings
- ≤ 8 mm tunnels
- Centralized tunnels
  - Minimize risk of angular deformity



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ACL Transitional-Technique

Tibial Tunnel Placement

- 7mm in front of the PCL in ACL foot print
- Tibial guide set @ 50-55 degrees (Sag)
- More vertical then standard technique




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ACL Transitional-Technique

Femoral Tunnel Placement

- Femoral tunnel 2mm off back wall
- More vertical
  - Right 11 o'clock position
  - Left 1 o'clock position




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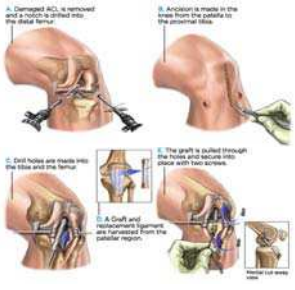
ACL Mature- Technique

- Allograft
  - Bone patellar tendon bone
  - Hamstrings
  - Anterior tibialias tendon
  - Achilles tendon
  - Quadriceps Tendon
- Autograft
  - Bone patellar tendon bone
  - Hamstring
  - Quadriceps



Netter Knee Arthroscopy

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ACL Mature- Technique

•Tibial tunnel

- Posteriormedial aspect of the ACL footprint
- Adjacent to the slope of the medial eminence
- Along a line extended from the posterior border of the anterior horn of the lateral meniscus
- 7mm in front of the PCL
- Tibial guide set @ 50-55 degrees (Sag) ACL foot print



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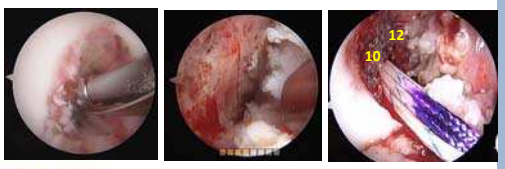
ACL Mature- Technique

•Femoral tunnel
- Notchplasty +/-
  - Visualization
  - Minimize graft impingement
- 2mm off back wall
- Right 10-11 o'clock position
- Left 1-2 o'clock position



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ACL Complications- Skeletally Immature

1. Growth Arrest
   1. Longitudinal
   2. Angular deformity
2. Technical errors
3. Failure of graft fixation
   1. Failure of incorporation
   2. Tunnel widening
   3. Failure of hardware
   4. Graft instability
   5. Cystic degeneration
4. Traumatic Failure
   1. Return to activity before complete graft incorporation
5. Associated Ligament Deficiencies
6. Arthrofibrosis

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ACL Complications- Skeletally Immature

•Growth Arrest
- Longitudinal
- Angular deformity

•Centralizing tunnels
- Minimizes risk of angular deformities
- Less anatomic positioning increases risk of re-rupture

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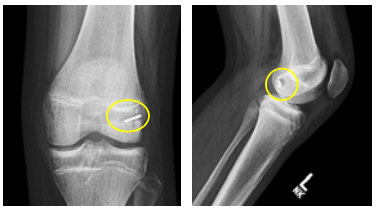
ACL Complications- Skeletally Immature



Loss of Fixation
- Loss of endobutton fixation
- Clinically stable

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ACL- Technical Complications

Technical errors in tunnel placement

- Tibial tunnel
  - Too anterior
    - notch impingement
    - lack of extension
  - Too posterior
    - instability with flexion
  - Too vertical
    - rotational instability
- Femoral tunnel
  - Too anterior
    - Restricts flexion
    - Elongates graft
  - Too vertical
    - impingement on PCL
    - rotational instability
  - Too lateral
    - impingement on lateral condyle

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ACL- Other Complications

Patellar Fracture

•Traumatic fracture of patella after bone-patellar-bone

•Required ORIF to repair

AAOS Complications in Orthopaedics

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ACL Reconstruction does guarantee no re-tears!

- 16+7 mth old male 13mths s/p left ACl reconstruction with autograft hamstrings
- Tackled in football
- Re-presents with effusion and instability

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Outcomes

- Low rate of complications
  - Kocher et al 2002
    - survey of the Herodicus Society and the ACL study group reported 15 cases of growth arrest or angular deformity.
  - Vavken and Murray 2011
    - Systemic review of pediatric ACL complications where at least one tunnel crossed the physes, found 5 of 479 patients or .01% with a growth arrest, angular deformity or limb length discrepancy.
    - No growth arrests in extra-physeal reconstructions.
  - Baldwin et al 2013
    - Meta-analysis of non-operative vs operative treatment of pediatric ACL injuries
    - 86% of operative patients returned to sport
    - 13% of operatively treated patients reported residual instability

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Conclusion

- Surgical reconstruction has low risks and good outcomes.
- Families and patients must be aware of the possibility of physeal injury.
- Return to play more likely with surgical reconstruction

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References

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THANK YOU

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