2017 Cook Children's SPORTS Symposium

Immature ACL Injuries and Reconstruction

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Disclosures

- I have no financial/ industry disclosures.

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Objectives

- Explain the importance of skeletal immaturity on treatment and reconstruction type
- Compare the various reconstruction techniques available in the skeletally immature patient
- Summarize the potential implications of ACL injury in this age group

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Immature ACL Injury

- 8 year old with original injury of playing football
  - instant swelling; inability to return
  - MRI confirmed ACL tear
  - no meniscal pathology
  - Physeal sparing ACL reconstruction recommended by 2 surgeons
  - family elected to wait - lost to follow up
  - bracing recommended since non-operative course pursued

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Immature ACL Injury

- Returns at age 10 with symptoms:
  - instability
  - inability to cut
  - pain
  - No new injury
  - not wearing any brace

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Immature ACL Injury

- MRI confirms complete ACL deficiency and suggests no meniscal patholgy
- Surgical management recommended
- Based on degree of skeletal and developmental maturity
  - All - epihyseal ACL reconstruction with hamstring autograft is recommended.

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Non-surgical Management

- Kocher 2002 - partial tears treated non-operatively
  - 2 year follow-up
  - 31% went on to reconstruction
  - Risk Factors for failure
    - tears >50% mid width
    - PL bundle
    - mildly positive pivot shift
    - older chronologic and skeletal age

- Concluded partial tears with near normal Lachman and pivot shift <14 could be treated non-surgically

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Rationale for Reconstruction

- Vavken and Murray meta analysis *Arthroscopy* 2011
  - better clinical outcomes with reconstruction regardless of type than non-op
  - future stability and injury prevention

- Lawrence JT *AJSM* 2011
  - delayed management >12 weeks increased
    - irreparable medial meniscal tears
    - lateral chondral injuries

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Rationale for Reconstruction

- Anderson and Anderson 2015
  - 135 patients; age 13y 8 m
  - Lateral Meniscal tear 2.6 times incidence with inc. grade
  - Medial Meniscal tear 3.5 times incidence with inc. grade

- Newman, et. al.
  - delay in surgery > 3 months increase risk of injury
  - increased irreparable meniscal injury
  - additionaly surgery

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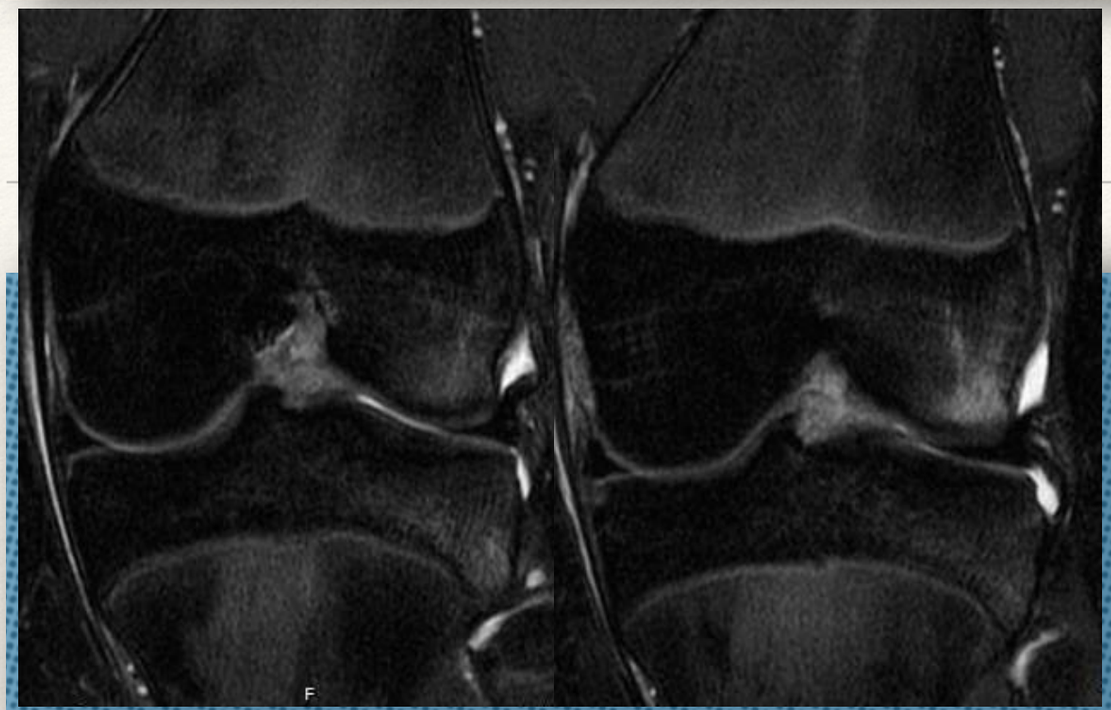
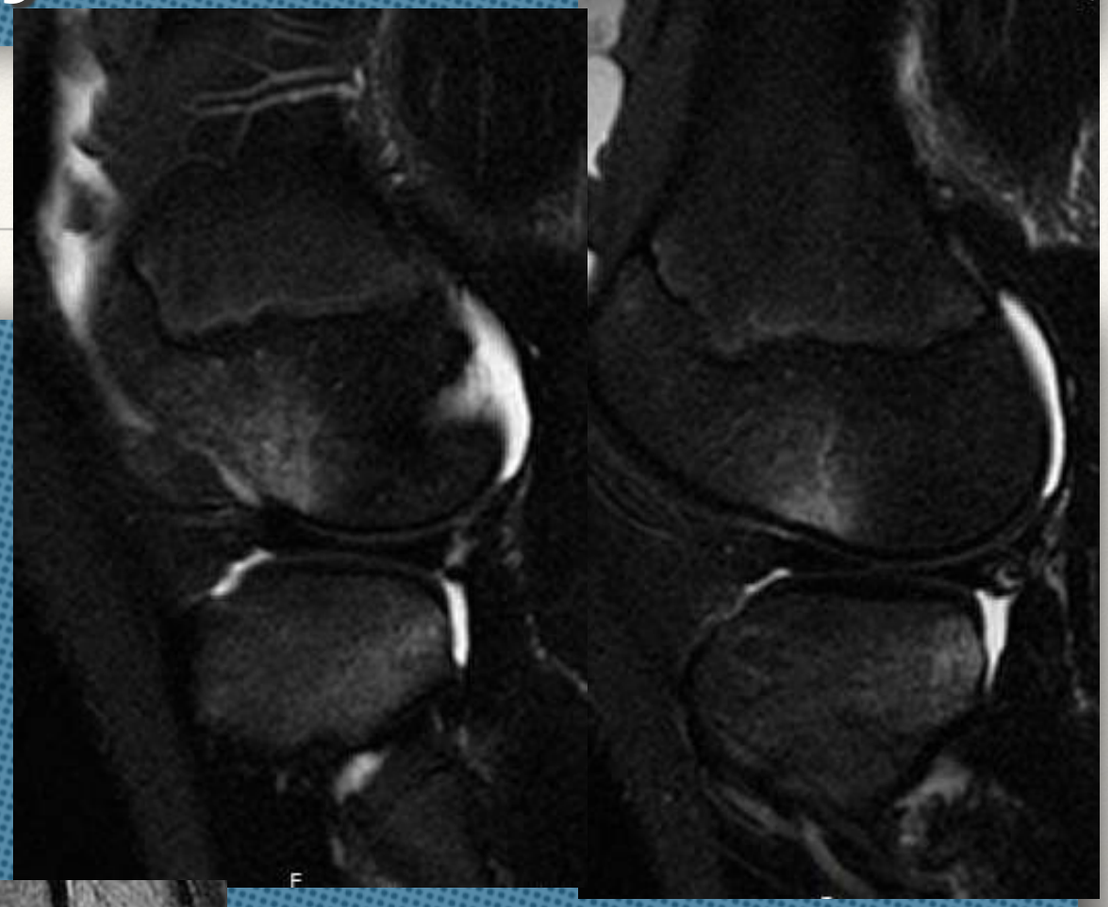
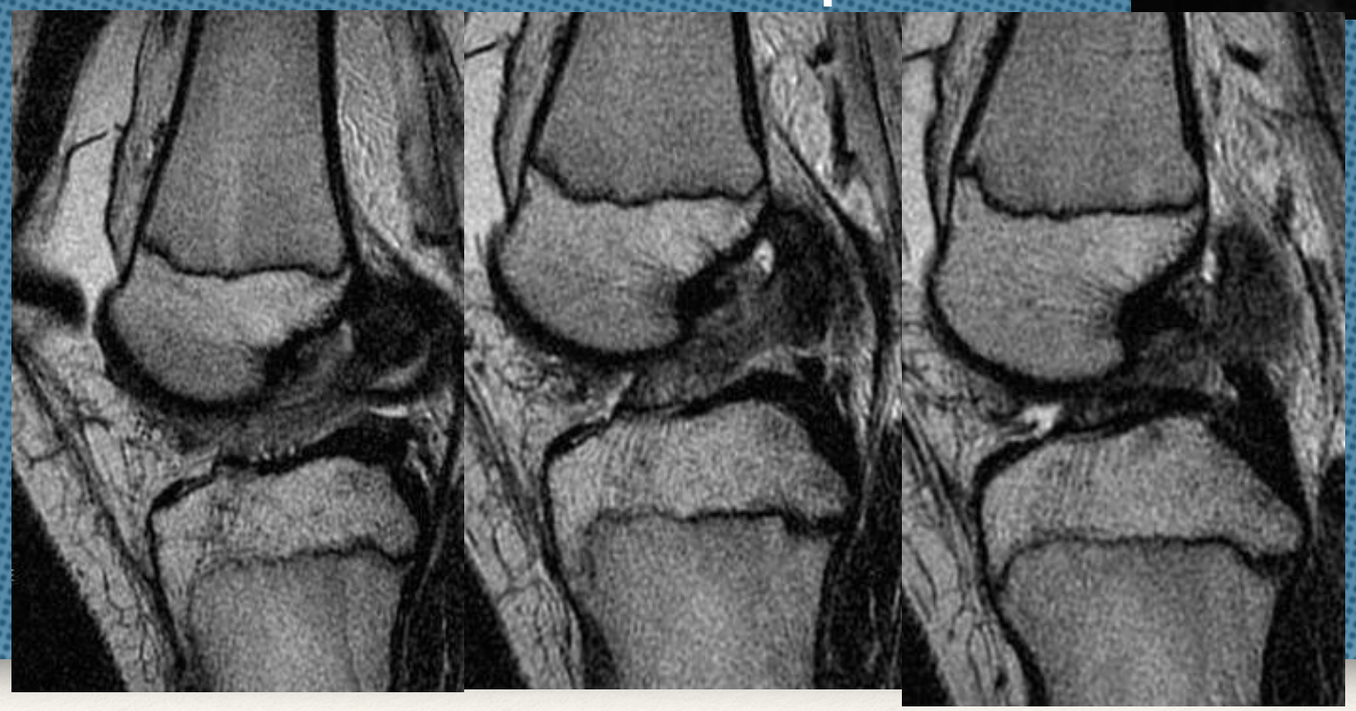
ACL - Skeletally Immature





Pivot shift bone bruise pattern



Oblique images

Cruciates in plane

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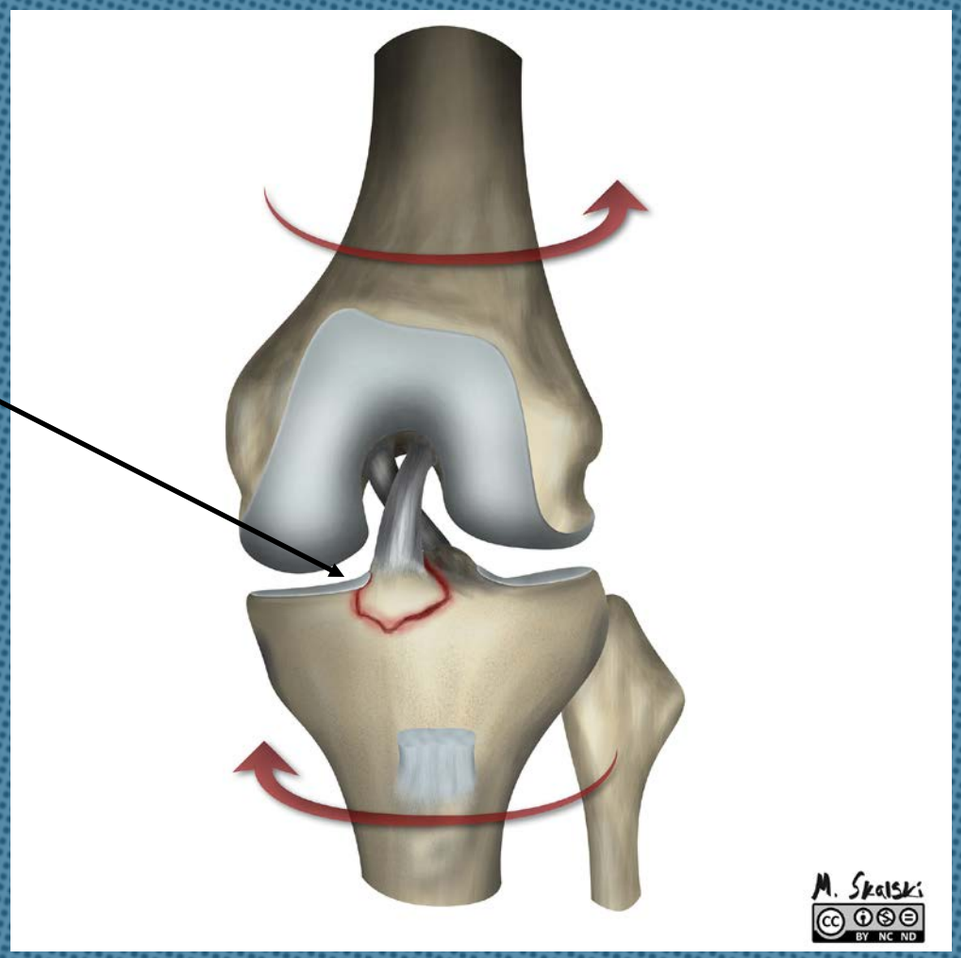
Proximal Tibia

- Tibial Spine/Eminence
  - ACL attachment
- Repaired surgically
- Can lead to late instability
  - requiring reconstruction



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ACL Reconstructions

- Physeal Sparing
  - IT band
  - All - Epiphyseal
- Physeal Respecting
  - Mixed
  - Vertical Tunnels
- Skeletally Mature

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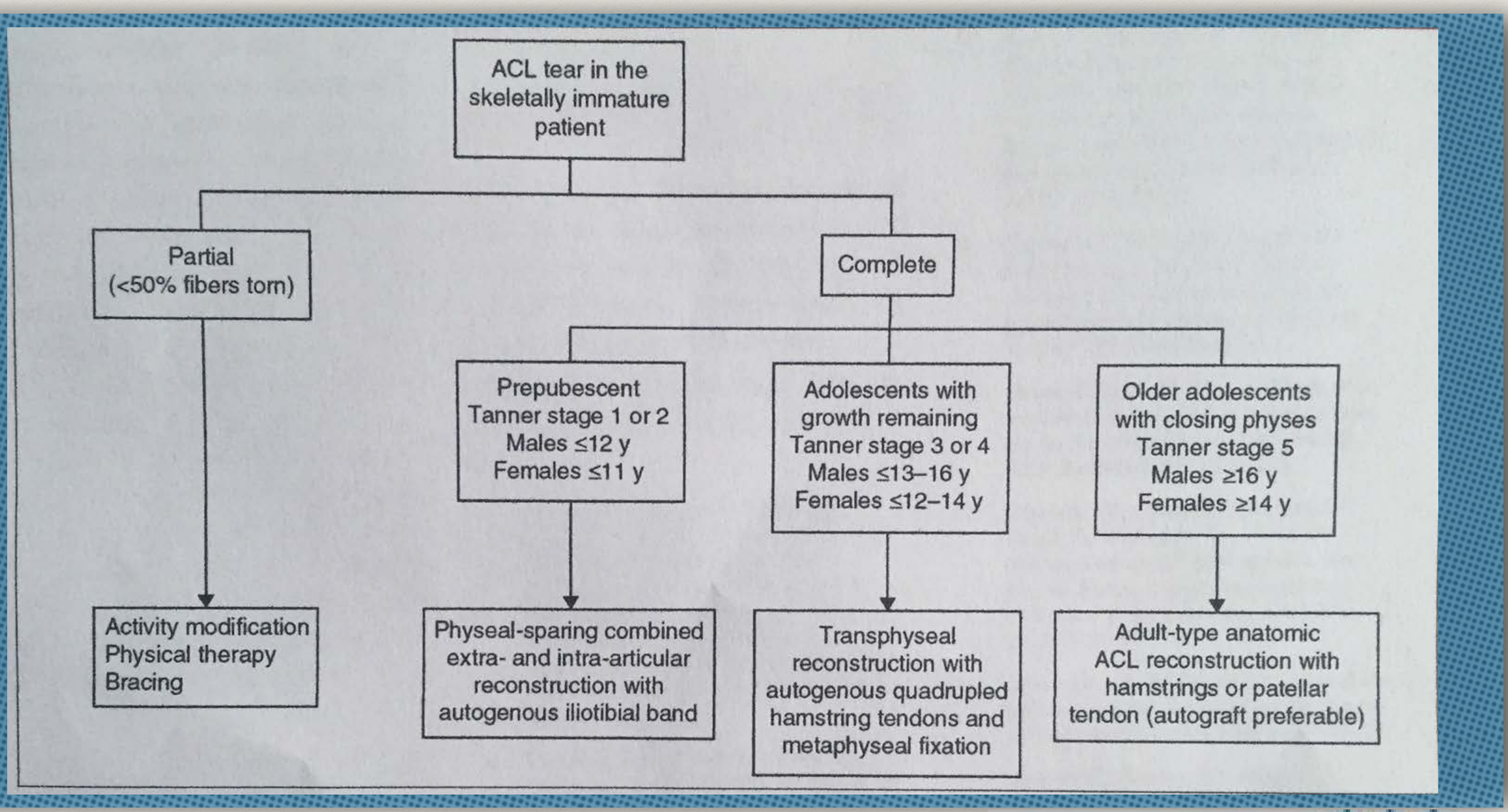
Reconstruction Algorithm



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Bone Age

- Compared to Greulich and Pyle atlas

Bone age - all physes open
Age 11 correlate

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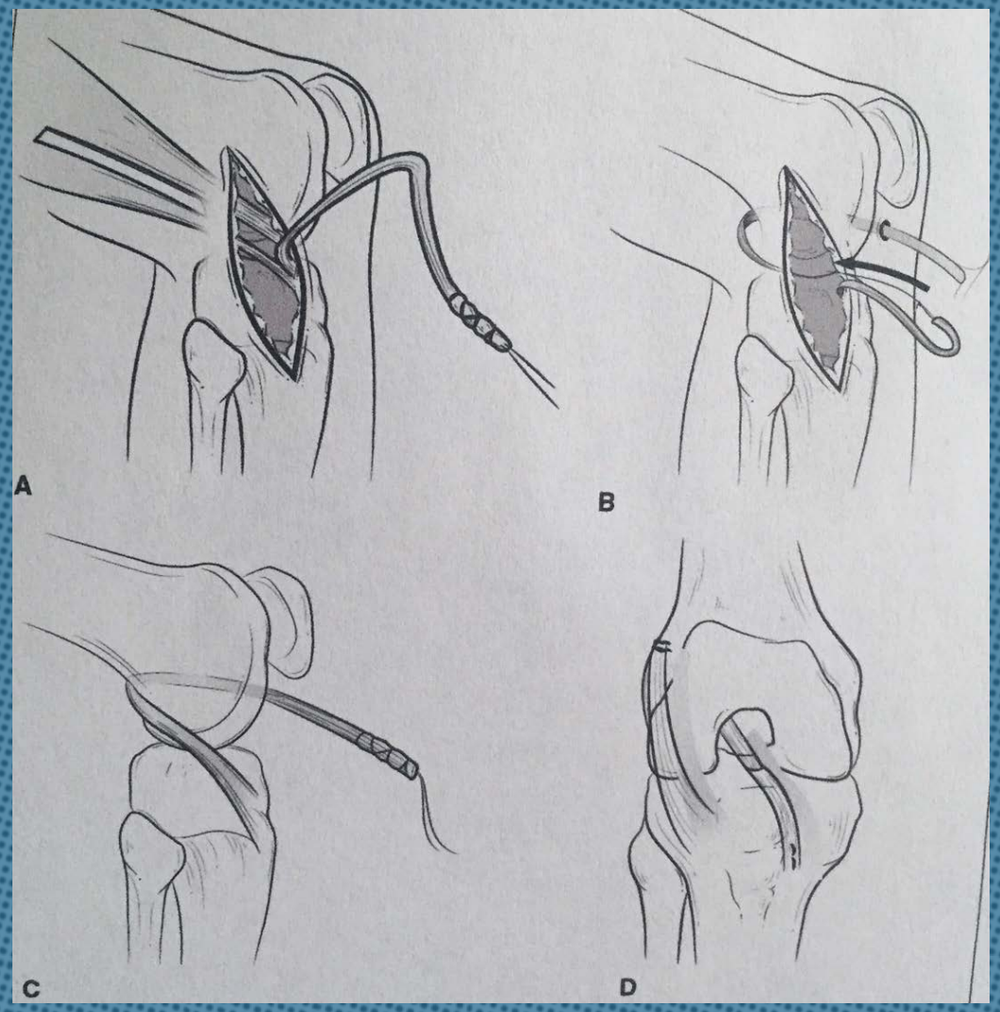
Immature ACL Injury

- IT Band combined Extra-articular/Intra-articular Reconstruction



Frank JS, Gambacorta PL *JAAOS* 2013

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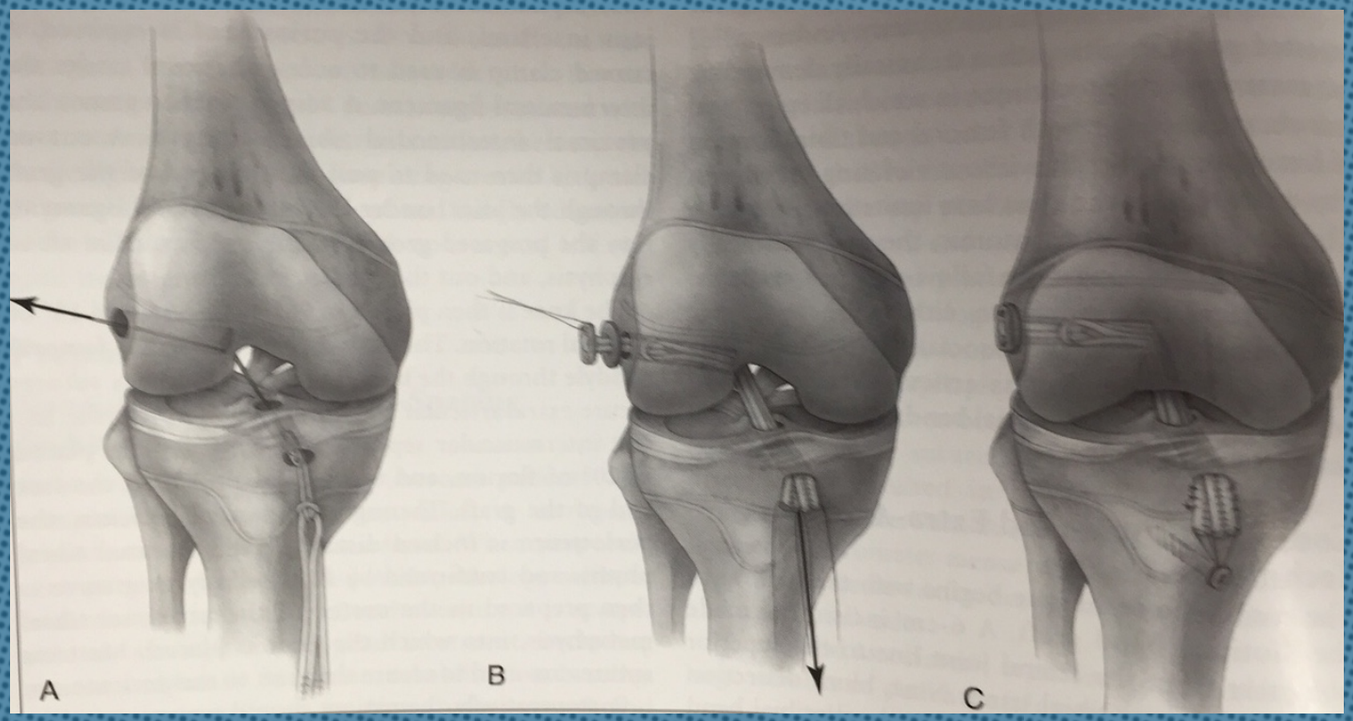

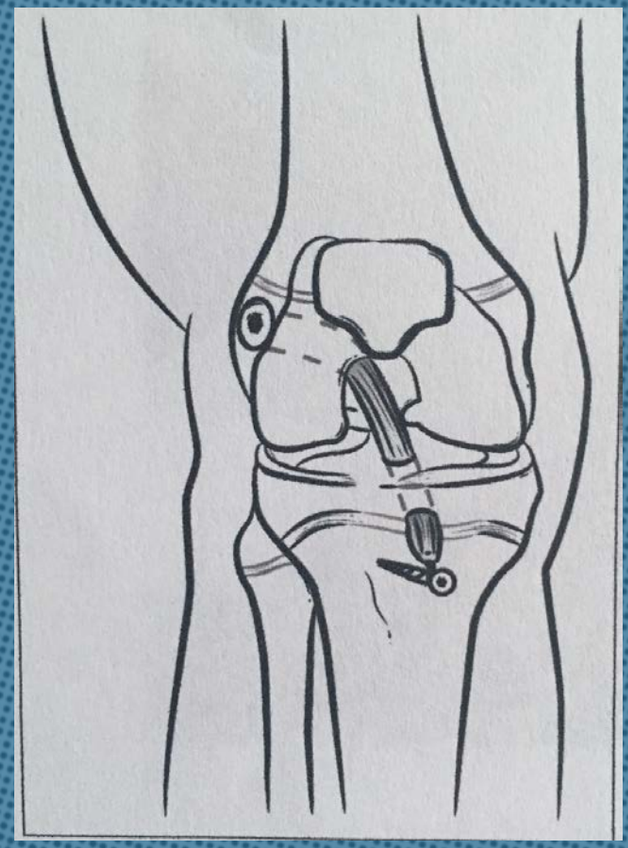

Anderson AF *JBJS* 2003

Various Fixation Methods

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All-Epiphyseal

- I prefer this technique in:
  - Males 12 and under
  - Females 11 and under
  - generally correlates with Tanner 1 & 2
  - will go with IT band usually under 10 depending on size of epiphyses
- Older adolescents
  - Physeal respecting
    - smaller vertical tunnels
    - more like adult hamstring
  - Mature reconstruction
    - BTB vs. Hamstring

All-Epiphyseal Intra-Op

Drills contained within epiphyses

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All - Epiphyseal Post-Op

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Growth Disturbance

- 1-1.8% incidence
  - Frosch 2010
  - Vavken and Murray 2011

- Iatrogenic
  - Direct violation of physis
  - Tethering of the physis by IT band method

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Results

- IT Band
  - 4.5% revision rate
  - low rate of growth disturbance
  - controls rotation well
  - may over constrain the knee during some flexion angles

- All-Epipyseal (Outside in)
  - Cruz (2015) - 103 pts; 10% rupture; 1 pt with overgrowth
  - Anderson - 79 pts ;4 failures; 1 overgrowth
  - Anderson - 125pts with technique show similar success

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Postoperative Management

- Long leg hinged knee brace for 6 weeks
- Inline running at 3 months
- Generally 9 months to 1 year out from sports (no consensus)
- Functional brace recommended for 1-2 years after return to sport. Little data to support this, but generally recommended.

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Summary

- We covered the treatment options for Boys 12 and under and Girls 11 and Under
- Surgeon preference on IT band modified extra-intra-articular versus All-Epiphyseal
- Biomechanical and technical considerations on choice.
- Similar results. Generally preferred to non-operative management.

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