

ACL Reconstruction in the Skeletally Immature



Philip L. Wilson, M.D.

Asst. Professor UT Southwestern
Texas Scottish Rite // Children Medical Center
Pediatric Orthopedics and Sports Medicine

- I have no relevant financial relationships with the manufacturers of any commercial products or provider of commercial products or services discussed in my presentation
- I will not discuss unapproved use of any commercial products in my presentation



philip.wilson@childrens.com

Cell: 214-205-3458

sportsmedicine@childrens.com

ACL Reconstruction in the Skeletally Immature

AAOS/POSNA Cutting Edge Techniques in Sports
Surgery
for Children and Adolescents #3809

June 25-26, 2010; Rosemont, IL

Skeletally Immature ACL

Injuries in the Skeletally Immature

- Organized Sport
- Increased Recognition

Skeletally Immature ACL

Meniscal and chondral lesions frequently occur in less than 2 years in skeletally immature population

- Aichroth, P, et al (2002) JBJS Br
- Millet, P, et al (2002) Arthroscopy
- Foster, A, et al (2005) Knee

Skeletally Immature ACL

Nonoperative Treatment

Bracing effective in reducing subluxation, but ultimate protective effect for cartilage and meniscal injury unknown

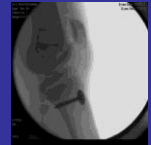
- Kocher, M, et al (2003) J Knee Surg
 - Bracing decreases injury rates in ACL deficient skiers

Skeletally Immature ACL

Reconstruction in the Skeletally Immature

– Transphyseal Reconstruction is reported without physeal injury

- < 3 yrs growth remaining
- Edwards, et al (2001) A J Knee S
- Guzzanti, et al (2003) AJSM



Skeletally Immature ACL



Skeletally Immature ACL

Reconstruction in the Skeletally Immature

– Majority of Arrests reported have been secondary to fixation in the physis or excessively large (> 10mm) tunnels

- Management and complications of anterior cruciate ligament injuries in skeletally immature patients: survey of the Herodius Society and The ACL Study Group. Kocher M, Saxon H, Hovis W, Hawkins RJ. *Pediatr Orthop.* 2002 Jul-Aug;22(4):452-7.

Skeletally Immature ACL

- Anterior cruciate ligament injury in pediatric and adolescent patients: a review of basic science and clinical research. Shea K. *Sports Med.* 2003;33(6):455-71. Review

Skeletally Immature ACL

- Intra-articular anterior cruciate ligament reconstruction using patellar tendon allograft in the skeletally immature patient. Fuchs R. *Arthroscopy.* 2002 Oct;18(8):824-8
- Results of transphyseal anterior cruciate ligament reconstruction using patellar tendon autograft in tanner stage 3 or 4 adolescents with clearly open growth plates. Shelbourne K. *Am J Sports Med.* 2004 Jul-Aug;32(5):1218-22.

Skeletally Immature ACL

Reconstruction in the Skeletally Immature

- Transphyseal Reconstruction is reported without physeal injury
- Lower age limit for tensioned graft across both physes unclear

Skeletally Immature ACL

Reconstruction in the Skeletally Immature

- Angulation Deformity and Acceleration of Growth can be seen

- The influence of femoral technique for graft placement on anterior cruciate ligament reconstruction using a skeletally immature canine model with a rapidly growing physis. Chudik S, Rodeo S, Potter H, et al. Arthroscopy. 2007 Dec;23(12):1309-1319.e1

Skeletally Immature ACL

Reconstruction in the Skeletally Immature

- Angulation Deformity and Acceleration of Growth can be seen

- Transephyseal reconstruction of the anterior cruciate ligament in skeletally immature athletes: an MRI evaluation for epiphyseal narrowing. Higuchi T, et al. J Pediatr Orthop B. 2009 Jul 18.
- Valgus and flexion deformity after reconstruction of the anterior cruciate ligament in a skeletally immature patient. Robert HE Knee Surg Sports Traumatol Arthrosc. 2009 Nov 28.

Skeletally Immature ACL



Skeletally Immature ACL

Physeal-sparing Techniques

- All Epiphyseal
- Extra-Physeal

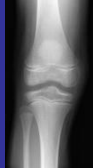
Skeletally Immature ACL

Physeal-sparing Techniques

- All Epiphyseal

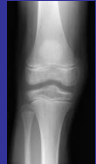
Skeletally Immature ACL

- Transepiphyseal replacement of the anterior cruciate ligament using quadruple hamstring grafts in skeletally immature patients.
Anderson AF J Bone Joint Surg Am. 2004 Sep;86-A Suppl 1(Pt 2):201-9



Skeletally Immature ACL

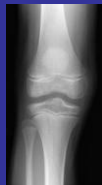
- All-epiphyseal Anterior Cruciate Ligament Reconstruction in Skeletally Immature Patients.
Lawrence JT, Bowers AL, Belding J, Cody SR, Ganley TJ. Clin Orthop Relat Res. 2010 Feb 20.



Skeletally Immature ACL

Physeal-sparing Techniques

- Extra-Physeal



Skeletally Immature ACL

- Anterior Cruciate Ligament Reconstruction in the Skeletally Immature with Extra-physeal Iliotibial Band Reconstruction Kocher, Micheli et al Bone Joint Surg Am. 2005

Skeletally Immature ACL

Reconstruction in the Skeletally Immature

Current Practice

Skeletally Immature ACL

Reconstruction in the Skeletally Immature

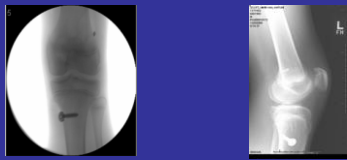
- Current Practice is Transphyseal reconstruction with an anatomic technique using smaller tunnels (< 9 mm) , a hamstring graft, and fixation away from the physes in adolescents with < 3 yrs growth remaining

Skeletally Immature ACL

Reconstruction in the Skeletally Immature



Skeletally Immature ACL



Skeletally Immature ACL



Skeletally Immature ACL

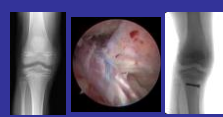


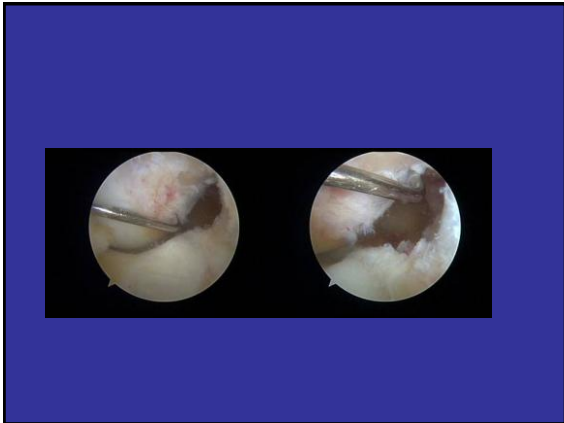
Skeletally Immature ACL

Reconstruction in the Skeletally Immature

For younger patients with significant instability

- All epiphyseal techniques
 - Anderson (2004) JBJS
 - Lawrence (2010) CORR
- Extra-physeal reconstruction
 - Kocher, et al (2005) JBJS

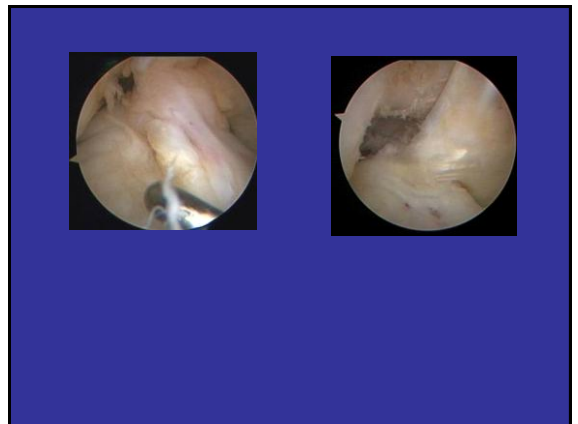


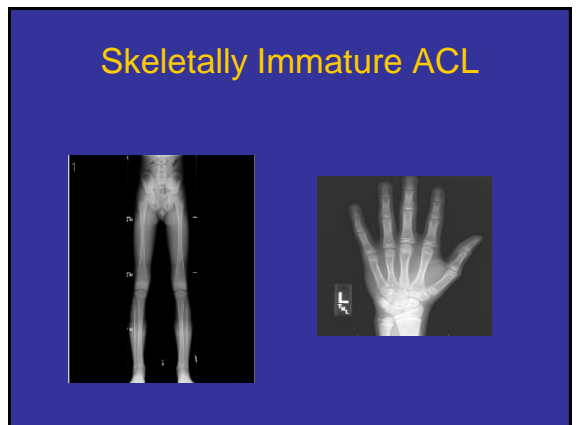
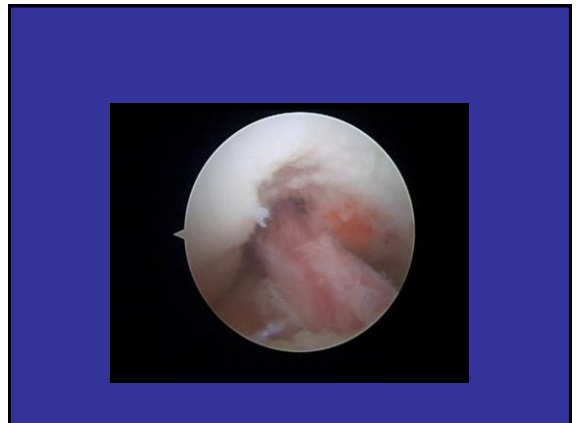
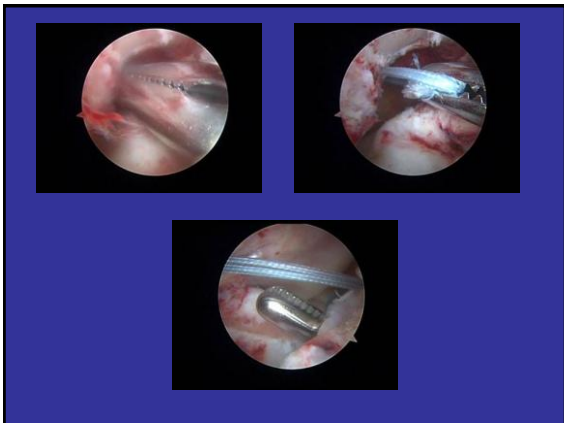
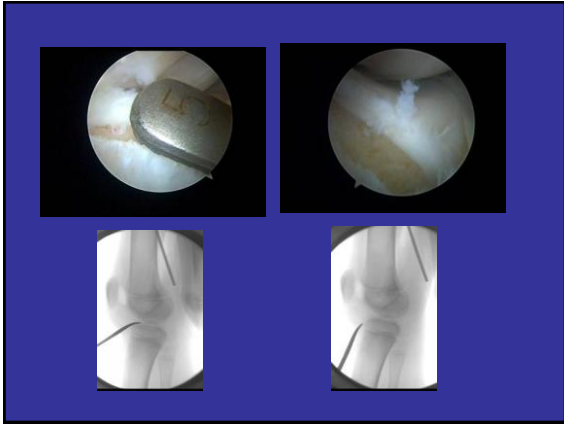


Skeletally Immature ACL

Extra-physeal reconstruction

- Kocher, Micheli et al (2005) JBJS
- ITB / Extra-physeal
- 44 pts
- Avg age 10.3
- Avg 5 yr F/U
- No LLI / No angular deformity





Skeletally Immature ACL



Skeletally Immature ACL

Unanswered Questions / Future Directions

Skeletally Immature ACL

Unanswered Questions / Future Directions

- Transphyseal Reconstruction with Lower / More Horizontal Femoral Tunnel (AM Portal Drilling)
- Volumetric injury of the physis during single-bundle anterior cruciate ligament reconstruction in children: a 3-dimensional study using magnetic resonance imaging. Shea KG, et al. Arthroscopy. 2009 Dec;25(12):1415-22.
- Anterior cruciate ligament reconstruction in the skeletally immature: an anatomical study utilizing 3-dimensional magnetic resonance imaging reconstructions. Kercher J, et al. J Pediatr Orthop. 2009 Mar;29(2):124-9.

Skeletally Immature ACL

Unanswered Questions / Future Directions

- Lower age limit for tensioned graft across both physes unclear
- Valgus and flexion deformity after reconstruction of the anterior cruciate ligament in a skeletally immature patient. Robert HE Knee Surg Sports Traumatol Arthrosc. 2009 Nov 28.
- The influence of femoral technique for graft placement on anterior cruciate ligament reconstruction using a skeletally immature canine model with a rapidly growing physis. Chudik S, Rodeo S, Potter H, et al. Arthroscopy. 2007 Dec;23(12):1309-1319.e1

Skeletally Immature ACL

Unanswered Questions / Future Directions

- All Epiphyseal reconstruction / fixation with latest generation Equipment and Implants
- All-epiphyseal Anterior Cruciate Ligament Reconstruction in Skeletally Immature Patients. Lawrence JT, Bowers AL, Belding J, Cody SR, Ganley TJ. Clin Orthop Relat Res. 2010 Feb 20.



philip.wilson@childrens.com

Cell: 214-205-3458

sportsmedicine@childrens.com