ACL form and function: A Brief Summary

Dr. Vennettilli PGY2
Dr. Ogilvie
June 20, 2007
ACL Function

Five principle functions:
1. Resists Anterior Tibial Translation
2. Prevents Hyperextension
3. Limits axial rotation
4. Secondary stabilizer valgus/varus
5. Fine tunes screw home stabilization in terminal extension
ACL deficiency

- Deficiency in one or all of these functions results in early degenerative changes
- Has been described as a progressive loss of tissue homeostasis
- Precise definition of function may help guide reconstruction
Figure 1. A, a typical MR image of the knee; B, a knee model with ACL and PCL bundle insertion sites for a typical subject.
Anatomy

- Functions like a ribbon
- AM and PL bundle tension at different angles of flexion
- **Maximum tension is at 15 deg approx 2000N**

The PL bundle moves anteriorly with knee flexion. Note the position of A, B, C as the knee flexes.

This is important during ACL repair.
In vivo

- ACL not strong enough to resist large joint reactive forces

- More useful in limiting repetitive insult to tissue homeostasis

- Accomplished by protecting menisci
Femoral rollback

- Condyles behaving like wheels rolling up a slippery slope

- Also instrumental in stability at 15 deg flexion with a tibial axial load e.g. walking
Embryology

- Cruciate’s appear with menisci @ week 4 of gestation
- Before other ligamentous structures
- Migrate centrally with invagination of the femoral condyles
Histology

- In addition to type I collagen, they contain Pacinian and Ruffini corpuscles

- These are responsive to changes in tension and pressure

- Emerging literature on a proprioceptive component to cruciate’s stabilizing forces

References

References

- Dye SF. The knee as a biologic transmission with an envelope of function: A Theory. CORR 1996; 323: 10-18