Graft choice in ACL reconstruction: Autograft vs. Allograft

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What’s up with the ACL?

- Ligament that prevents translation, angulation and rotation of knee
- Extends from lateral femoral notch to tibial spine
• May occur with contact and non-contact injury
  – Failure of deceleration
• Generally in midsubstance
ACL Reconstruction

• Replacement of the torn ligament
  – Repair not currently possible as current results are uniformly poor
  – Reconstruction is operative treatment of choice
    • Anatomic
    • Nonanatomic
      – Generally reserved for Tanner 1-2 patients
      – ITB autograft in physeal sparing approach
ACL Reconstruction

- Graft choices:
  - Autograft
    - Patella tendon
    - Quads tendon
    - Hamstring tendons
  - Allograft
- Historical
  - Synthetic material
  - Abandoned due to high failure rate
ACL reconstruction –
Graft choices

• Patella tendon
  – Uses central 10mm patella tendon with bone block each end
  – “Gold standard”
  – Graft is flat
  – Not generally suitable for skeletally immature

• **Problems:**
  – *Patella fracture*
  – *Patella tendinopathy*
  – *Kneeling pain*
  – *Patellofemoral issues*
ACL reconstruction – Graft choices

• Quadriceps tendon
  – Uses central 10 mm with option for bone block on one end
  – Became more popular in 90s
  – Less kneeling pain
  – Not as well studied

• Problems:
  – Donor site morbidity
  – Technical challenge of harvest
    • Avoid entering joint
  – Compartment syndrome
ACL reconstruction – Graft choices

• Hamstrings
  – Semitendinosus and gracilis
  – Four-stranded graft
  – Soft tissue across physis

• Problems:
  – Fixation not as secure
  – Decreased H/S strength
Graft healing

• Up to week 4
  – Necrosis of tissue centrally
  – Influx of host cells
    • From remnant ACL, synovium

• Weeks 4-12
  – Remodeling of ECM
    • Creeping substitution
  – Max cellular activity
  – Appearance of myofibroblasts
    • Important in ligamentization
  – Graft weakest at 6-8 weeks
Graft healing

- Weeks 12 and on
  - Ligamentization
    - Cellularity resembles intact ACL by 3-6 months
    - Vascularity resembles intact ACL by 6-12 months
    - Collagen fibrils resemble intact ACL by 6-12 months

- Allograft vs. autograft differences
  - Need to eliminate donor cells
  - Slower rate of remodeling
  - Prolonged host inflammatory response
ACL reconstruction

- Risks for reinjury
  - Age <18
  - Allograft
  - Level of activity
Graft Considerations – Ideal Graft?

- Strength
- Cost
- Morbidity of harvest
- Safety
Graft Choices by Country

- US – autografts 58%
- Canada – autograft 90%
- UK – autograft 95%
- Scandinavia – allograft only for multi ligament reconstructions
“The practitioner should use either autograft or appropriately processed allograft tissue because the measured outcomes are similar”
AAOS Evidence Based CPG

“Results may not be generalizable to all patients, such as young patients or highly active patients”
Allografts in the Literature

• Prospective cohort study of 120 pts undergoing ACL reconstruction
  • USMA cadets
  • Autograft failure 20%; Allograft failure 44%

• Pallis M. Survival Comparison of Allograft and Autograft ACL Reconstruction at the USMA. AJSM. 2012
Allografts in the Literature

• Kaeding et al (MOON)
• Prospective cohort study in 281 patients
• Allograft failure rate 10% vs autograft failure rate of 5%
• Rate of allograft failure particularly high in patients younger than 20
Failure of Allograft

- Type of allograft
- Preparation of allograft
- Size of allograft
- Factors unrelated to allograft including age of patient, sport, tunnel position
Women at Risk

• Anatomic considerations
• Influence of hormones
• Neuromuscular patterns
• Male and female soccer players between 13-19 have highest risk of revision surgery
Hamstring Autograft in Women?

• Hamstring strength 80% injured vs unaffected leg pre op
• Hamstring strength 60% and 80% at 3 and 6 months post op respectively
• Q/H < 2:1
DISCUSSION