Hamstring (soft tissue)
ACL Reconstruction

Indications and Surgical Pearls

Aaron Bare, MD
Northwestern Medicine
Director, Shoulder, Knee and Sports Medicine
Northwestern Orthopedic Institute

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Case

- 19 year old competitive female basketball player with torn ACL

Questions
  - When ?
  - How ?
  - Graft
  - Technique
Clinical History

70% noncontact
Pivoting injury
Foot planted
Deceleration
Hyperflexion
Hyperextension
30% direct contact

ACL injuries occur when bones of the leg twist in opposite directions under full body weight.
ACL
Epidemiology

`YOU HAVEN'T TORN YOUR ACL`

`YOU HAVE.`
Epidemiology

- Annual incidence 1 in 3000 per athlete

- With approximately 100,000 primary ACL reconstructions performed annually in the US (over $2 billion of health care dollars)

- Even a small percentage of non-successfully surgical results equates to thousands of unhappy athletes every year
Opportunity for the Athletic Trainer and Staff

- The initial evaluation
- Education / Treatment
  - Preoperative
  - Postoperative
Exam - 1st is best

- ROM
- **Lachman**
- Anterior drawer
- Pivot Shift
- Varus/Valgus
- Dial test
- Meniscus stress

*Best exam is directly after the injury (prior to the effusion)*
Championing the ACL

- Graft selection
- Fixation
- Technique - tunnel orientation

Anterior Cruciate Ligament
Graft Selection

- Bone-Patella Tendon-Bone Autograft (BTB)
- Hamstring (ST/G) Autograft
- Quadriceps Tendon Autograft
- Allografts
  - BTB
  - Posterior tibialis
  - Hamstring
ACL Reconstructive Options

- Grafts
  - Patella Tendon
  - Hamstring Tendon
  - Allograft
- Technique
- Rehabilitation
Allografts

- No harvest, minimal pain
- Surgeon friendly
- Limitations recognized
  - Post-rehab laxity due to creep
  - Slower to incorporate
- Longevity a concern
- Good primary option for recreational, lower-demand, older, “weekend warrior”
- Revision option for failed autografts
- SHOULD rehab slower in light of quick initial recovery
Allografts

- Advantage: Less Pain, Lack of Donor Morbidity, Speed
- Disadvantage: Cost, Risk of Disease Transmission Risk, Slower Incorporation, Post fixation laxity (creep)
Allografts

- vanEck CF, Fu F  AJSM Jan 2012
  - 206 allografts
  - 18 month f.u
  - 13% failure rate
  - all anatomic ACLs
  - factors associated with failure
    - Young age (less 22)
    - Earlier return to sport
    - High body mass index
Bone Patellar Tendon Bone (BTB)

- Own tissue (autograft)
- Central third of patellar tendon
- Replace same size graft or larger

Advantages
- Bone - bone healing
- Rigid fixation
Bone-Patella Tendon-Bone

Advantages

- Bone - bone healing
- Rigid fixation
- Ease to harvest
- Good for contact athletes
BTB

Disadvantages

- Chronic anterior knee pain secondary to graft harvest
- Postoperative patella fractures
- Relatively large incision
- Contraindicated in open physis patients
Hamstring

Advantages

• Less morbidity vs BTB
• Small harvest incision
• Unlikely to have lingering symptoms from harvest site
• Better option in open physics
Hamstrings

Disadvantages

• Initial fixation not as strong as BTB
• Possible more challenging harvest
• Potential for graft elongation with fixation
### Patellar Tendon vs Hamstring / Soft tissue

**Patellar Tendon**
- Ultimate Tensile Load: 2300 N
- Stiffness: 620 N
- Advantage: Rigid fixation of bony to bone, bone-bone heal
- Disadvantage: Donor site morbidity

**Hamstring / Soft tissue**
- Ultimate Tensile Load: 4100 N
- Stiffness: 410 N
- Advantage: Multiple Bundle/Strength
- Disadvantage: Initial fixation/tendon-bone healing
Patellar Tendon vs Hamstring

- Contact Athletes
- Patient with Hyperlaxity
- Revision of prior HS, Allo
- Younger patients

- Prior Anterior Knee Pain
- Patellar Chondrosis
- Thin Patellar Tendon
- Kneeling sport or occupation
- Patients >25yo
- Revision of Prior BTB, Allograft
BTB vs HS Autograft

- **Gobbi A, et al Arthroscopy 2003**
  - BTB vs HS, prospective, 3 yr followup
  - higher postop pain and kneeling in BTB
  - same knee fx, laxity

- **Samuelsson K, et al Arthroscopy 2009**
  - BTB with greater kneeling pain, usually disappears
  - No difference in laxity and outcome
  - HS may create flexion strength weakness for 12 months

- **Leys T, et al AJSM, 2011**
  - 15yr f.u, 90 BTB, 90 HS
  - Both excellent result function and satisfaction
  - But HS better score and less XR dx of OA
Graft Trends

2003
- 63% BTB
- 25% HS
- 12% Allografts

2008
- 46% BTB
- 32% HS
- 22% Allografts

* Duquin TR et al J Knee Surg 2009

2017
- 45% BTB
- 41% HS
- 11% Allograft

* Budny J, Fox J AAOS March 2017
Technical Improvements

- In the coronal plane, the ACL “bends” from the tibial footprint to the 2:00/10:00 position on the femur
Modify single bundle technique?

- Lateralize the femoral tunnel?
- Decrease verticality
- 2’clock vs 1 o’clock positioning
  - Anterior translation identical
  - Less anterior translation when combined with a rotatory load when tunnel at 2 o’clock

(Loh et al, Arthroscopy, 2003)
Anatomic Technique

1:00

2:30

[Diagram of anatomic technique with an arrow indicating the location of a lesion or structure]
Anatomic ACL

- Low femoral tunnel rarely possible through trans-tibial approach
- Vertical grafts in coronal plane associated with persistent rotational instability
- Negative Lachman
- Persistent Pivot

Harnet et al. Arthroscopy 2007
Advantages to AM portal tech

- Accurate femoral tunnel placement independent of tibial tunnel placement
- Compatible with any graft choice or fixation device
- Allows parallel placement of interference screw fixation through same medial portal as that used for tunnel creation
- Improved rotational stability

Harner et al. – Arthroscopy 2008
Anatomic ACL Surgical Pearls
Factors Affecting Rehab

- Graft Selection
- Graft Placement
- Graft Tensioning
- Graft Fixation
- Graft Incorporation
The Question.............
ACL in competitive athlete

BTB or Soft Tissue?

Outcome of Patellar Tendon Versus 4 - Strand Hamstring Tendon ACL Reconstruction : Meta-analysis of Prospective Randomized Trials, (Arthroscopy Feb 2017, Chee et al)

- Clinical results are comparable

- Both choices are good options if we strive to champion the technique and anatomically recreate the native ACL
My Preference

- High level competitive/young, no anterior knee issues = BTB
- High level, squatter, kneeler, ant pain = HS
- Recreational athlete 25-40 = HS
- Recreational athlete > 40 = allograft
- High level rec athlete > 40 = HS/allograft
Graft Selection

- No graft has clearly proven to champion a faster return to play
- Autografts are preferable for most for high-performance athletes
- Hamstring grafts less morbid than BTB but less initial rigidity, gold standard for those with PF pain
- Allografts have some relative advantages for lower demand athletes and offer less morbidity BUT take longer to heal/incorporate ("double edge sword")
- Allografts often stretch out, elongate during rehabilitation
- While autografts create more initial morbidity than allografts, recent data shows a trend toward better stiffness after reconstruction
Happy Father's Day

You're the world's greatest dad although my frame of reference is limited.

someecards