Minimally Invasive ACL Surgery

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TAMPA BAY RAYS (1995 – PRESENT)
TAMPA BAY BUCCANEERS (2015 – 2016)
TAMPA BAY ROWDIES (2014 – 2017)
Anterior Cruciate Ligament Injuries

- **ACL:**
  - Prevents anterior translation and internal rotation of tibia
  - Prevents hyperextension
  - Injuries most common in soccer, football and basketball
ACL Physical Exam

- **Lachman exam**
  - Patient supine, 20-30 degrees of flexion
  - Grasp distal femur with one hand, tibia at level of tubercle with the other hand
  - Pull tibia forward
  - Positive result indicated by no discernible end point, or increased motion compared to contralateral knee
ACL Physical Exam

• Anterior drawer
  ○ Patient in a relaxed supine position with knees bent to approximately 90 degrees
  ○ Stabilize feet of patient
  ○ Place hands around the upper tibia of one leg, while the thumbs of both hands are on the supero-anterior aspect of tibia
  ○ Apply posterior-anterior force
  ○ Positive result is soft end point, or >6mm of anterior translation
ACL Physical Exam

- **Pivot shift test**
  - extension to flexion: reduces at 20-30° of flexion
  - patient must be completely relaxed (easier to elicit under anesthesia)
  - mimics the actual giving way event
ACL Structure – Double-bundle

- **Anteromedial bundle**
  - Moderately lax in extension
  - Tightens in flexion
  - Primary restraint against anterior tibial translation

- **Posterolateral bundle**
  - Tight in extension
  - Relaxes in extension
  - Stabilizes the knee near full extension, particularly against rotatory loads
ACL Structure – Double-bundle
The ACL – To Repair or Reconstruct?

- **ACL Repair**
  - Great for acute partial tears, posterolateral bundle
  - Great option for older patients with lesser activity levels
  - Less pain, less healing time

- **ACL Reconstruction**
  - Complete or chronic tears
  - Younger, high caliber athletes
  - Contact athletes
ACL Repair Technique

- #2 FiberWire is passed in locking fashion through ACL remnant
- Microfracture performed within notch at location of anchor placement to create bleeding bone bed
- Hole punched/tapped in notch to receive SwiveLock anchor
- Suture passed through anchor and inserted
ACL Repair Technique
ACL Repair Technique
ACL Repair – End Result
ACL Repair – My Results

- 36 ACL repairs performed out of 219 total ACL surgeries since June 2014
- 16% of ACL injuries treated effectively with ACL repair surgery
- To date, no failures of repairs
- Effective treatment of ACL injury in the right patient
Case Report – ACL Repair

- 81-year old healthy, active female, snowskiing in Colorado sustained knee injury
- MRI showed partial ACL tear
- Successful ACL repair performed
- Great for older patient who wishes to remain active
ACL Reconstruction - Principles

- Single vs. double bundle technique

- Freddie Fu, M.D.
  - Has been a pioneer in the research of single vs. double-bundle ACL reconstruction
  - Author of *Current Concepts in ACL Reconstruction*
  - Winner of Jack Hughston Award

- Concludes that anatomic single-bundle reconstruction resulted in less anteroposterior and rotational laxity than conventional single-bundle reconstruction, and the results of the double-bundle group surpassed those of the anatomic single-bundle group for laxity.
Single vs. Double Bundle Technique

ACL Reconstruction Techniques

Single Bundle  Double Bundle
ACL Reconstruction – How It’s Done

- Femoral drill tunnel is made with a 10 mm reamer, then overdrilled with 4.5 mm reamer
- Tibial tunnel drilled with 10 mm reamer over guidepin, outside-in technique
- Graft is harvested
- Passed through knee joint
- Fixation on femoral side with Endobutton
- Fixation on tibial side with 6.5 mm screw and washer
Postop X-rays
Graft Options

- Middle third of patella tendon is what I use
- Can use strip of quad tendon, great for revision
- Hamstrings are an option, but graft is much thinner than patella/quad tendon and can result in ongoing knee problems at graft site
Bone-tendon-bone graft is harvested from the middle third of the patellar tendon.

Graft is defatted and the bone plugs are contoured to slide into the tibial and femoral tunnels snugly for optimal healing and fixation.
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- Nobody wants a large incision
- Cosmesis is important to most people, particularly females
- The smaller the incision, the better
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How can an ACL reconstruction with an autologous patellar tendon graft possibly be performed through such a small incision?

- The double knife
- The towel clip
- The bone clamp
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- Incision is based over medial aspect of patellar tendon
- Allows for exposure of tendon for harvesting, and also allows tibial drill tunnel to be made
- Typically 1-1.5 inches is sufficient
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Subcutaneous tissue freed up with Cobb elevator

Double knife is used to cut vertical borders of graft
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Distal end of graft is cut with TPS saw

Proximal end of graft is harvested by using towel clip on patella to deliver inferior pole, cuts are completed
Contouring the Graft

- In the olden days of patellar tendon graft harvesting, the bone plugs were shaped with a Rongeur.
- Passed through a metal sizing tunnel.
- If it didn’t fit, you whittled some more.
- Contouring the graft with a Rongeur could take 15 - 20 minutes, and it seemed that there must be a more efficient way to get the job done.
The Bone Clamp

- WHITTLE NO MORE!
- Cuts down graft preparation time
- Reproducible results
- Securely holds graft for suture passing
The Bone Clamp

- Idea behind the sizing of the bone plug is based on the Pythagorean Theorem

- \( a^2 + b^2 = c^2 \)

In order for \( c \) to be 10mm, sides \( a \) and \( b \) are 6 mm and 8 mm respectively.
The Bone Clamp
The Bone Clamp

- The bone clamp securely holds the bone plug
- A TPS saw blade is passed over the bone plug, removing excess bone
The Bone Clamp

- Bone plug is rotated 90°, tendinous portion turned away, and cut is repeated
- Small holes drilled through bone plug while cradled in the bone clamp for passing of suture
The bone clamp is a safe and effective surgical instrument for shaping and sizing the bone plugs at either end of a bone-tendon-bone graft. The results are consistent and reproducible, while use of the bone clamp decreases operative time.
Citations