STATE OF THE ART OF ACL SURGERY
(Advancements that have had an impact)

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Dr. David Drez has no relevant financial relationships with commercial interests to disclose.

Biggest Impact on ACL Surgery
Better defining ACL Anatomy

Anatomic ACL Reconstruction

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Two Bundle ACL anatomy

Anterolateral view  Anteromedial view

"Posterior lateral bundle" — attaches on posterior and lateral aspect of tibia (tightest in extension)

ACL Anatomy

The Function of AM and PL Bundle Varies in Different Knee Flexion Angles

Controls rotation of tibia on femur

AM

Controls forward motion of tibia on femur

PL

NORMAL ANATOMY

Intercondylar ridge (Hunter's ridge)
Bifurcate ridge

AM

PL
Reconstruction of Anterior Cruciate Ligament

Single Bundle Anatomic ACL Reconstruction

Double Bundle Anatomic ACL Reconstruction

“Accessory Medial Portal” to gain better access to anatomic ACL attachment on femur
Outside in Reconstruction

“All inside” ACL Reconstruction

ACL Reconstruction in child with open growth plates

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Meniscus Repair

- Inside-out repair with sutures
- Meniscus suturing device

Grafts for ACL Reconstruction
- Middle 3rd of patellar tendon
- Hamstring graft
- Distal quad tendon graft
- Allograft
- Synthetic or prosthetic graft

Middle 3rd of Patellar Tendon

Tendon graft is harvested from the patellar tendon.
Hamstring Grafts

- Longer time to incorporate in tunnels
- Less stiffness than BPB
- Slightly more laxity than BPB
- Higher failure rates in females – esp. if have valgus alignment
- Variable size of tendons

Evaluation of Muscle Size and Fatty Infiltration with MRI 9-11 Years Following Hamstring Harvest for ACL Reconstruction

- Gracilis & Semitendinosus muscles showed atrophy & fatty infiltration
- Variable tendon regeneration
- Persistent quadriceps atrophy
- Compensatory hypertrophy of long head of biceps
Distal Quadriceps Tendon Graft

Scar is larger
New harvesting device is being made

Graft Morbidity

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<tr>
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<th>Nerve injury</th>
<th>PF pain</th>
<th>Weakness</th>
<th>Tendon rupture</th>
<th>Patellar fix</th>
<th>Hematoma</th>
<th>Problem with size of grafts</th>
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Allografts (????)

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ALLOGRAFT FOR ACL RECONSTRUCTION IN PATIENTS UNDER THE AGE OF 25
20% required revision
62% were classified as failures (+ Lachman & pivot shift)

Recent Study
Arthroscopy-Dec. 2012
• Comparison of Autograft BPB and Allograft BPB ACL reconstruction in patients under 25 with closed growth plates
• Failure rates
  • Autografts – 3%
  • Allografts – 11%

Synthetic or Prosthetic Graft
**Graft stiffness**
- Stiffer the structure – more force needed to lengthen it
- Less stiff – the less force needed to lengthen
- In order for graft to function properly, a force must be applied to it to reduce slack that will result when loaded
- Question is how much force is needed to reduce the laxity that may result when the graft is loaded?

**Pretensioning of grafts**

"Theoretically" will reduce the laxity in the knee when one uses grafts that have reduced stiffness

**Methods to pretension**
- Graft tensioning board
- Tensioning device
"Simple" way of pretensioning

Fix femoral attachment first
• Surgeon pulls on tibial end of graft
• Flex and extend knee 10-20 times before fixing tibial attachment

Average force exerted with a single hand pull by a surgeon is 99N (approx. 25lbs.)

WHAT ARE SYMPTOMS?

- POP – FELT OR HEARD BY PATIENT OR BYSTANDER
- FELT LIKE JOINT SEPARATED
- SEVERE PAIN
- SWELLING WITHIN 30 MINUTES TO 2 HOURS
- INABILITY TO CONTINUE PARTICIPATION

Usually a noncontact injury when athlete plants foot and turns.
DIAGNOSIS OF ACL INJURY

- Clinical tests demonstrate the instability
- Plain X-rays are needed to rule out an injury to bone
- MRI is usually done to confirm clinical diagnosis and check for associated injuries (such as meniscus)

EXAM

- LARGE EFFUSION
- LOSS OF MOTION
- CLINICAL TESTS ARE POSITIVE FOR TEAR OF ACL
  - LACHMAN TEST
  - LATERAL PIVOT SHIFT
  - LOSEE TEST

Clinical tests for ACL tear

Lachman
Lateral Pivot Shift

Reference – JBJS 60A #8 Dec. 1978 pp. 105-1030
ACL – X-rays & MRI
Segond Fracture
**Determining Return to Play**
(There is no literature to determine the appropriate time when an athlete can return to full unrestricted activity)

1. Patient perspective
2. Physician perspective
3. Isokinetic testing +/-
4. Functional tests should be about 85%-90% of normal side – I/N = %

**Determination of healing and maturation of graft by MRI**
(Univ. of Pitt.)
- Signal intensity of ACL graft should be same as PCL
- MRI can be used as an adjunct to functional testing

**“Non scientific” determination of graft maturation & healing**

“When the color of the skin incisions become the same color as the normal skin”
PRP
• Platelets contain the bioactive factors
• Not all PRP systems are the same
• Many studies using different systems
• Which system is the best????
• No proven benefit in ACL surgery
• Promotion tool

INDICATIONS FOR ACL SURGERY
“7 A’s”
1. Age
2. Activity level – same as before surgery?
3. Amount of instability
4. Associated Injuries
5. Arthritis – hopefully less arthritis
6. Attitude – will patient do pre-op rehab?
7. A’s normal – will knee be as good as new?

Summary
• Most important “state of art” development has been better defining ACL anatomy
• Many techniques are out there – so for none have been proven to be "the best" by long term follow up – esp. true for anatomic double bundle vs. anatomic single bundle
• Best ACL graft is still not determined
• Females with valgus knees have higher failure rates if use hamstring grafts
• Makes little difference which graft one uses if a non-anatomic reconstruction is done !!!!!
- Overall retear rates of ACL grafts - about 10% - same for opposite knee (approx. 25% in younger patients who return to sport)
- Allografts in young patients have a high failure rate
- Allografts that are irradiated and chemically treated show higher failure rates (fresh frozen are best)
- If meniscus excision done when ACL reconstructed – increased risk of arthritis
  - Repair if possible
  - Meniscus transplant ???
- Value of PRP in ACL surgery ????

- Nothing ruins good results like follow up
- Don’t be swayed by the media and unfounded advertisement

Thanks for your attention