# ACL Anatomy: From the Cadaver to the Camera

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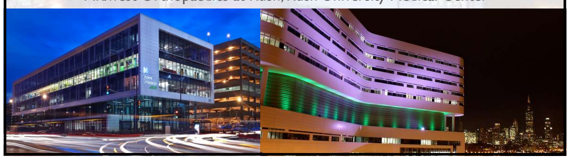

## Disclosures:

- Consultant: Stryker
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- Royalties: Elsevier
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## Introduction

- Some controversy (?) in ACL reconstruction technique
  - Femoral tunnel (anteromedial portal vs. transtibial)
  - Graft (patellar tendon, hamstring, quad)
  - Allograft vs. autograft
- My Technique of choice:
  => AM portal approach w/ BTB auto or allograft
  – Skeletally immature: Intra-epiphyseal w/ hamstrings!
- We will discuss anatomical features of ACL reconstruction

## ACL Anatomy

Anteromedial bundle: tight in flexion

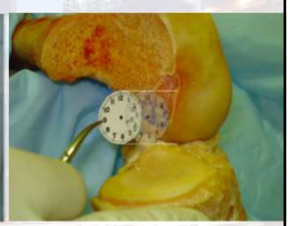
Posterolateral bundle: tight in extension



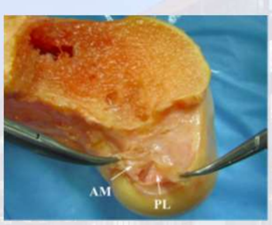
## ACL Terminology:

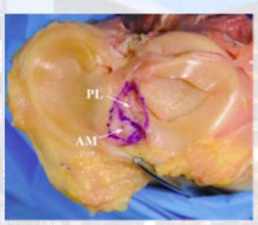
⇒The ‘0’clock’ roadmap varies with knee flexion angles!

⇒ACL Anatomy is described w/ knee in 90 degrees of flexion

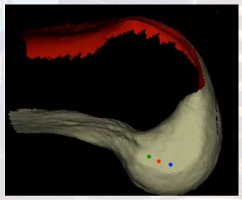
## My Roadmap:
## Remnant tissue & Topographical Landmarks



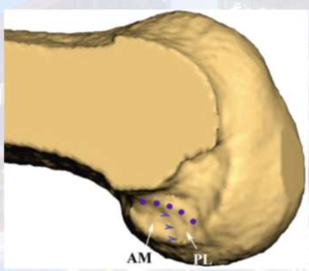
## Anatomical Dissection

- Center points of AM and PL bundles are identified
- Intercondylar (Resident's ridge) => upper border ACL
- Bifurcate ridge => separates the AM & PL bundles

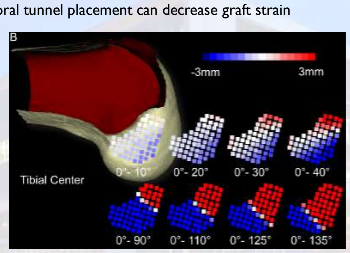
## 3D CT Scan Topography:

- Intercondylar ridge
  - Continuation of posterior femoral cortex
  - ACL inserts on the lower 1/3rd of the wall




## Is an Anatomic ACL Isometric?

- Two functional bundles => Single hybrid reconstruction
- Proper femoral tunnel placement can decrease graft strain




Arthroscopy. 2018 Aug;34(8):2466-2475. doi: 10.1016/j.arthro.2018.03.033.

**Dynamic 3-Dimensional Mapping of Isometric Anterior Cruciate Ligament Attachment Sites on the Tibia and Femur: Is Anatomic Also Isometric?**

Forsythe B[1], Lansdown D[2], Zuke WA[3], Verma NN[3], Cole BJ[3], Bach BR Jr[3], Inoue N[4].

## Isometric ACL Position

- Femoral tunnel placement at junction of bifurcate and intercondylar ridges shows most isometric course
- Anterior fibers of the AM bundle!

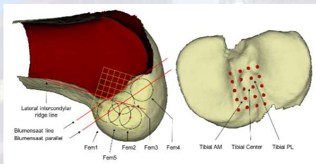


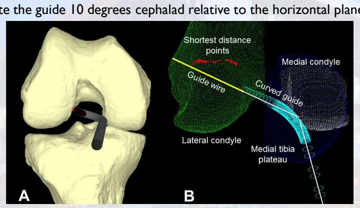

TABLE 1
Range of Normalized Lengths (%)

| Tibial Points | | Fem1 (AM) | Fem2 (PL) | Fem3 | Fem4 | Fem 5 |
|---|---|---|---|---|---|---|
| | AM | 17% | 20% | 8% | 29% | 17% |
| | Center | 28% | 26% | 14% | 32% | 26% |
| | PL | 20% | 22% | 9% | 33% | 19% |

MIDWEST ORTHOPAEDICS at RUSH

## Optimizing Femoral Tunnel Reaming

- 3D point cloud model: We achieve virtual placement of a **Curved Guide (40 deg)**
- To optimize 1) Footprint coverage 2) Posterior Wall thickness
  - Place the guide and ream at 110 degrees of knee flexion
  - Rotate the guide 10 degrees cephalad relative to the horizontal plane



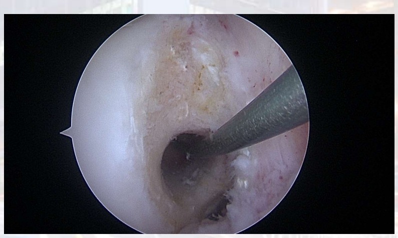

Arthroscopy. 2017 May;33(5):1036-1043. doi: 10.1016/j.arthro.2016.11.004. Epub 2017 Jan 20.

**Optimization of Anteromedial Portal Femoral Tunnel Drilling With Flexible and Straight Reamers in Anterior Cruciate Ligament Reconstruction: A Cadaveric 3-Dimensional Computed Tomography Analysis.**

Forsythe B[1], Collins MJ[2], Arns TA[2], Zuke WA[2], Khair M[3], Verma NN[2], Cole BJ[2], Bach BR Jr[2], Inoue N[2].

## Femoral Tunnel Reaming

- Goal: 75-85% coverage of the ACL footprint
- Guide through AM portal =>
  - At the junction of the intercondylar and bifurcate ridges
  - **Anterior fibers** of the AM bundle



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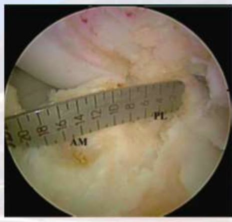
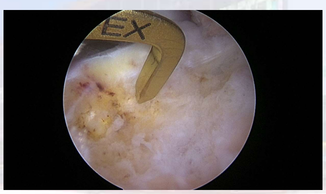
## Tibial Dissection

- AM & PL bundle fovea => High AL portal view
  - A Ridge separates the two bundle centerpoints
  - "Anterior intertubercular ridge" is the target



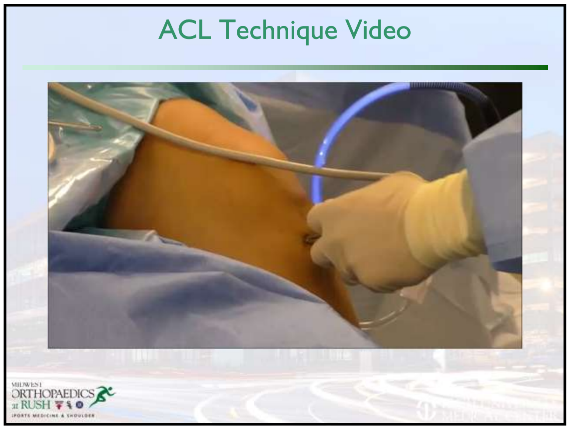

## Tibial Guide Preparation

- Place on the midpoint between AM & PL bundle origins
- Guide typically set between 55 and 65 degrees



## ACL Arthroscopy Portals

- AL→ 'high'
  - view of tibia ACL footprint
- Transpatellar → 'low'
  - femoral ACL footprint
- AM portal → standard
  - not far medial with curved reamer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