

# Landmark-Based Determination of Femoral Attachment Site for Lateral Extraarticular Tenodesis

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**A Landmark-Based Technique for Determining an Isometric Femoral Attachment Site for Lateral Extraarticular Tenodesis is Inaccurate**

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# Disclosures

- J.W.X. reports personal fees from Arthrex and Trice Medical.
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# Why Are Lateral Augmentation Procedures Important?

1. Return to high level sport following ACL-R as low as 63% at 2 years
2. Up to 25% continue to have residual ALRI following ACL-R → associated with poorer outcomes

Return to sport following anterior cruciate ligament reconstruction surgery: a systematic review and meta-analysis of the state of play

Clare L Ardern,<sup>1</sup> Kate E Webster,<sup>1</sup> Nicholas F Taylor,<sup>1,2</sup> Julian A Feller<sup>1</sup>

**BMJ** Journals

3. LET procedures may reduce risk of graft failure & ALRI
  - Particularly in high-risk athletes

# Indications for LET

- High-grade pivot shift, GLL, knee hyperextension ( $>5-10^\circ$ )
- Revision ACL
  - Esp if no technical reason for failure
- Relative Indications:
  - Increased posterior tibial slope  $>12^\circ$
  - Meniscal Deficiency
  - Primary ACL in high-risk athletes:
    - $<25$  y/o
    - Females
    - Pivoting Sports (ex. Soccer)
    - Prior contralateral ACL tear



## Lateral Augmentation Procedures in Anterior Cruciate Ligament Reconstruction

CME

AJSM  
2018

**Anatomic, Biomechanical, Imaging, and Clinical Evidence**

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Brian Forsythe,<sup>‡</sup> MD, Alan Getgood,<sup>§</sup> MD, Nikhil N. Verma,<sup>‡</sup> MD,  
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*Investigation performed at Midwest Orthopaedics at Rush,  
Rush University Medical Center, Chicago, Illinois, USA*





# Background

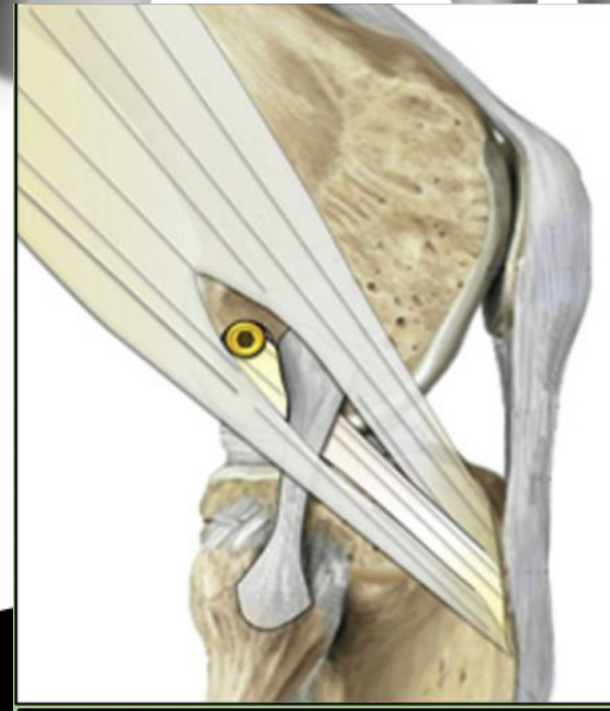
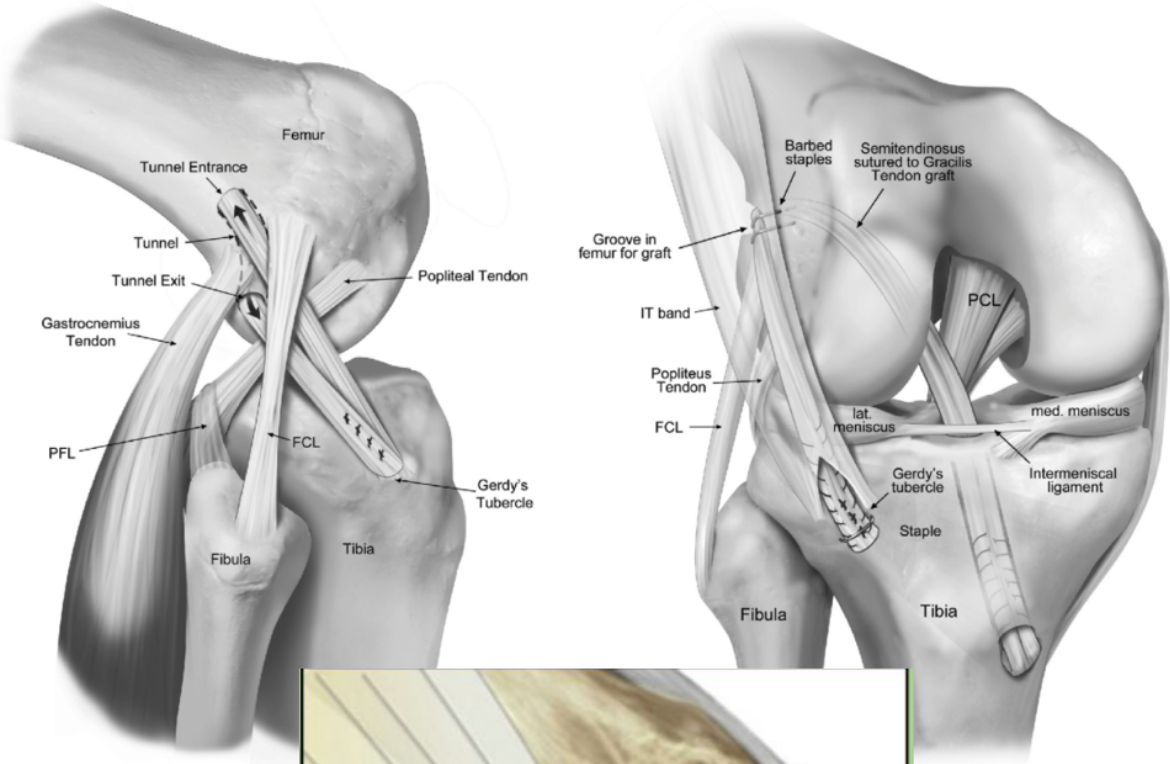
Adding lateral extraarticular tenodesis (LET) to ACLR improves anterolateral rotatory stability in biomechanical studies

LET reduces graft failure & residual instability in certain patient populations

Increasing interest in LET to improve ACLR outcomes in at-risk populations

Method for intraoperatively localizing the femoral fixation location for LET remains poorly defined

**A**

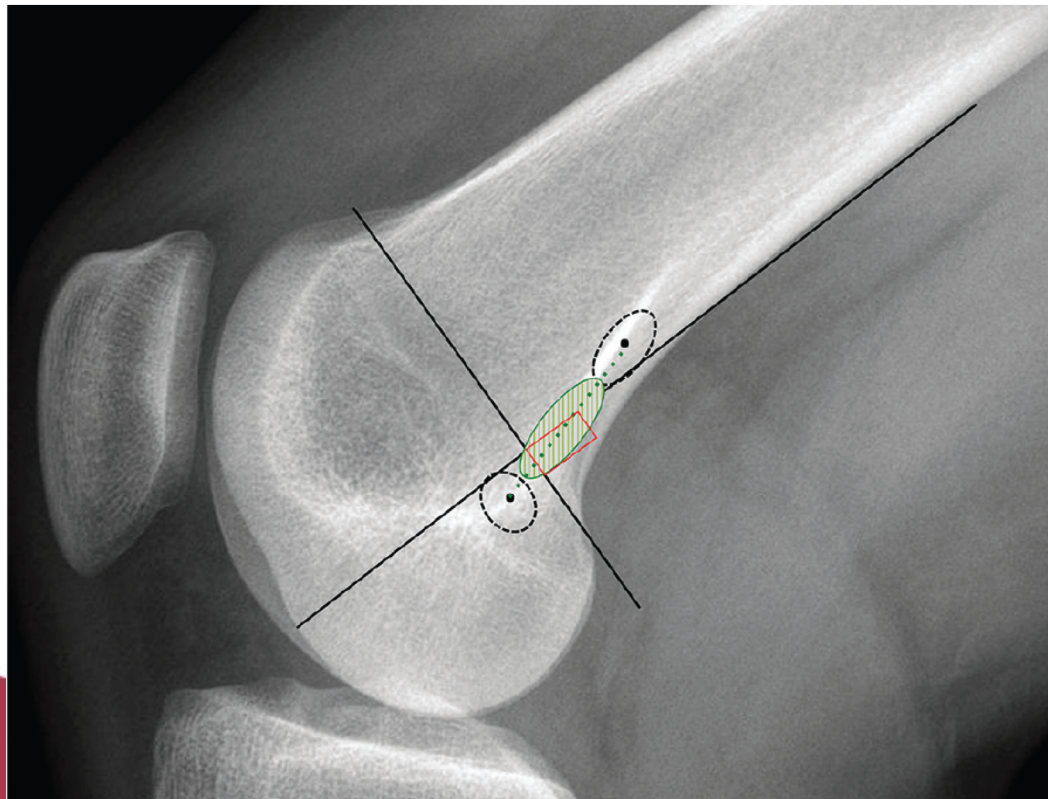


# Radiographic Landmarks for Femoral Tunnel Positioning in Lateral Extra-articular Tenodesis Procedures

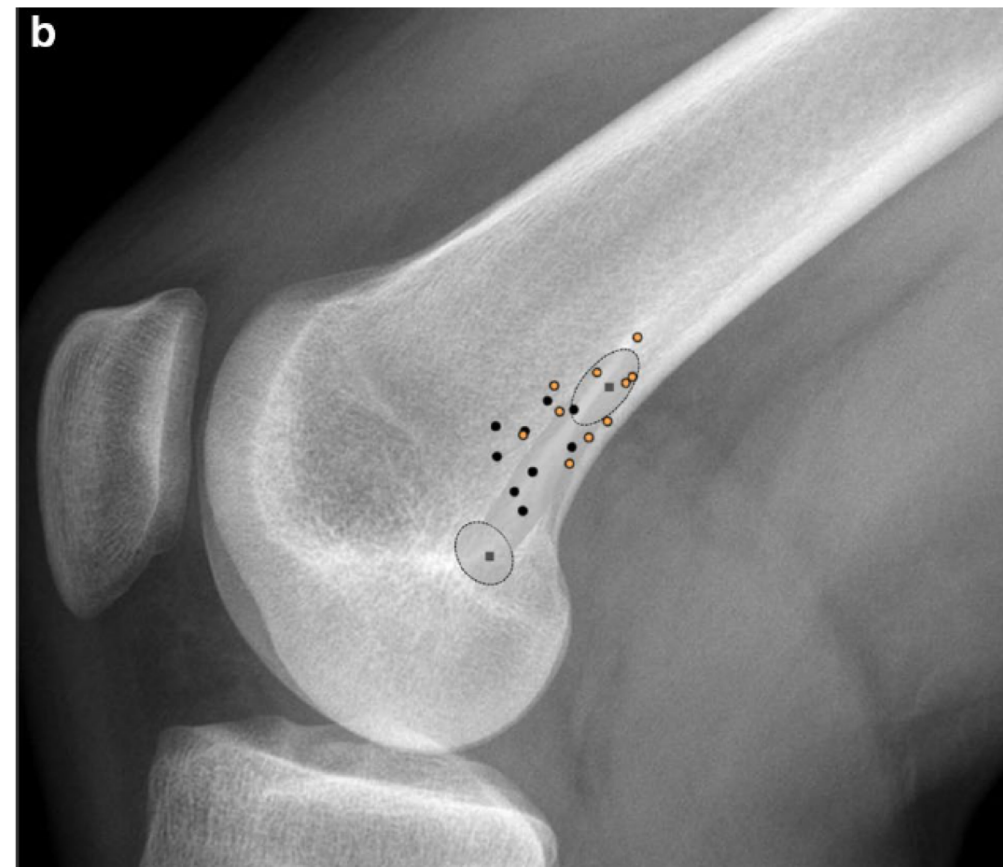
Vera Jaecker,\* MD, Jan-Hendrik Naendrup,\* BS, Thomas R. Pfeiffer,\* MD, Bertil Bouillon,\* MD, and Sven Shafizadeh,<sup>†‡</sup> MD  
*Investigation performed at Department of Trauma and Orthopaedic Surgery, Witten/Herdecke University, Cologne Merheim Medical Center, Cologne, Germany*

Tactile techniques are associated with a high variability of tunnel positions in lateral extra-articular tenodesis procedures

Vera Jaecker<sup>1</sup> · Sven Shafizadeh<sup>2</sup> · Jan-Hendrik Naendrup<sup>1</sup> · Philip Ibe<sup>3</sup> · Mirco Herbort<sup>4</sup> · Thomas R. Pfeiffer<sup>1</sup>



**Red box: Safe Isometric area**  
**Green ellipse: Isometric attachment area**



**High variability for both MacIntosh (orange) and Lemaire (black)**



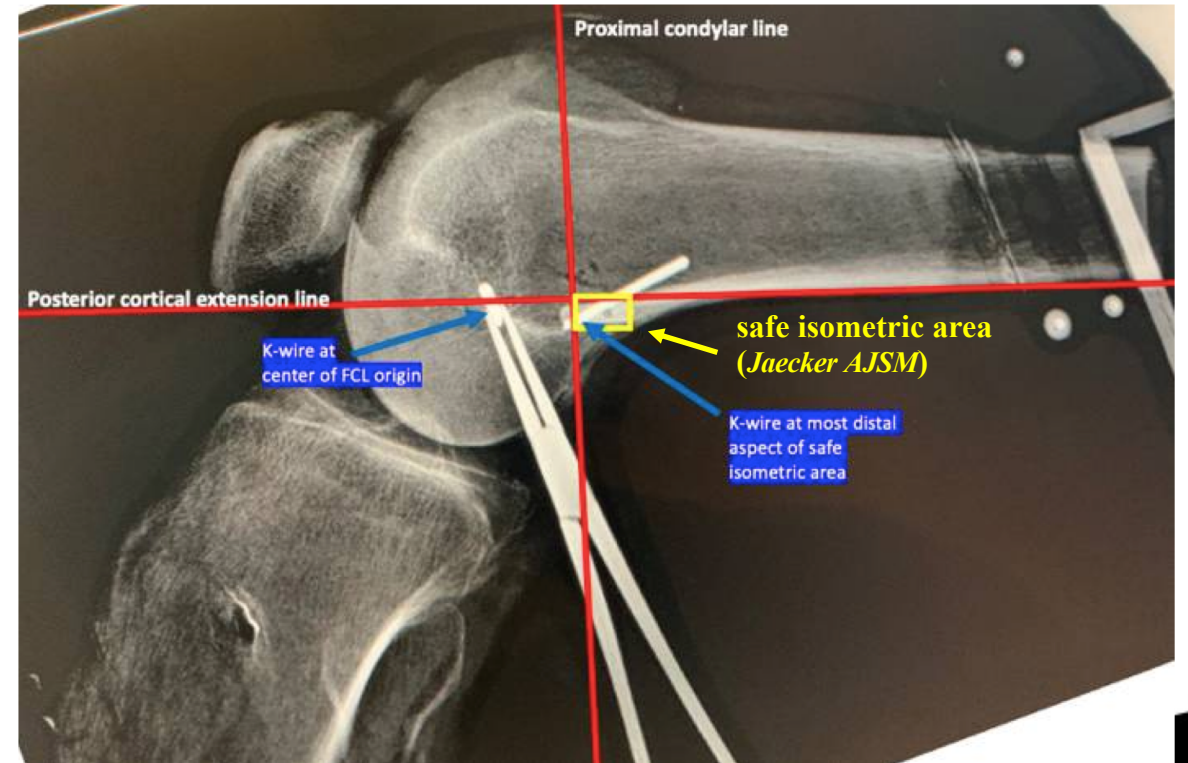
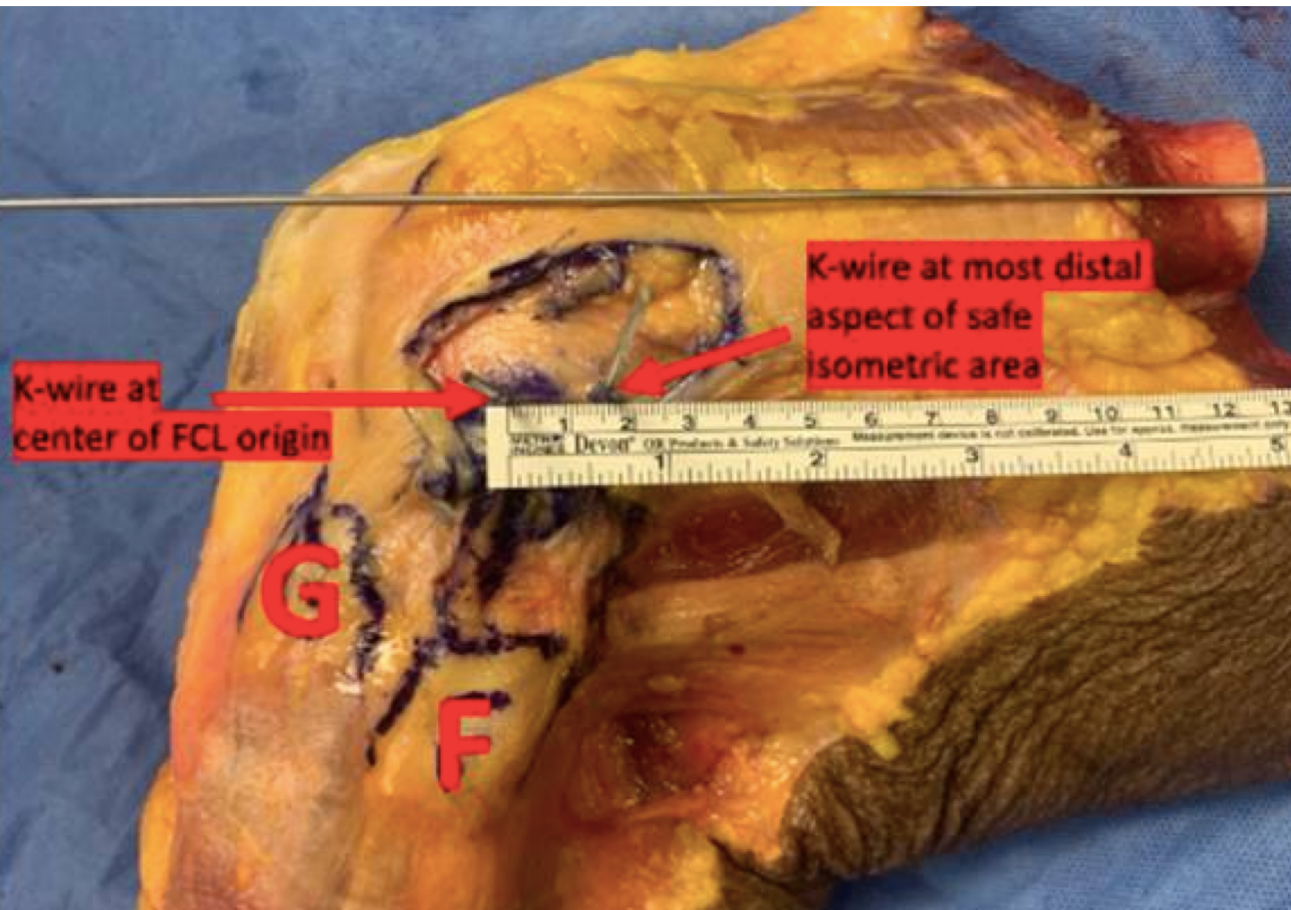
- ✓ Determine a reproducible method of placing femoral fixation for LET within a safe isometric area using anatomic landmarks **without intraoperative imaging**
- **Hypothesis:** Method that references central aspect of FCL femoral insertion consistently places the femoral attachment for LET within isometric area



# Methods – Pilot Specimen

1. Using pilot specimen, the center of the FCL femoral insertion identified and K-wire placed here
2. Endobutton approximating length of safe isometric area (SIA) placed 15mm directly proximal to FCL along long axis of the femur

3. Using fluoroscopy, center of the SIA for LET determined to be 20mm directly proximal to center of FCL femoral insertion

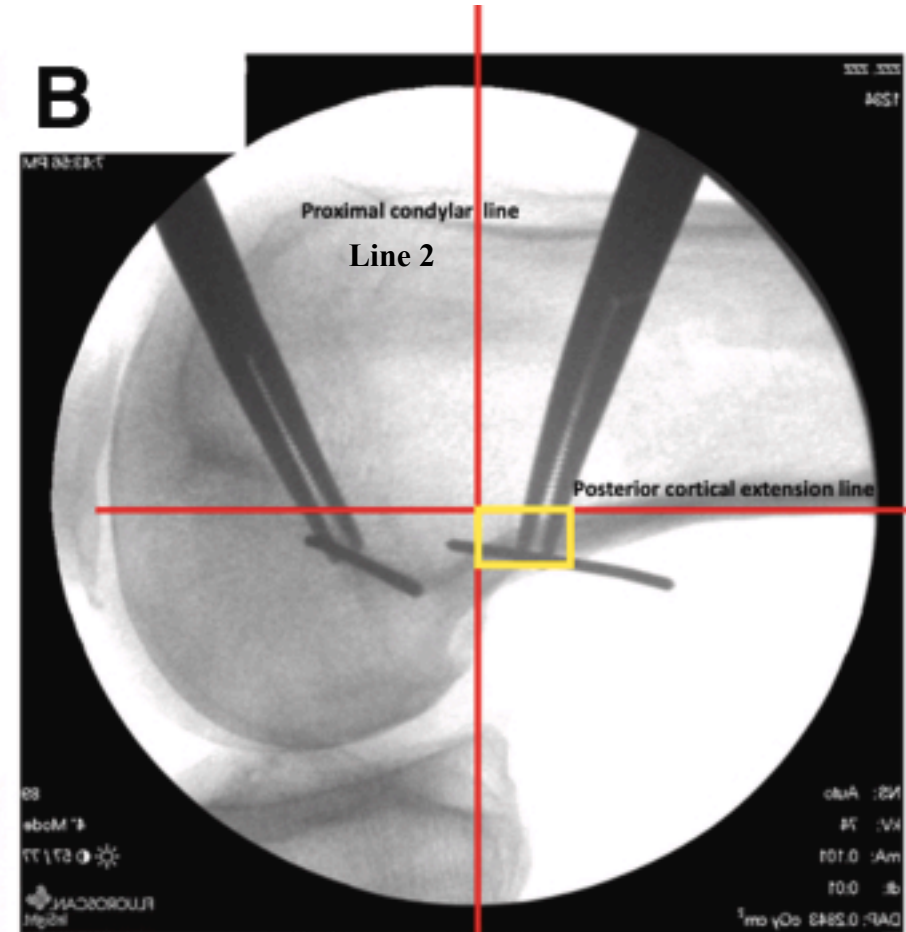
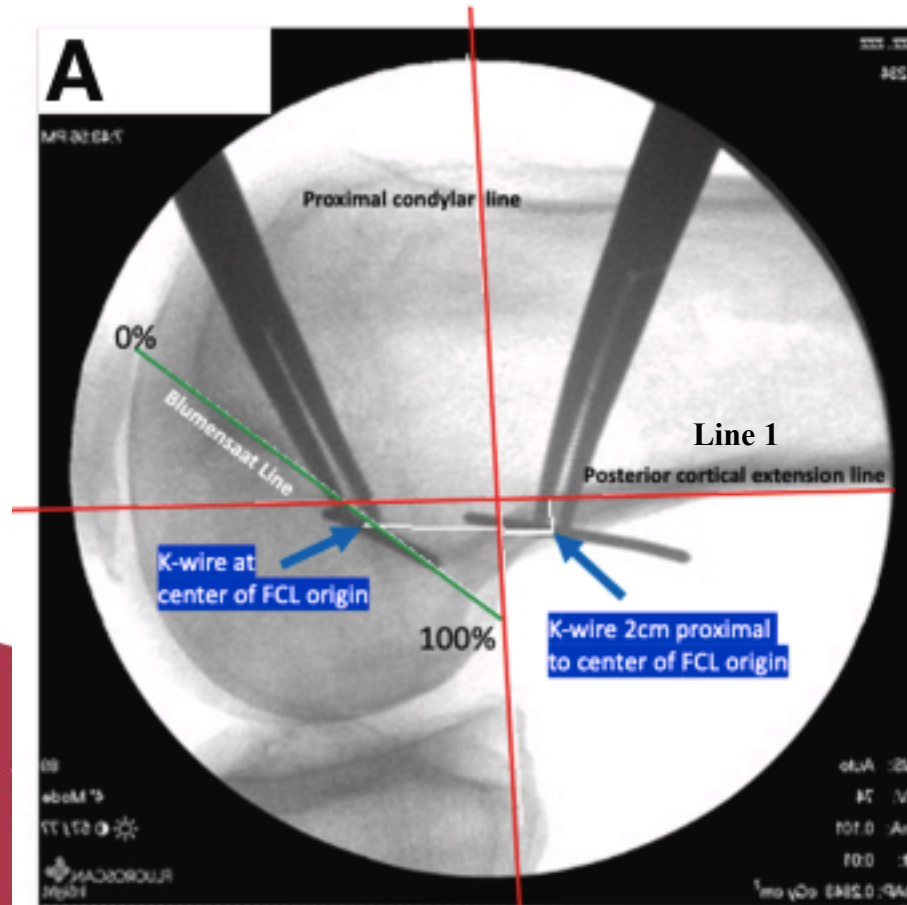




# Methods – Experimental Specimens

1. 10 additional cadaveric specimens: Center of FCL femoral insertion and a location 20 mm directly proximal were identified, marked with K-wires
2. On lateral fluoroscopic image, distance of proximal k-wire from posterior cortical extension line (line 1) and proximal condylar line (line 2) measured (A).

3. Accuracy determined by position of proximal k-wire relative to SIA indicated by the 1cm-long yellow box (B)
4. Inter- and intra-rater reliability was calculated using intraclass correlation coefficients (ICCs)



# Results

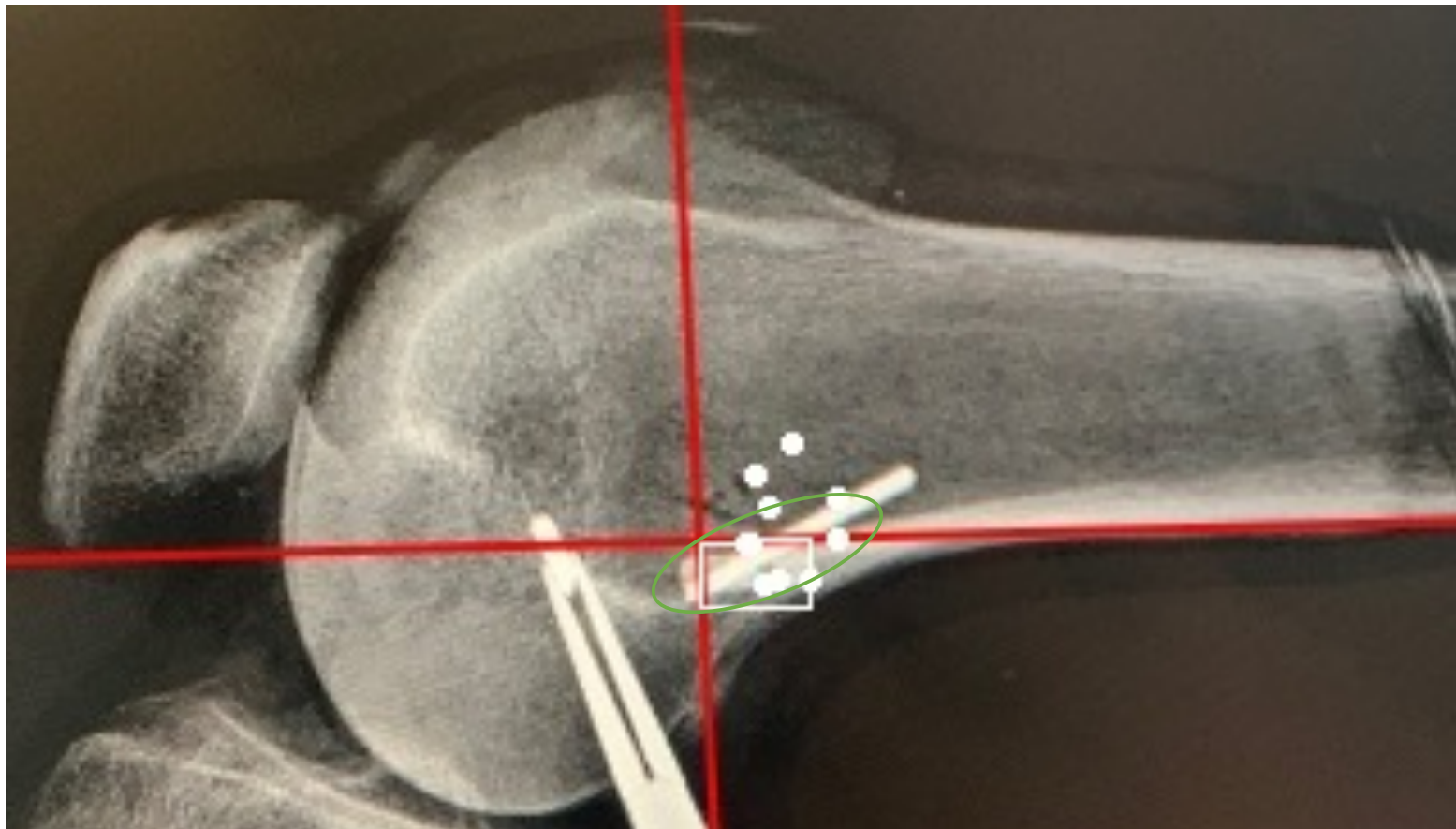
- Intra- and Inter-rater reliability was excellent for all measurements (ICCs > 0.908)
- In 50% of specimens, proximal k-wire was outside of SIA, with most errors **anterior** to posterior cortical extension line (PCEL)
- In 80% of specimens, proximal k-wire was within isometric attachment area

	Mean	Standard Deviation
Condylar Width (mm)	46.3	3.74
Distance of FCL Femoral Insertion along the Blumensaat Line (%)	56.7	9.3
Distance of FCL Femoral Insertion from the Blumensaat line (mm) <sup>^</sup>	1.76	2.68
<b>Distance from Posterior Cortical Extension Line (mm)* (Range -4.3– 9.6)</b>	<b>1.1</b>	<b>4.3</b>
<b>Distance from Proximal Condylar Line (mm)<sup>^</sup> (Range 1.4- 13.5)</b>	<b>7.5</b>	<b>3.1</b>

\*Positive value indicates anterior to the posterior cortical extension line

<sup>^</sup>Positive value indicates proximal to the metaphyseal flare/proximal condylar line

# Results



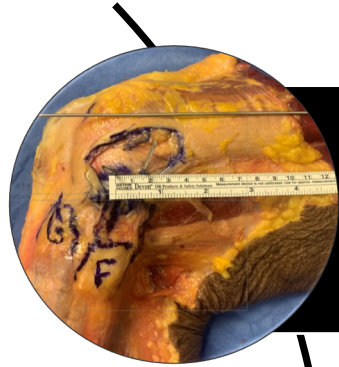
Green ellipse: Isometric attachment area (IAA)

White box: Safe isometric area

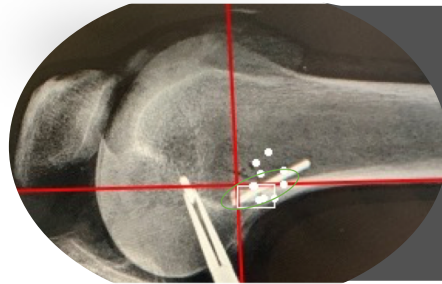
***5/10 specimens within safe isometric area***

***8/10 specimens within IAA***

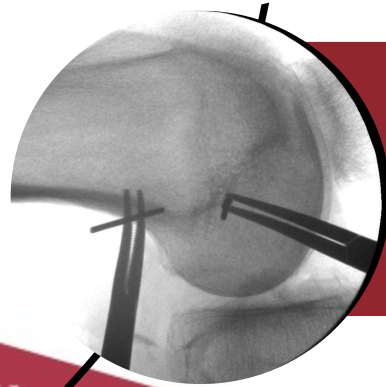
# Conclusion



A landmark-based technique referencing femoral FCL insertion **does not** reliably place femoral fixation site for LET within the safe isometric area, with ***MOST COMMON ERROR BEING EXCESSIVELY ANTERIOR***



However, 80% of specimens were within isometric attachment area for LET

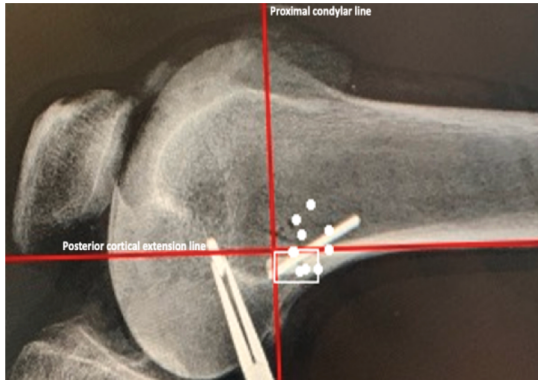


Ultimately, intraoperative fluoroscopy should be considered. If imaging will not be utilized, a location at or proximal to metaphyseal flare taking care to avoid an excessively anterior location should be utilized.



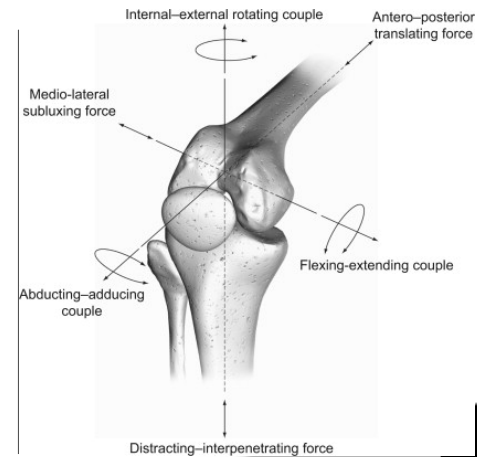


# Significance of Findings



These findings may help to decrease the likelihood of misplacement of femoral fixation during LET

May also help reduce inferior clinical outcomes related to femoral fixation misplacement, such as abnormal joint kinematics, graft elongation, or overconstraint of the knee



THANK  
YOU!

Questions?

Contact Camryn Petit, B.S., MD student

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