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# CORONAL ALIGNMENT PATTERNS IN PRIMARY ANTERIOR CRUCIATE LIGAMENT TEARS: THE INFLUENCE OF TIBIAL DOMINANCE FOR BOTH VARUS AND VALGUS ALIGNMENT

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# DISCLOSURES

I, Luke Tollefson, have no relevant disclosures.

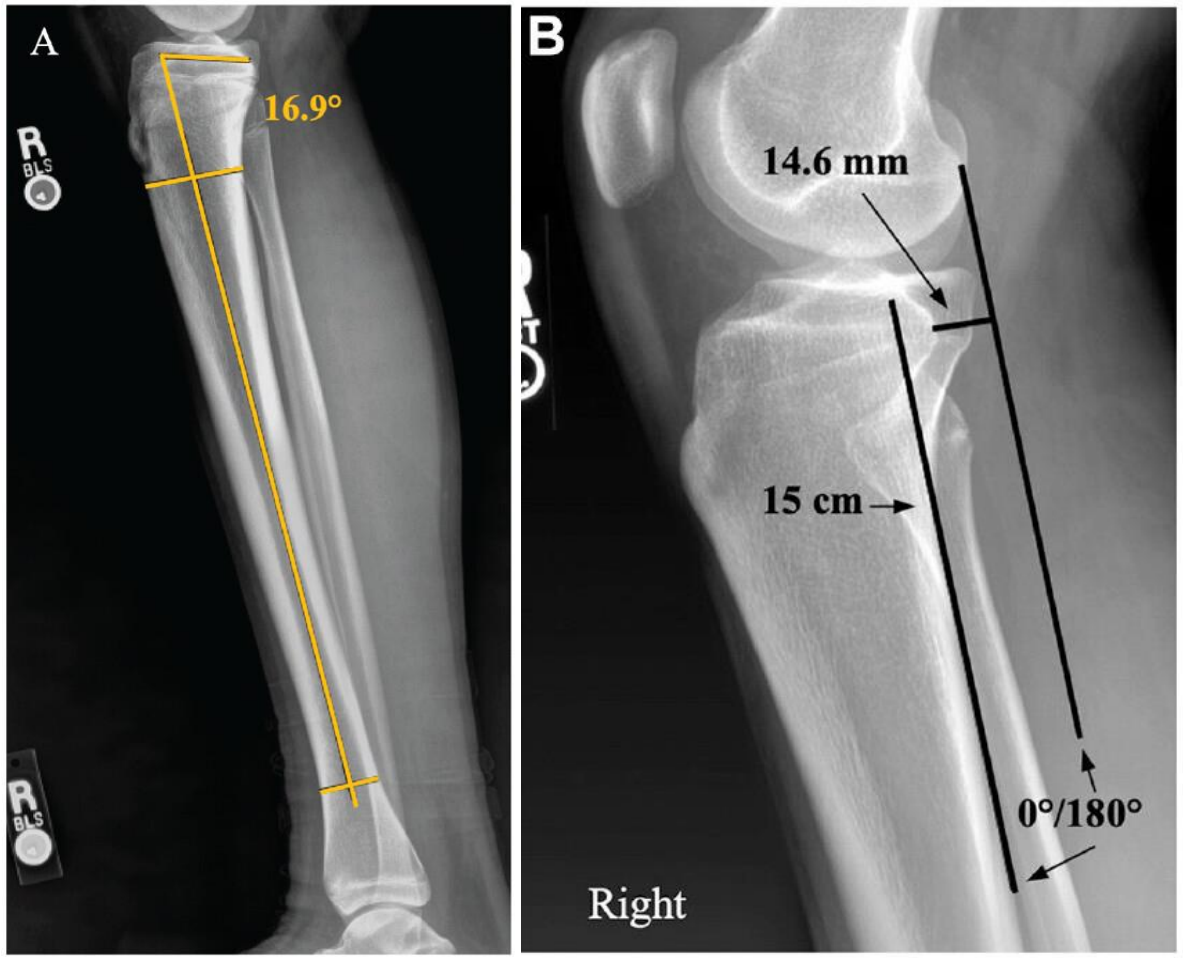
# BACKGROUND

Posterior tibial slope (sagittal alignment)

- Risk factor for ACL tears and ACLR failure
- Many studies cite slope >12° as cutoff
- Increased force on ACL/ACL graft
- Increases ATT

Varus or valgus alignment (coronal alignment)

- Risk factor for failure of:
  - Meniscus repairs
  - Collateral ligament reconstruction
- Not well understood for ACL tears




Correlation of Increased Lateral Tibial Slope With Baseline Tibial Position in Intact Knees and Side-to-Side Anterior Tibial Translation for Knees With ACL Tears

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# PURPOSE

**Primary Purpose:**

Evaluate primary ACL tear patients' overall coronal plane alignment, identifying individual mechanical femoral and tibial angles.

**Secondary Purpose:**

Determine if secondary concomitant injuries associated with ACL tears were related to overall or individual mechanical femoral and tibial alignment.

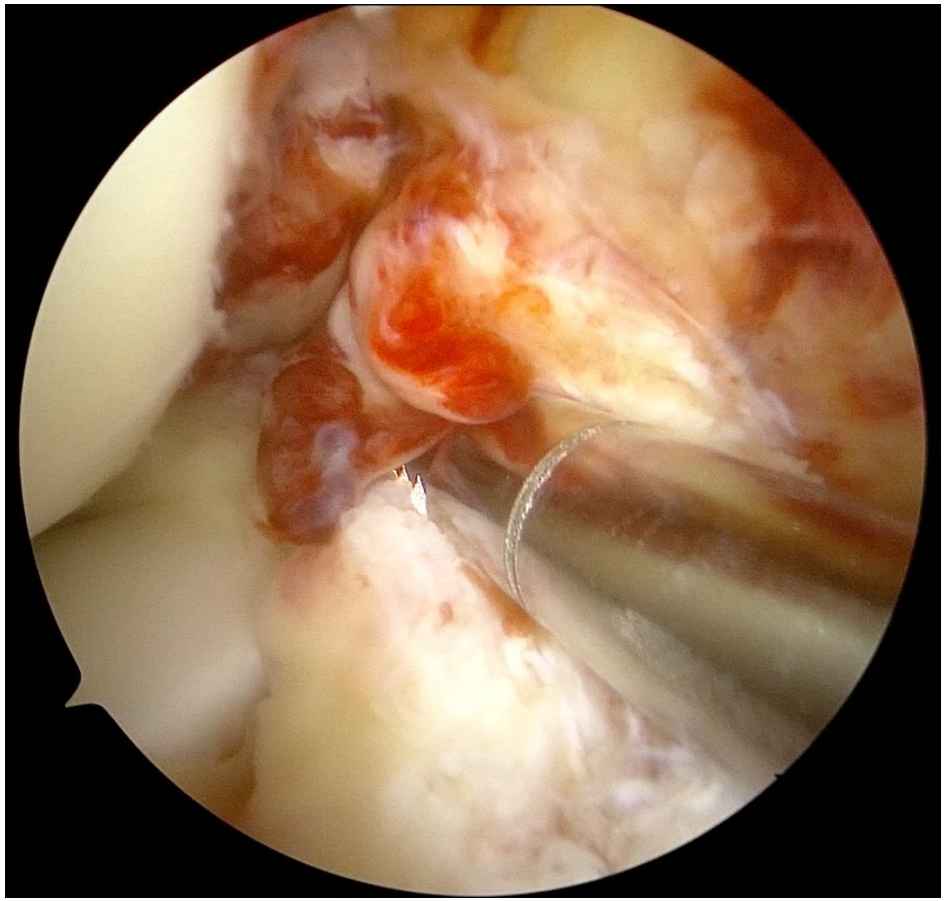
# METHODS

Consecutive patients with primary ACL tears between June 2019 and July 2024.

Patients were categorized based on coronal alignment.

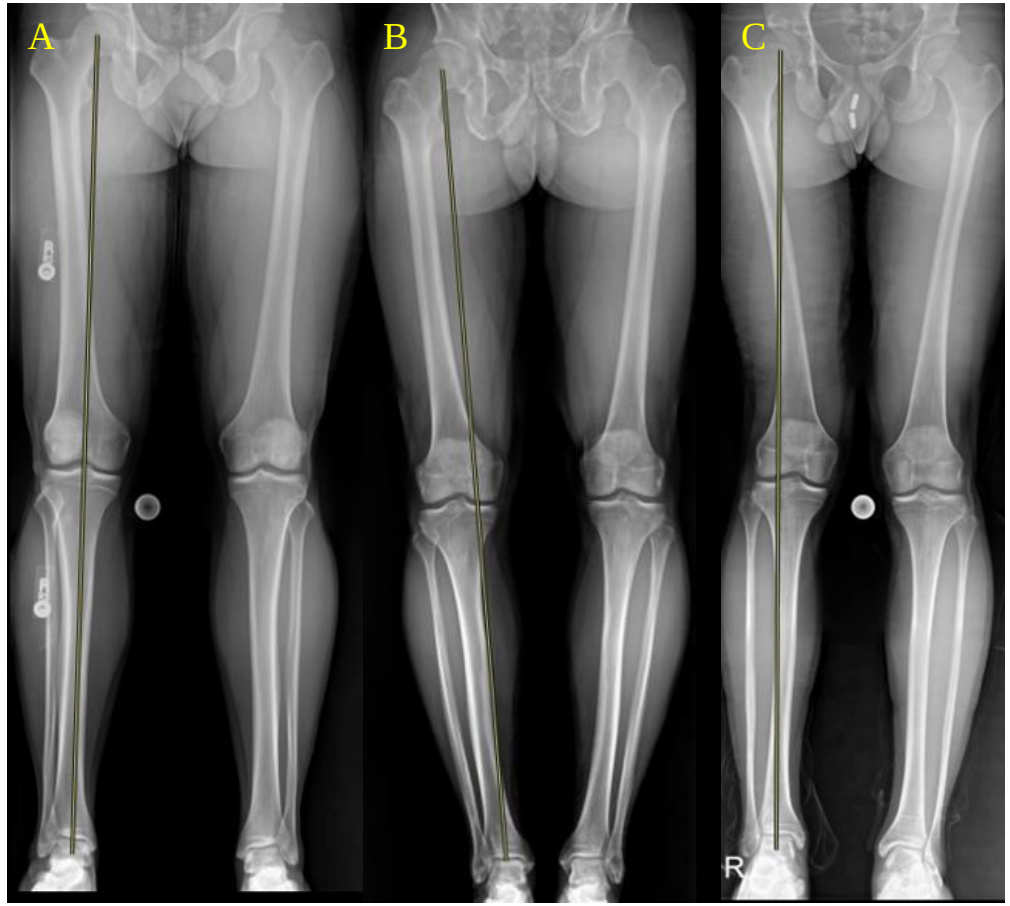
Posterior tibial slope and specific femoral and tibial coronal alignment were assessed.

Concomitant injuries were collected.



# MEASUREMENTS

## VARUS, VALGUS, NEUTRAL AND PTS




**Posterior Tibial Slope**

Angle between lateral tibial plateau and anatomic axis of tibia

Anatomic axis – center of tibia 5 cm and 15 cm below joint line


**Mechanical WB Axis**

A) Neutral – line between MTE and LTE
B) Varus – line medial to MTE
C) Valgus – line lateral to LTE

MTE: medial tibial eminence; LTE: lateral tibial eminence

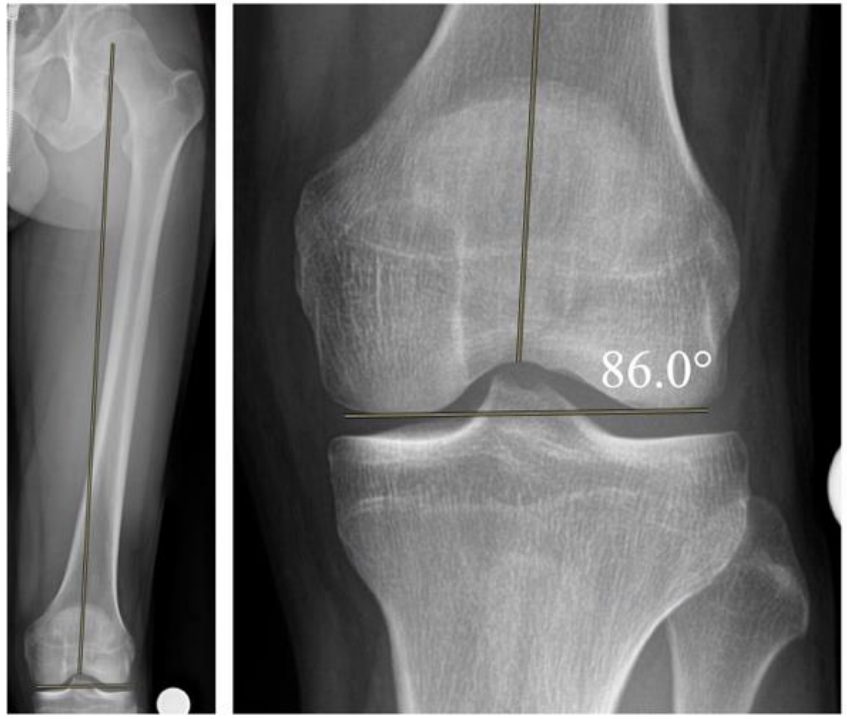


Luke V. Tollefson, BS

# MEASUREMENTS CONT.

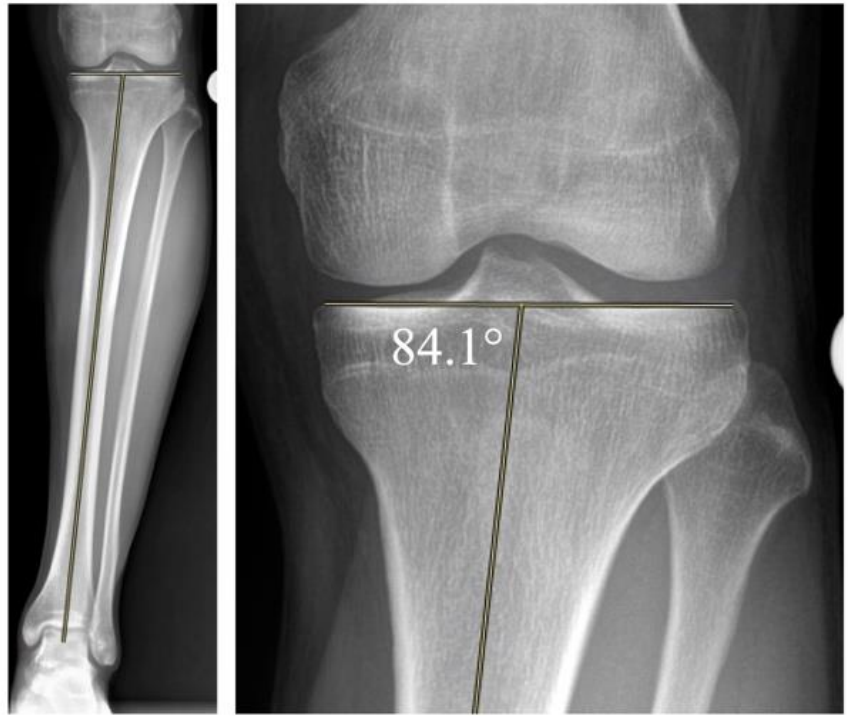
## MPTA, LDFA, and HKA

**Mechanical Lateral Distal Femoral Angle**




Anatomic axis of femur: Center of femoral head to center of notch

**Mechanical Medial Proximal Tibial Angle**




Anatomic axis of tibia: Midway between medial and lateral tibial eminences to center of tibiotalar joint

**HKA**


Angle between anatomic axis of femur and tibia



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# RESULTS
## DEMOGRAPHICS

250 total patients: 113 neutral, 77 varus, and 60 valgus patients

Significantly more females in valgus group, otherwise no differences in demographic data between cohorts

| Cohort | Age (Mean ± SD) | Sex (N Females, %) | BMI (Mean ± SD) |
|---|---|---|---|
| **All patients (N=250)** | 27.7 ± 13.5 | 116, (46.4%) | 25.3 ± 4.70 |
| **Neutral (N=113)** | 26.7 ± 12.7 | 51, (43.0%) | 25.4 ± 4.92 |
| **Varus (N=77)** | 28.7 ± 13.8 | 25, (32.5%) | 25.1 ± 4.56 |
| **Valgus (N=60)** | 28.2 ± 14.7 | 40, (66.7%)* | 25.3 ± 4.57 |
| **One-Way ANOVA P-Value** | 0.569 | <0.001 | 0.926 |

# RESULTS

Significant differences in LDFA, MPTA, and HKA between all cohorts

No significant difference in PTS between cohorts

Tibia (MPTA) contributed to overall alignment 1.81 times more that femur (LDFA)

| Cohort | All patients (N=250) | Neutral (N=113) | Varus (N=77) | Valgus (N=60) | One-Way ANOVA P-Value | Tukey's HSD P-Value < 0.05 |
|---|---|---|---|---|---|---|
| LDFA (°) | 86.3 ± 1.8 | 86.2 ± 1.4 | 87.3 ± 1.6 | 85.1 ± 1.6 | <0.001 | All cohorts |
| MPTA (°) | 87.4 ± 2.2 | 87.5 ± 1.7 | 85.5 ± 1.6 | 89.5 ± 1.8 | <0.001 | All cohorts |
| HKA (°) | 179.9 ± 2.9 | 180.2 ± 1.1 | 176.6 ± 1.6 | 183.6 ± 1.6 | <0.001 | All cohorts |
| PTS (°) | 11.1 ± 3.2 | 10.7 ± 3.1 | 11.3 ± 3.5 | 11.49 ± 3.3 | 0.224 | N/A |
| Slope ≥12 (N, %)) | 102, 40.8% | 39, 34.5% | 36, 46.8% | 27, 45.0% | 0.181 | N/A |

# RESULTS
## CONCOMITANT INJURIES

84.4% of patients had meniscus tears, 42.8% had ramp tears and 8.0% had ramp and LM root tears

No significant difference between cohorts for types of meniscus or ligament tears was found

| Cohort | Meniscal Injury | | | Vertical | | Root | | Radial | | Ramp | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | LM | MM | Multiple | LM | MM | LM | MM | LM | MM | Isolated | Ramp + LM Root |
| All patients (N=250) | 162, 64.8% | 148, 59.2% | 99, 39.6% | 52, 20.8% | 17, 6.8% | 48, 19.2% | 7, 2.8% | 54, 21.6% | 5, 2.0% | 107, 42.8% | 20, 8.0% |

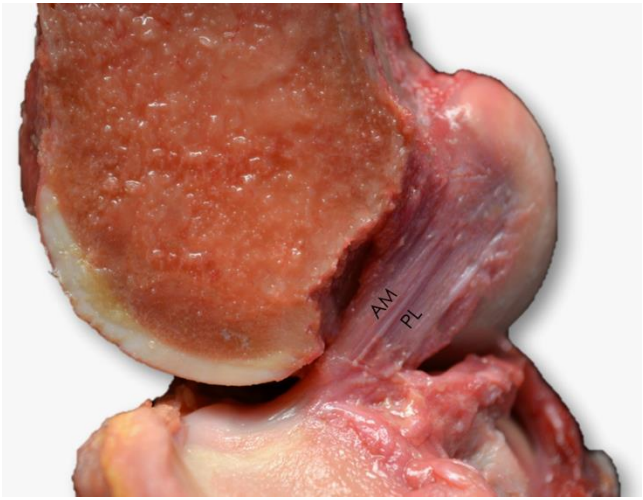
| Cohort | Concomitant ligament injury | Multiple concomitant ligament injuries | MCL/Medial side | FCL/PLC | PCL |
|---|---|---|---|---|---|
| All patients (N=250) | 103, 41.2% | 17, 6.8% | 33, 13.2% | 71, 28.4% | 12, 4.8% |

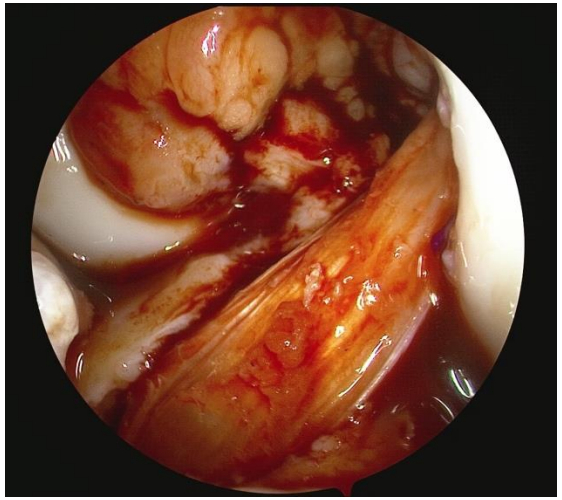
# CONCLUSIONS

The present study found overall varus and valgus alignment were influenced more by the tibia, or mMPTA, than by the femur.

Females exhibited significantly more overall valgus alignment than males, with the tibia being the primary determinant of the coronal valgus alignment.

Coronal alignment did not influence concomitant meniscal or ligament injuries.





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# THANK YOU

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