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# Risk Factors for Passive Anterior Tibial Subluxation on MRI in Complete ACL Tears

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# Faculty Disclosure Information

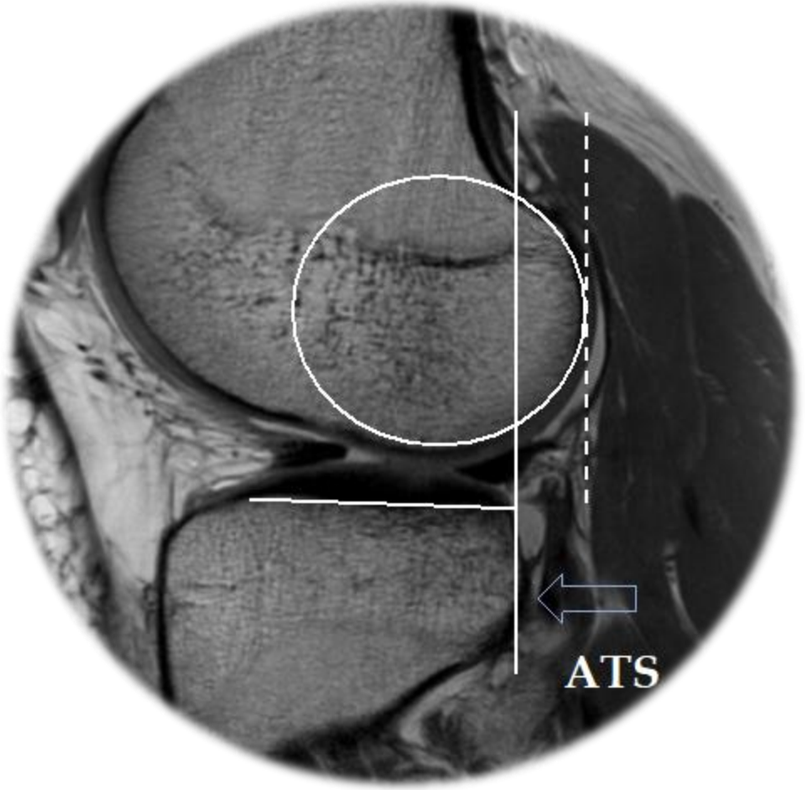
- The authors have no disclosures

# BACKGROUND

- Anterior Tibial Subluxation (ATS) following anterior cruciate ligament (ACL) injury highlights the altered relationship between the tibia and femur in patients with ACL insufficiency.

# CLINICAL RELEVANCE

- High preoperative ATS has been associated with:
  - Inferior postoperative stability
  - Poorer clinical outcomes
- Identifying predictors of ATS could improve pre-op risk stratification.



# PURPOSE

To assess the correlation between the degree of anterior tibial subluxation on MRI in complete ACL tears and:

- **Time from injury to MRI**
- **Demographics**
- **Tibial slope**
- **Associated lesions** ***(meniscal tears, chondral lesions, ALL injury)***

# METHODS

## Study design:

- Retrospective cohort study, Institutional registry
- **558** consecutive patients with complete ACL tears included

## Imaging Assessment:

- ATS of the medial and lateral compartments relative to the femoral condyles was measured on preoperative MRI according to Tanaka et al[6]
- Variables: Meniscal tears, Chondral lesions, ALL injury, Tibial slope (medial/lateral), Time from injury to MRI (Chronic ACL injury = MRI >3 months post-injury)

Linear regression analysis was performed for each variable to evaluate its association with ATS

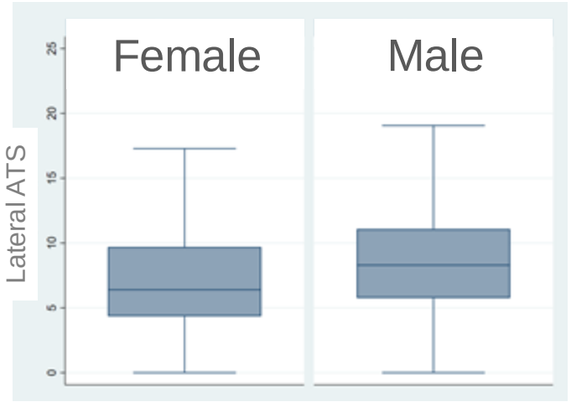
# RESULTS - Demographics & Injury Characteristics

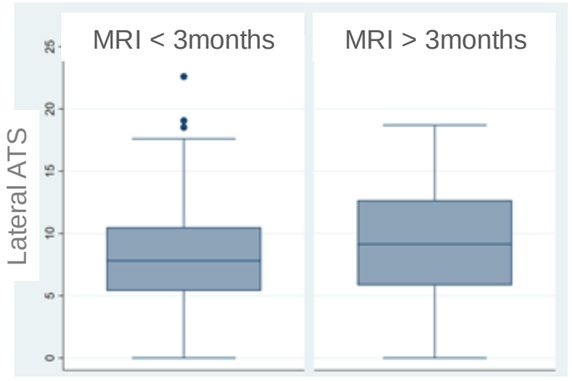
Demographic data and analyzed variables of the patients divided into three groups according to the degree of lateral ATS.

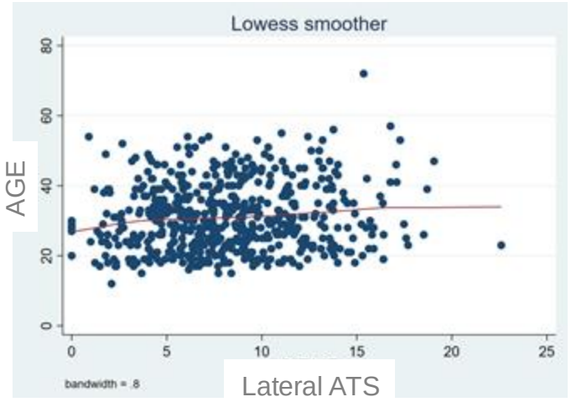
| | All | ATS lat ≤3.5mm | ATS lat 3.6 a 9.9mm | ATS lat ≥10mm | p value |
|---|---|---|---|---|---|
| n | 558 | 56 | 328 | 174 | |
| Age, (SD) | 31.0 (9.57) | 28.2 (9.58) | 30.8 (9.16) | 32.2 (10.1) | 0.022 |
| Sex male, (%) | 458 (82%) | 42 (75%) | 265 (81%) | 151 (87%) | 0.087 |
| Chronic ACL injury, (%) | 186 (33%) | 16 (29%) | 98 (30%) | 72 (41%) | 0.025 |
| ATS med, (SD) | 3.68 (2.33) | 2.40 (1.96) | 3.36 (2.00) | 4.69 (2.64) | <0.001 |
| ATS lat, (SD) | 8.26 (3.86) | 2.10 (1.00) | 6.89 (1.79) | 12.8 (2.19) | <0.001 |
| SLOPE medial, (SD) | 4.55 (2.83) | 4.63 (2.78) | 4.26 (2.66) | 5.05 (3.10) | 0.012 |
| SLOPE lateral, (SD) | 5.17 (3.10) | 5.49 (3.11) | 4.86 (2.87) | 5.64 (3.44) | 0.019 |
| Asociated Injuries: | | | | | |
| Cartilage, (%) | 110 (20%) | 14 (25%) | 64 (20%) | 32 (18%) | 0.552 |
| Meniscus, (%) | 279 (50%) | 23 (41%) | 149 (45%) | 107 (62%) | 0.001 |
| Medial Meniscus, (%) | 221 (40%) | 18 (32%) | 125 (38%) | 78 (45%) | 0.025 |
| Lateral Meniscus, (%) | 118 (21%) | 11 (20%) | 59 (18%) | 48 (28%) | 0.041 |
| Both Meniscus, (%) | 61 (11%) | 6 (11%) | 35 (11%) | 20 (12%) | 0.166 |
| Anterolateral ligament (%) | 140 (25%) | 16 (28%) | 82 (25%) | 40 (23%) | 0.923 |

# RESULTS - Significant Associations

- Chronic injuries: ↑ Lateral ATS (9.2 vs. 8 mm; p = 0.002)
- Male sex: ↑ Lateral ATS (8.4 vs. 7.4 mm; p = 0.024)
- Meniscal injury:
  - Medial: +0.84 mm, 95% CI 0.09-1.58
  - Lateral: +1.72 mm, 95% CI 1.72-2.28
- Age: +0.42 mm (95% CI 0.08, 0.75) per decade (*minimal clinical relevance*)

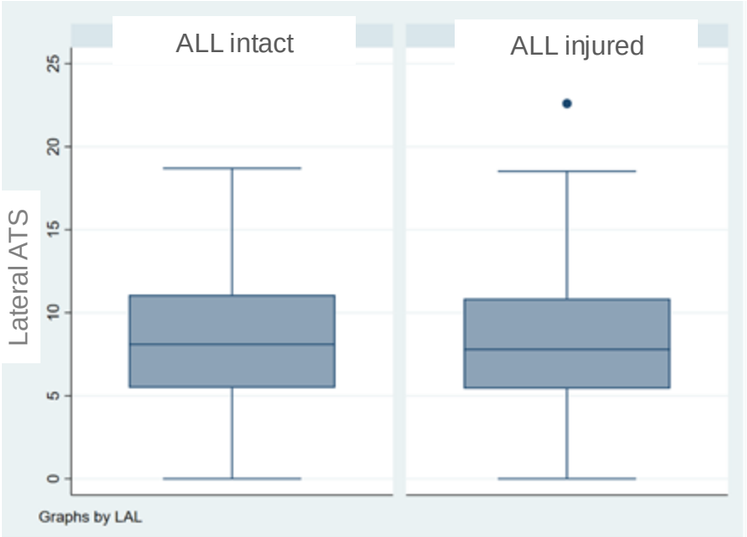


# RESULTS - Non-Significant Association

- Anterolateral ligament injury (p = 0.56)
- Tibial Slope*: While lateral tibial slope was not significantly associated with ATS, the medial tibial slope demonstrated a significant association of 0.15 mm (95% CI 0.04, 0.26), independent of sex and age.




** Possible methodological bias: the measurement protocol for ATS uses a line perpendicular to the tibial plateau as a reference, which may introduce deviation when analyzing the biomechanical relationship between tibial slope and ATS* [7]

# CONCLUSION

- Anterior tibial subluxation on MRI in cases of complete ACL rupture was significantly associated with male sex, MRI performed more than 3 months post-injury, and meniscal injuries.
- These findings may help identify high-risk patients preoperatively.

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