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Precision of Tibiofemoral Angle Assessment: A Comparative Analysis of Long Leg Radiographs and Magnetic Resonance Imaging

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The authors have nothing to disclose.

Introduction

- Tibiofemoral angle (TFA) reflects lower limb alignment
- Used in:
  - Pre-operative planning (e.g., HTO)
  - Post-op evaluation
  - Diagnosis of deformities (genu varum/valgum)
- Standard: Full-length standing radiograph (scanogram)
- MRI commonly used for soft tissue but done supine
- **Question:** Can MRI reliably replace scannogram for angular measurement?

Objectives

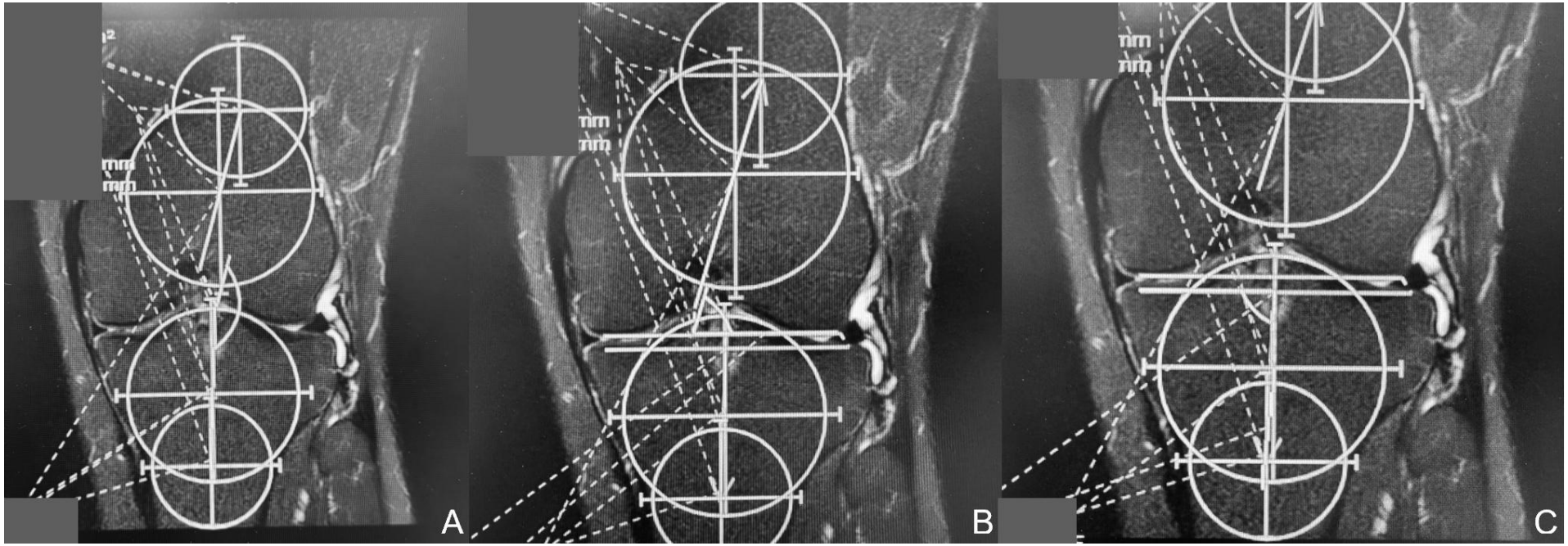
- **Primary Objective:**
  - Compare TFA between MRI and scanogram
- **Secondary Objectives:**
  - Compare
    - aLDFA - anatomical lateral distal femoral angle
    - aMPTA - anatomical medial proximal tibial angle
    - JLCA - joint line convergence angle
  - Assess intra- and interobserver reliability using ICC

Methods

- **Design:** Retrospective cohort
- **Subjects:**
  - Age 18–50 with both MRI and scanogram
  - Exclude deformity, fracture, advanced OA
- **Imaging Protocol:**
  - MRI: 1.5 Tesla, T2 coronal view, supine position
  - Scanogram: Standing full-length AP radiograph
- **Measurement:** Two orthopedic surgeons; repeated at 1 month

A long leg alignment radiograph of the left lower extremity

- (A) Anatomical axis of the femur was created by draw line between center of two perfect circle.
- (B) Tibiofemoral angle was measured between anatomical axis of femur and tibia.
- (C) Joint orientation lines of femur and tibia were created to measure joint line convergence angle(JLCA). Anatomical lateral distal femoral angle(aLDFA) was measured between anatomical axis and joint orientation line of femur.
- (D) Anatomical medial proximal tibial angle(aMPTA) was measured between anatomical axis and joint orientation line of tibia.



MRI images in T2 coronal views

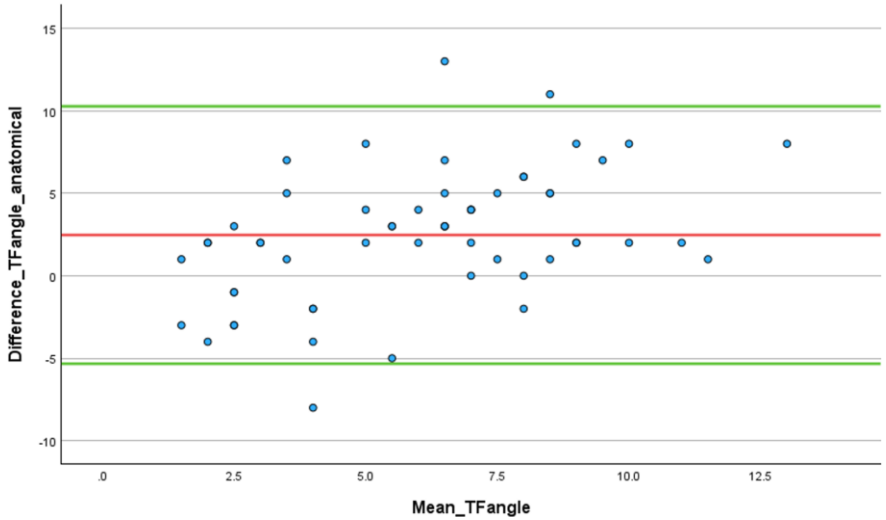
- (A) Anatomical axes of femur and tibia were drawn. TFA was measured between femoral and tibial anatomical axes.
- (B) JLCA was measured between joint orientation lines. The aLDFA was also measured between anatomical axis and joint orientation line of femur.
- (C) The aMPTA was measured between anatomical axis and joint orientation line of tibia.

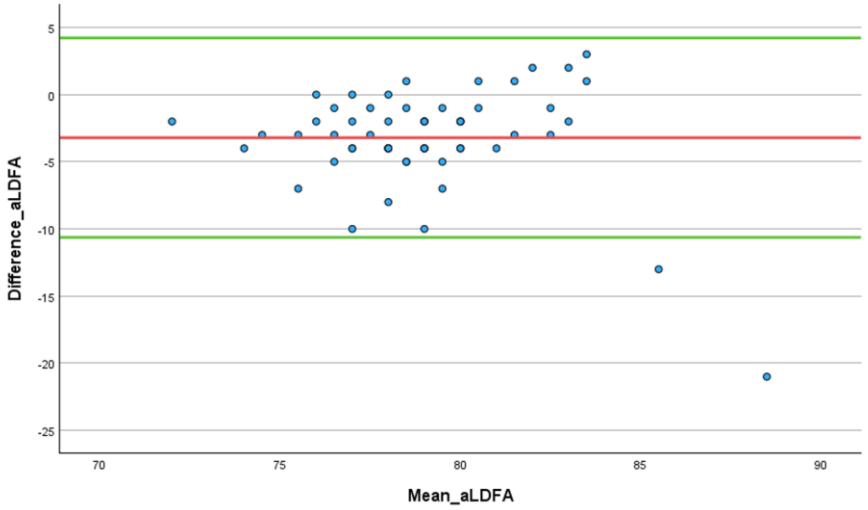
Results

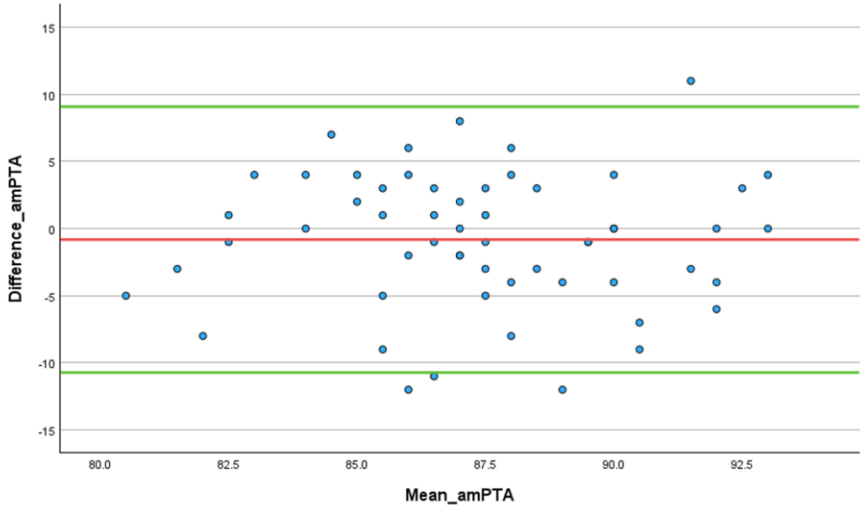
	MRI images	Scanogram	
	Mean ± SD	Mean ± SD	*P value*
Tibiofemoral angle (TFA) (degrees)	7.28±4.05	4.81±2.56	<0.001
Anatomical lateral distal femoral angle (aLDFA) (degrees)	77.40±3.08	80.61±3.69	<0.001
Anatomical medial proximal tibial angle (aMPTA) (degrees)	87.02±3.87	87.84±3.86	0.220
Joint line convergence angle (JLCA)	1.91±1.35	2.56±1.65	0.017

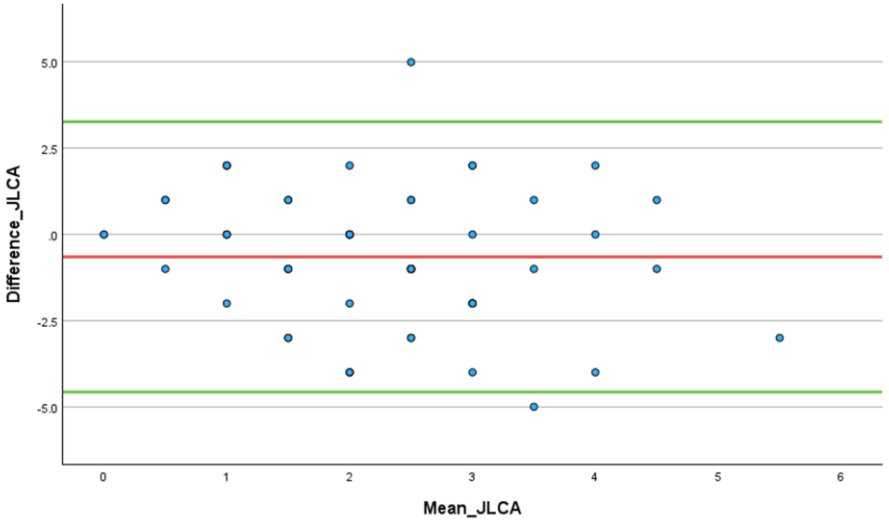
Intraclass correlation coefficient	MRI images		Scanogram	
	Intraobserver	**Interobserver**	**Intraobserver**	**Interobserver**
Tibiofemoral angle (TFA)	0.87	0.35	0.82	0.73
Anatomical lateral distal femoral angle (aLDFA)	0.77	0.34	0.79	0.28
Anatomical medial proximal tibial angle (aMPTA)	0.72	0.06	0.89	0.25
Joint line convergence angle (JLCA)	0.60	0.08	0.86	0.17

Bland-Altman plot of each measurement









Discussion

- MRI scans in supine = altered knee flexion/rotation
- Inadequate shaft visibility for axis drawing
- Results:
  - MRI overestimates TFA
  - Poor reproducibility on MRI, especially between observers
- Clinical implication:
  - MRI should not replace scanograms for deformity evaluation or surgical planning

Conclusion

- MRI and scanogram give significantly different TFA results
- MRI has poor reproducibility, especially between observers
- **Recommendation:** Continue using scanograms as the standard for alignment assessment
- Further studies needed with upright MRI or alternative protocols

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