



Background:

- Incidence of anterior cruciate ligament (ACL) injury and surgical reconstruction in the paediatric population has increased in recent decades¹⁻³.
- Early surgery is progressively more accepted as the preferred approach, because of the reported higher rates of secondary meniscal and chondral damage, and poorer functional results with non-operative treatment^{4,5}.
- Transphyseal techniques are commonly used, with rare reported major growth disturbances, but unclear incidence of subtler morphologic impacts, which may affect rerupture risks.

Purpose:

Compare mid-term postoperative knee morphology between the operated and contralateral knees.

Methods:

- Design:** Retrospective, matched within-subject case-control (Level III).
- Population:** Skeletally immature patients having undergone an arthroscopic anatomic single-bundle transphyseal ACL reconstruction (allograft ≈ 88 %).
- Imaging:** Weight-bearing EOS scans ≥ 9 mo post-op.
- Measurements:** α-angle, MPTS, mHKA, leg length (two fellow-trained surgeons; ICC ≥ 0.75).
- Analysis:** Wilcoxon signed-rank; α-angle sub-analyses by Tanner stage and sex.

Results:

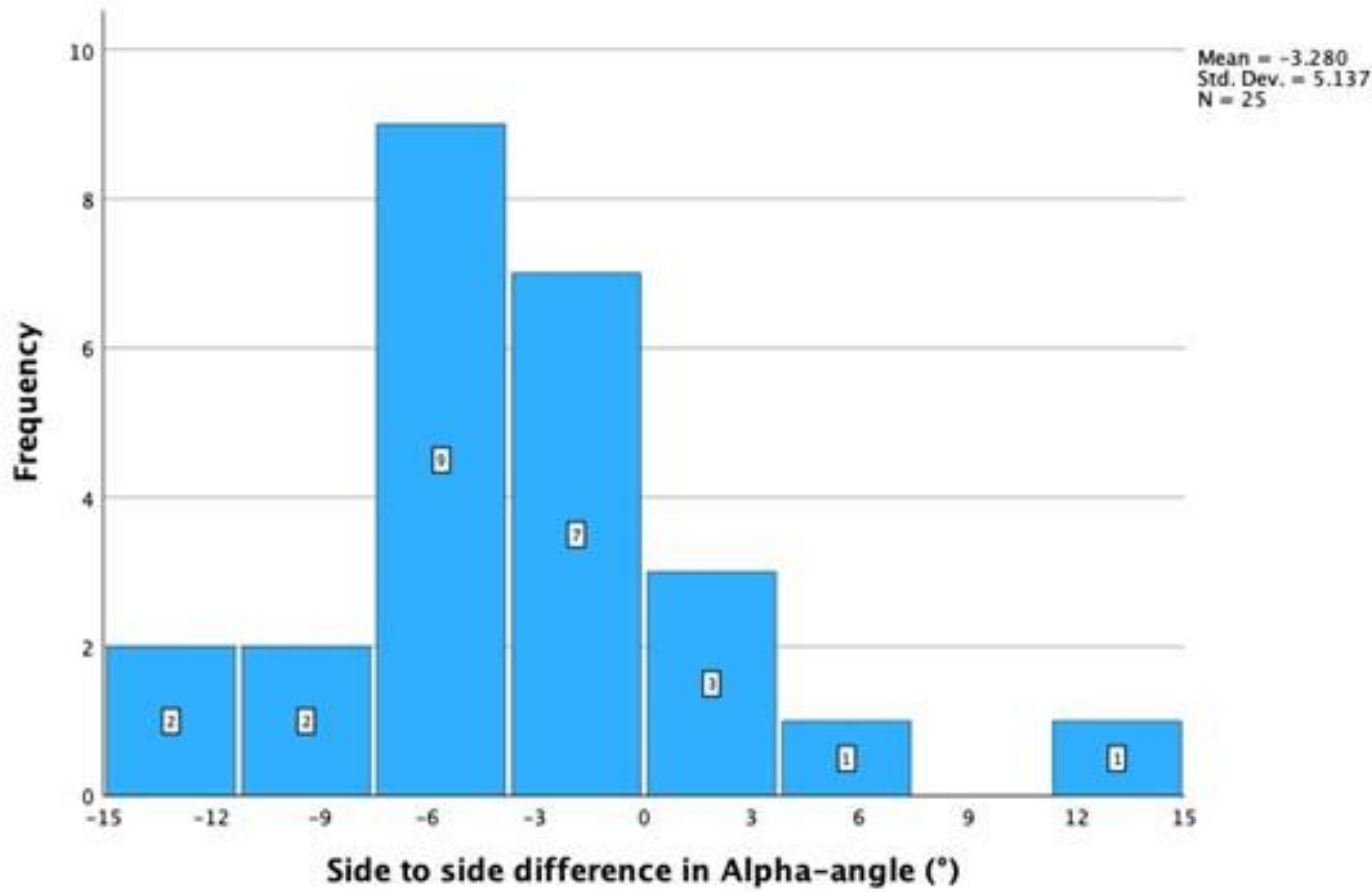
- 25 skeletally immature children
- 72 % male
- Mean age 11.8 y (range 8.3 to 15.0)
- Tanner 1 (52%), 2 (20%) and 3 (28%)
- Time to surgery: median 1.5 months (IQR = 1.7)
- Time from surgery to EOS: median 2.1 y (IQR = 3.4)

Table 1. Radiological Measures on the Surgical and Contralateral Limbs

	Operated Knee	Control Knee	Δ (Op – Ctrl)	p
α-angle (°), mean (SD)	36.6 (6.6)	39.9 (5.3)	-3.3 (1.7)	0.002*
Medial Posterior Tibial Slope (°), mean (SD)	9.1 (3.4)	9.5 (2.6)	-0.5 (0.9)	0.527
Coronal Alignment (°), median (IQR) **	-1.8 (-3.3 to -0.3)‡	-1.9 (-3.4 to -0.5)‡	-0.4 (0.7)	0.288
Leg Length (cm), mean (SD)	84.2 (7.6)	84.0 (7.3)	0.2 (2.1)	0.092

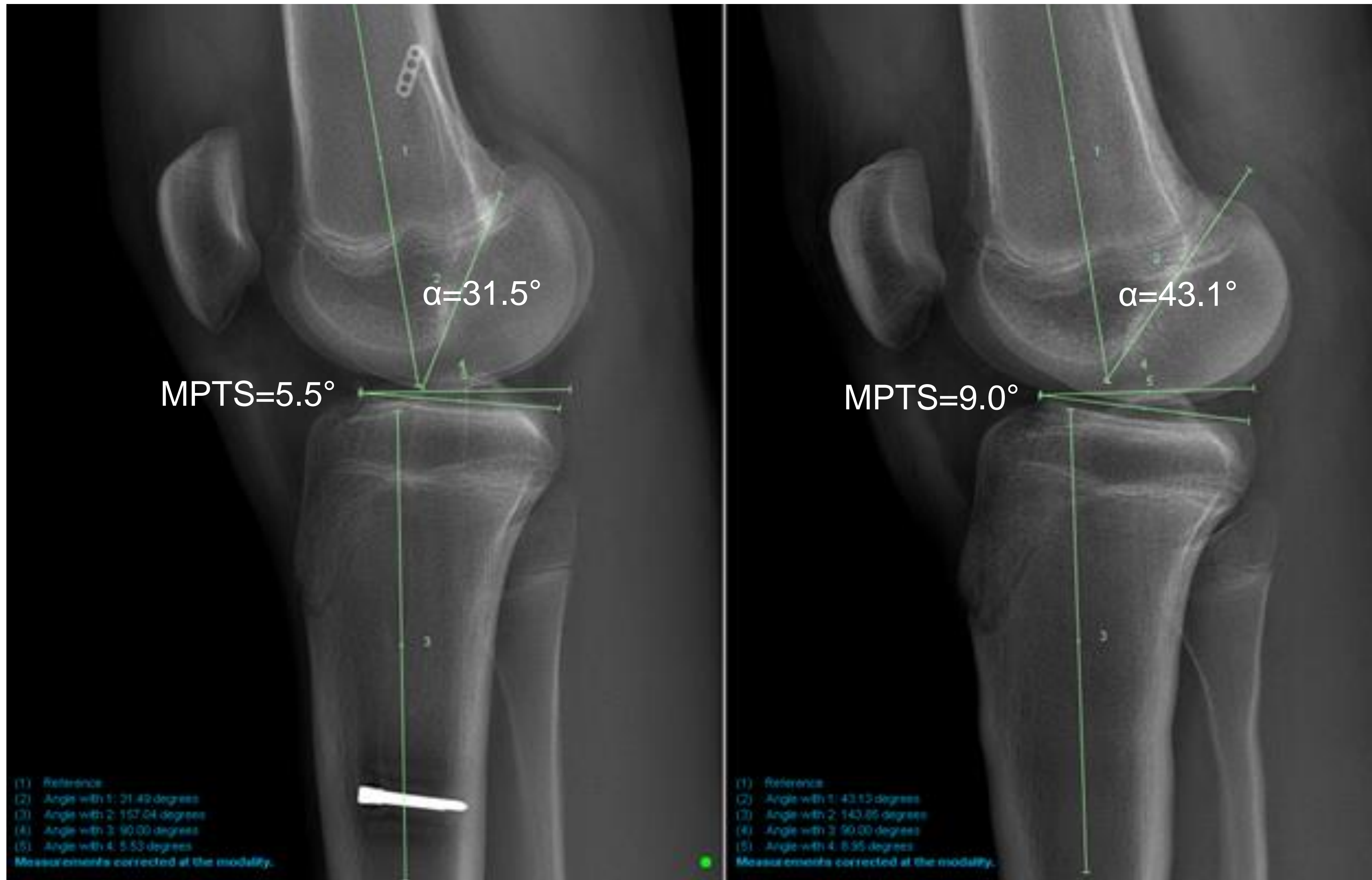
Legend: SD, Standard deviation; IQR, Interquartile range;
*Statistically significant
** negative value represents valgus alignment
‡Non-parametric variables
Since there was one non-parametric variable, all p-values were calculated with a Wilcoxon Signed Rank Test

Figure 1. Distribution of the Difference in α-angle Between Surgical Knees and Controls



- Sex effect:** Median Δα-angle male -5.0° vs female +0.6° (p = 0.009).
- Tanner effect:** Trend to larger Δα-angle in Tanner 1-2 (-4.9°) vs Tanner 3 (-0.5°), p = 0.074.
- Growth disturbance:** One (4 %) 10-year-old male with asymptomatic 5.4° coronal side-to-side difference in alignment (mHKA); no corrective surgery required.

Figure 2. 9-Year-Old Male Case



Conclusion

- Transphyseal ACLR produces a 3 to 4° verticalization of Blumensaat's line (smaller α-angle) after close to 2 years.
- Tibial slope, coronal alignment, and limb length remain statistically unchanged.
- Greater notch-roof change in boys, suggests residual growth modulates remodeling.
- The observed α-angle change equals the magnitude previously linked to lower ACL-injury risk.
- Long-term radiological surveillance during growth remains warranted.

References:

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