



The Lateral Femoral Notch Sign Decreases in Pediatric Patients Following Anterior Cruciate Ligament Reconstruction

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NO RELEVANT DISCLOSURES

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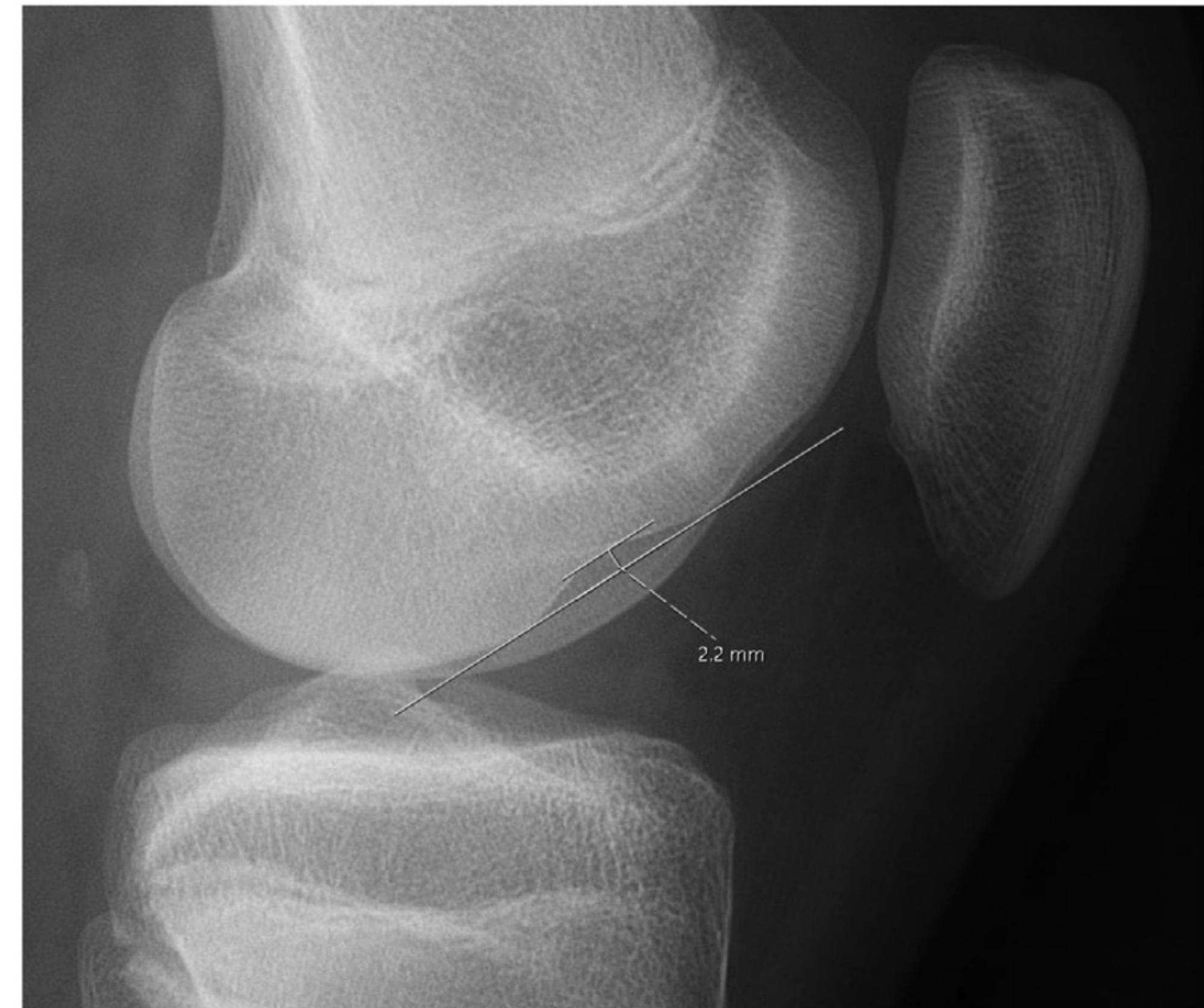
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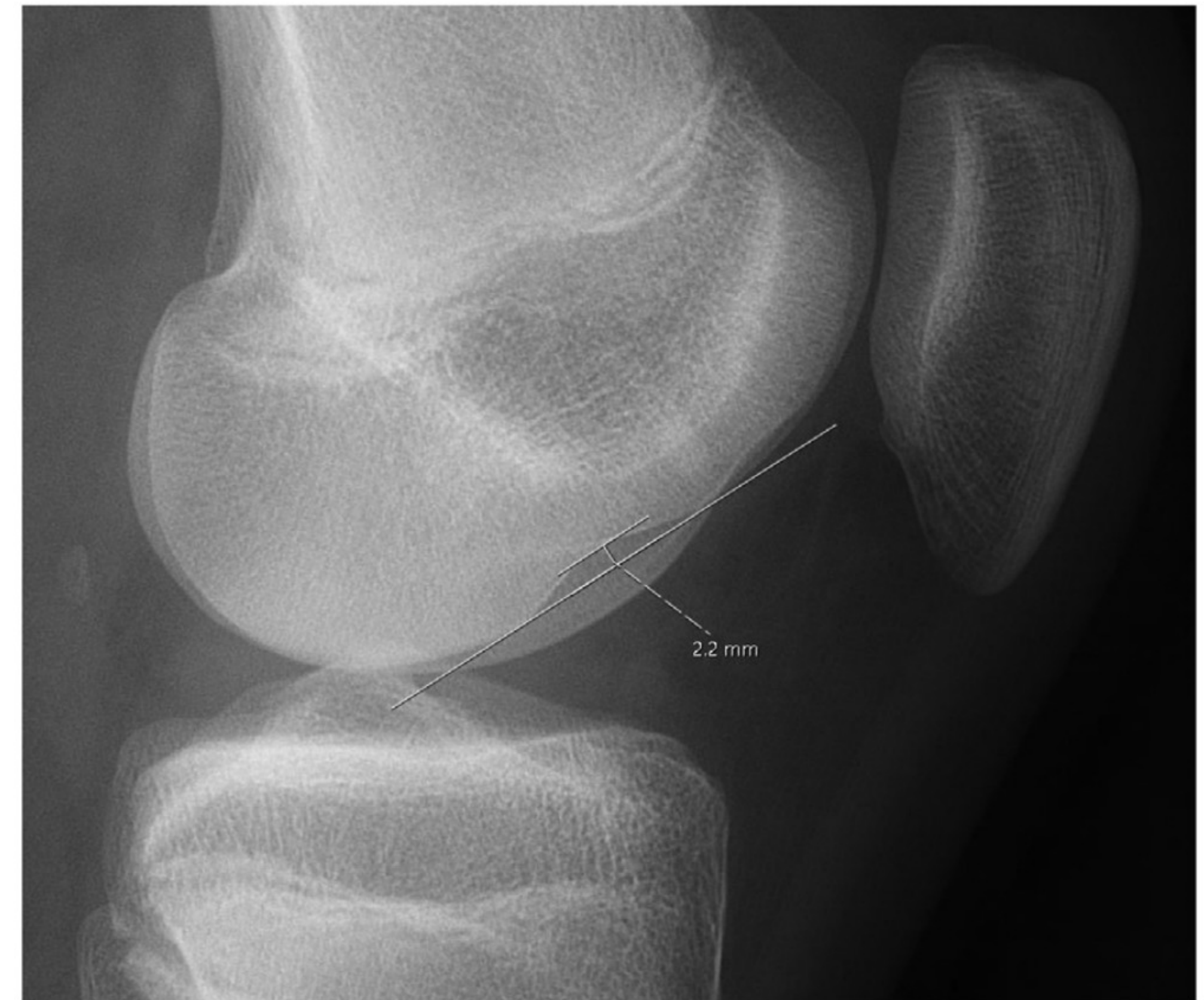
Objectives

- While MRI is typically used to confirm anterior cruciate ligament (ACL) rupture, certain radiologic findings can be indicative of an ACL tear
- A lateral femoral notch sign (LFNS) greater than 1.5 millimeters (mm) is one of these radiologic findings
- No study has focused on understanding the healing pattern of the LFNS in pediatric patients following ACL reconstruction (ACLR)



Aim

- Determine whether the depth of the LFNS regresses following ACLR
- **Hypothesis:** Following ACLR, the LFNS will decrease



- Retrospective chart review of CPT code 29888 for ACLR for patients between 5-18 years old
- 321 subjects were identified
 - Excluded:
 - Previous ipsilateral knee surgeries
 - Underwent primary ACL repair rather than reconstruction
 - No pre-operative lateral knee radiograph
 - 274 patients were included in the final analysis
 - LFNS was measured on pre-operative (PreOp) and most recent post-operative (PostOp) radiographs
 - A comparison cohort of 13 patients with a LFNS less than 1.5 mm matched by age within 1.5 years, sex, and laterality was also collected

- 274 PreOp radiographs were analyzed for a LFNS depth greater than 1.5 mm
- 17 (5.8%) radiographs met these criteria
 - Median depth = 1.7 mm
- Median LFNS depth at most recent follow up= 1.5 mm
- Median percent decrease = 28%

Table 1
Demographic information on patients with LFNS > 1.5 mm.

Demographic	Number	Percent
Total Number	17	100%
Sex:		
Male	8	47.1%
Female	9	52.9%
Race:		
White	11	64.7%
Black/African American	2	11.8%
Asian	2	11.8%
Native Hawaiian/Pacific Islander	1	5.9%
Unknown/Did Not Respond	1	5.9%
Ethnicity:		
Hispanic	2	11.8%
Non-Hispanic	14	82.4%
Unknown/did not respond	1	5.9%
Laterality:		
Right	7	41.2%
Left	10	58.8%

- Only 2/17 (11.8%) patients demonstrated no change in LFNS depth from PreOp to PostOp imaging
- Wilcoxon Signed-Rank test indicated that the PreOp LFNS was significantly greater than the PostOp LFNS ($p < 0.001$)
- Mann Whitney U tests with cases and the comparison cohort demonstrated no difference in the percent decrease ($p = 0.11$)

Table 2

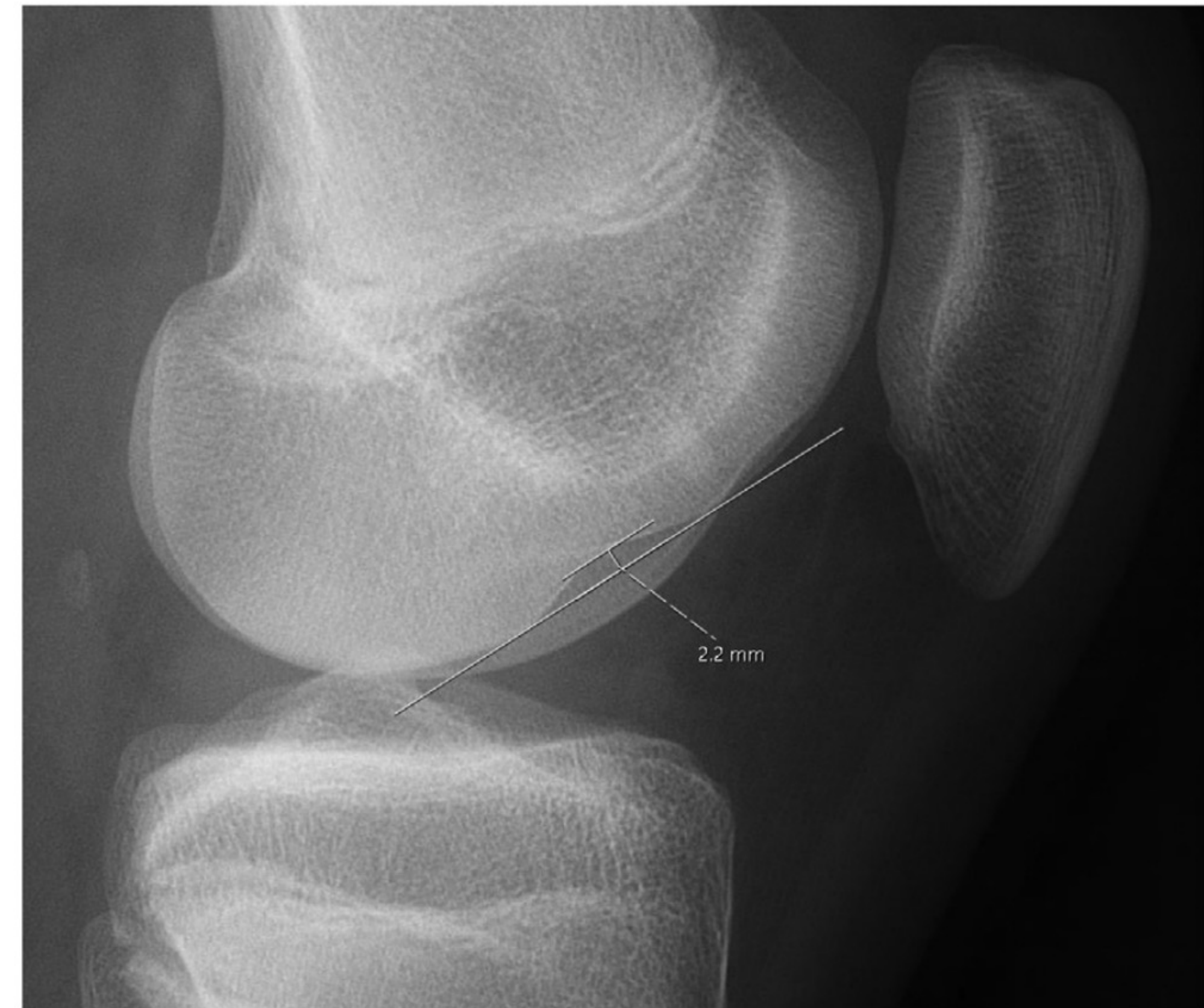
Cases versus comparison cohort with Mann–Whitney U test p values.

Variable	Cases	Comparison Cohort	P-value
Total	13	13	
Sex			
Male	6	6	
Female	7	7	
Laterality			
Right	5	5	
Left	8	8	
Age	16.3 (14.8–16.8)	15.7 (14.5–16.2)	0.186
Preop LFNS (mm)	1.70 (1.50–2.10)	0.69 (0.20–0.86)	<0.001*
Postop LFNS (mm)	1.50 (1.00–1.65)	0.48 (0.075–0.89)	<0.001*
Time between Radiographs	7.7 (1.9–19.2)	9.7 (1.5–19.6)	0.96
Depth Difference (mm)	0.60 (0.20–0.70)	0.00 (–0.02–0.20)	0.001*
Percent Decrease (%)	28.0 (11.4–42.0)	10.0 (–7.5–31.8)	0.106

Values are represented as medians (IQR). Statistically significant values are represented with a *.

Conclusion

- Sought to understand the resolution of the LFNS depth following initial ACL rupture
- At a median of 7.7 months following ACLR, the LFNS depth decreased significantly by 0.6 mm
- Suggests that following ACL rupture, the pediatric LFNS has the potential to heal
- Future studies should aim to further assess the healing pattern of the LFNS with advanced imaging, such as MRI





The lateral femoral notch sign decreases in paediatric patients following anterior cruciate ligament reconstruction

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Thank you!



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References

- Herbst E, Hoser C, Tecklenburg K, et al. The lateral femoral notch sign following ACL injury: frequency, morphology and relation to meniscal injury and sports activity. *Knee Surgery, Sport Traumatol Arthrosc.* 2015;23(8):2250-2258. doi:10.1007/s00167-014-3022-5
- Dimitriou D, Reimond M, Foesel A, et al. The deep lateral femoral notch sign: a reliable diagnostic tool in identifying a concomitant anterior cruciate and anterolateral ligament injury. *Knee Surgery, Sport Traumatol Arthrosc.* 2021;29(6):1968-1976. doi:10.1007/s00167-020-06278-w
- Lodewijks PCAM, Delawi D, Bollen TL, Dijkhuis GR, Wolterbeek N, Zijl JAC. The lateral femoral notch sign: a reliable diagnostic measurement in acute anterior cruciate ligament injury. *Knee Surgery, Sport Traumatol Arthrosc.* 2019;27(2):659-664. doi:10.1007/s00167-018-5214-x
- Lucidi GA, Grassi A, Di Paolo S, et al. The Lateral Femoral Notch Sign Is Correlated With Increased Rotatory Laxity After Anterior Cruciate Ligament Injury: Pivot Shift Quantification With A Surgical Navigation System. *Am J Sports Med.* 2021;49(3):649-655. doi:10.1177/0363546520982002
- Grimberg A, Shirazian H, Torshizy H, Smitaman E, Chang EY, Resnick DL. Deep lateral notch sign and double notch sign in complete tears of the anterior cruciate ligament: MR imaging evaluation. *Skeletal Radiol.* 2015;44(3):385-391. doi:10.1007/s00256-014-2056-6