Pediatric ACL Reconstruction: Does the Femoral PEEK Implant Cause Tunnel Widening?

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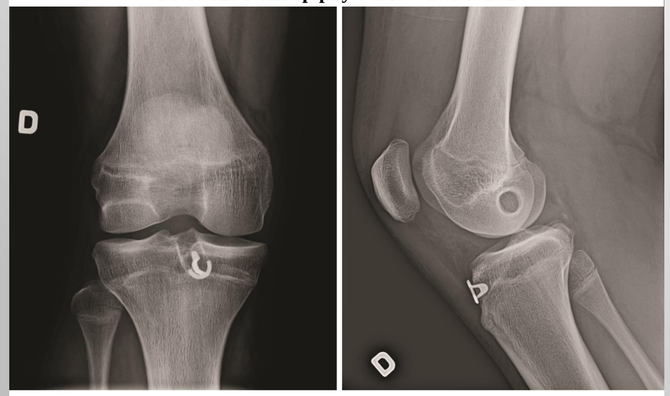
OBJECTIVES

1) Investigate the use of a femoral PEEK implant in ACLR performed on skeletally immature patients and to determine if it is associated with tunnel widening.
2) Assess the risk of growth complications associated with the use of PEEK.

FIGURE 1. All-epiphyseal reconstruction



ANTERO POSTERIOR LATERAL

CONCLUSIONS

At a mean follow-up of 19.2 months, the largest femoral tunnel diameter increase was 3.8 mm. It is not clear that this widening is clinically significant even though it is statistically significant. Also, association between femoral tunnel widening and physeal closure could not be formally established. This study provides the first assessment of tunnel widening in relation with PEEK fixation material in pediatric knees.

[a] **Reference**: Uzumcugil O, Yalcinkaya M, Ozturkmen Y, Dikmen G, Caniklioglu M (2012) Effect of PEEK Polymer on Tunnel Widening After Hamstring ACL Reconstruction. Orthopedics. 35(5):e654-e659. doi:10.3928/01477447-20120426-18.

METHODS

All patients who underwent all-epiphyseal ACLR surgery at CHU Ste-Justine between March 2015 and January 2017 were included in this retrospective study

Surgical technique

- All-epiphyseal reconstruction, with new titanium tibial anchor and a femoral PEEK implant (Figure 1)

Femoral bone tunnel widening

- Initial tunnel' approximate diameter: size of the drill bit retrieved from the operative protocol
- Latest tunnel sizes:
  - Latest lateral knee radiograph
  - Widest tunnel measurements with the sclerotic tunnel margins as reference points

Growth complications

- Physeal status on knee radiographs
- Limb length discrepancies (LLD) on EOS AP full-leg standing radiographs
  - Top-of the-femoral-head-to-ankle-center measurements
  - 2 cm differences defined as clinically significant
- Knee angulations on the EOS radiographs
  - Mechanical axis measurements
  - Varus and valgus malalignments of 5° or more absent prior to surgery considered significant

Statistical analysis

- Tunnel size initially and at follow-up: paired *t* tests

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RESULTS

General patient series description

- Eighteen patients (19 knees)
- 4 girls (22.2%) and 14 boys (77.8%)
- Greulich and Pyle bone age at time of surgery: 13.3 ± 1.0 years
- Chronological age at time of surgery: 13.5 ± 1.6 years
- Follow-up time: 19.2 ± 10.1 months

Mean femoral tunnel widening

- 1.7 ± 1.4 (-0.9-3.8) mm
- Statistically significant ($P<0.001$)

Growth complications

- No symptomatic growth abnormalities requiring intervention
- 2 unilateral early physeal closures at the distal femur (11.1)
  - 3.0 mm of femoral tunnel widening and no observable growth disturbance
  - 3.5 mm of femoral tunnel widening and non-progressive asymptomatic unilateral knee valgum of 5 degrees

DISCUSSION

- The only one paper (Uzumcugil *et* al.) that specifically reports the results of a study on PEEK implants in relation with tunnel widening did demonstrate significant tunnel enlargement but did not report clinical impact.
- Similarly, this study shows statistical significance of the association between PEEK implants and tunnel widening, but clinical significance remains unclear.
  - There were no symptomatic growth disturbances.
  - Physeal damage might have occurred postoperatively, due to tunnel widening, as the 2 unilateral physeal closures in this series correlated with notable tunnel enlargement.
- Limitations of this study:
  - No sagittal plane knee radiographs
  - Retrospective study and lacking quality of some knee radiographs
  - Small sample size and short-term follow-up
  - No comparison group with other fixation material

TABLE 1. Preoperative and Postoperative Growth Characteristics

	Preoperative Mean or N (%)	Latest follow-up Mean or N (%)
Physes status		
Open	19 (100.0)	12 (66.7)
Bilateral closure	0 (0.0)	5 (27.8)
Unilateral closure	0 (0.0)	2 (11.1)
LLD (mm) [1]	6.1 ± 4.7 (0-15)	6.9 ± 4.7 (0-15)
Less than 1 cm	11 (57.9)	13 (68.4)
Between 1 and 2 cm	4 (21.1)	4 (21.1)
More than 2 cm	0 (0.0)	0 (0.0)
Unavailable	4 (21.1)	2 (10.5)
Angular deformity[2]		
Injured knee (degrees)	-0.7 ± 2.3 (-6–3)	-0.6 ± 2.8 (-7-5)
Minor angulation (<5°)	14 (73.7)	15 (78.9)
Significant varus (>5°)	0 (0.0)	1 (5.3)
Significant valgus (≥5°)	1 (5.3)	1 (5.3)
Unavailable	4 (21.1)	2 (10.5)
Contralateral knee (degrees)	0.3 ± 2.6 (-7–4)	0.7 ± 2.4 (-3-4)
Minor angulation (<5°)	14 (77.3)	17 (89.5)
Significant varus (≥5°)	0 (0)	0 (0.0)
Significant valgus (≥5°)	1 (5.3)	0 (0.0)
Unavailable	4 (21.1)	2 (10.5)
Harris growth arrest lines		
Femur	0 (0.0)	7 (36.8)
Tibia	0 (0.0)	7 (36.8)
Unavailable radiographs	0 (0.0)	1 (5.3)
Number of knees	0 (0.0)	9 (47.4)

[1] LLD: Limb-length discrepancy

[2] Negative angle values were used for knee valgum while positive angle values were used for knee varum