

# Skeletally immature patients undergoing distal femoral replacement experience higher rates of implant failure and growth-related complications

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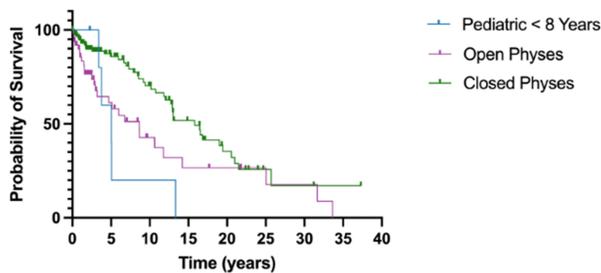
**INTRODUCTION:** Skeletally immature osteosarcoma patients undergoing endoprosthetic reconstruction face significant growth-related and biomechanical challenges, yet long-term implications remain poorly understood. This study investigates the impact of skeletal maturity on implant survival and complications following distal femoral endoprosthetic reconstruction (DFR).

**METHODS:** We retrospectively reviewed 179 osteosarcoma patients treated with DFR. Patients were stratified as: pediatric < 8 years (<8yr), open physes (OP: females 8–14, males 8–16), and closed physes (CP: females >14, males >16). <8yr (n = 6) had a mean age of 7.2 years, OP (n = 49) 13.1, and CP (n = 124) 22.2. Kaplan-Meier analysis assessed implant survival. Henderson failure mode classification was utilized.

**RESULTS:** Kaplan-Meier analysis revealed significant differences in implant survival across age-based groups (log-rank  $\chi^2 = 11.65$ ,  $p = 0.003$ ). Pairwise comparisons showed that CP had superior survival compared to both <8yr ( $p = 0.0096$ ) and OP ( $p = 0.0185$ ). There was no significant difference between <8yr and OP ( $p = 0.39$ ). Implant failure rates were highest in <8yr (83.3%), followed by OP (55.1%) and CP patients (33.8%). Aseptic loosening and structural failure were the most frequent modes of failure. Growth-related complications were highest in <8yr (LLD 60%, contracture 40%).

**DISCUSSION AND CONCLUSION:** Skeletal immaturity has a strong association with poorer implant survival, with children under 8 years experiencing the highest rates of growth-related complications. This study underscores the challenges of reconstruction in a growing skeleton.

DFR Implant Survival



Complication	Pediatric < 8 (n = 6)	OP (n = 49)	CP (n = 124)
Implant Failure	5/6 (83.3%)	27/49 (55.1%)	42/124 (33.8%)
Soft Tissue Failure (Type 1)	0/0 (0.0%)	0/0 (0.0%)	0/0 (0.0%)
Aseptic Loosening (Type 2)	2/6 (33.3%)	8/49 (16.3%)	16/124 (12.9%)
Mechanical Failure (Type 3)	3/6 (50.0%)	12/49 (24.5%)	17/124 (13.7%)
Infection (Type 4)	0/0 (0.0%)	3/49 (6.1%)	2/124 (1.6%)
Tumor Recurrence (Type 5)	0/0 (0.0%)	4/49 (8.2%)	8/124 (6.5%)
Limb Length-Discrepancy	5/6 (83.3%)	14/49 (28.5%)	1/124 (0.8%)
Joint Contracture	3/6 (50.0%)	8/49 (16.3%)	3/124 (2.4%)