

Early Survivorship Analysis of a Modern Anatomic Cementless Tibial Baseplate

A Multicenter Retrospective Study

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Disclosures

I have no financial disclosures.

Dr. Matthew Bullock is a consultant for Smith and Nephew.

Introduction: Background

Rising Cementless TKA Adoption

Cementless TKA fixation has experienced a resurgence in recent years, driven by demand for biologic implant-bone interfaces in younger, high-demand patients.

Potential advantages include:

- Biologic long-term fixation
- Shorter operative times
- Comparable short-term failure profile to cemented fixation

Key Clinical Challenge

Aseptic loosening of the tibial baseplate is a primary cause of early cementless TKA failure.

The tibial component bears greater compressive and shear forces than the femoral component, making it especially susceptible to early instability.

Modern keel-and-peg configurations aim to provide immediate mechanical stability to facilitate osseointegration.

Introduction: Study Rationale & Hypothesis

Prior Designs

Keel-and-peg cementless tibial components show promising survivorship with low early aseptic loosening rates (1.0–2.7% at 2 years).



Helvie et al. 2023; Gibian et al. 2025

Gap in Evidence

Limited data exist on the modern anatomic cementless tibial baseplate (Smith & Nephew LEGION CONCELOC) in a multicenter setting.

Andronic et al., Bone Joint J 2025

Study Aim

Evaluate early outcomes of this novel cementless tibial baseplate using multi-institutional survivorship data versus a matched cemented counterpart.

Materials & Methods: Study Design

| | |
|--------------|--|
| Study Design | Retrospective cohort study |
| Institutions | Two high-volume academic-affiliated centers |
| Surgeons | Three fellowship-trained adult reconstruction surgeons |
| Period | January 2022 – December 2023 |
| Inclusion | Age >18; primary TKA; ≥1 year clinical or radiographic follow-up |
| Exclusion | < 1 year follow-up |

Study Cohort

394

Total Patients

183

Cementless (LEGION CONCELOC)

211

Cemented (Genesis II)

2.1 yrs

Mean Follow-Up (all patients)

Materials & Methods: Implant Design

Additive Manufacturing

3D-printed titanium-aluminum-vanadium (Ti-6Al-4V) alloy for consistent, highly porous architecture

80% Porosity

Pore range: 228–633 μm — designed to facilitate rapid bone ingrowth and osseointegration

Anatomic Keel

Medialized anatomic keel (50 mm) increases surface area for osseointegration

Anti-Rotation Pegs

Two cruciate anti-rotation pegs provide rotational stability during early postoperative loading

3° Posterior Slope

Optimizes tibial coverage and distributes mechanical stress more evenly

Biologic Advantage

23% greater pull-out strength vs. traditional sintered bead coatings (in-vivo data)

Smith & Nephew LEGION CONCELOC™

- Material: Ti-6Al-4V alloy
- Porosity: 80% (228–633 μm)
- Keel length: 50 mm
- Pegs: 2 cruciate anti-rotation
- Slope: 3° posterior
- Manufacturing: Additive / 3D print



Materials & Methods: Surgical Technique & Outcomes

Surgical Technique

- Anterior midline skin incision
- Medial parapatellar or midvastus approach
- Cementless or cemented tibial implant per construct
- Femoral fixation at surgeon discretion
- Patellar resurfacing per surgeon preference
- Robotics used selectively
- Immediate full weight-bearing postoperatively

Follow-Up Schedule

- 2 weeks, 6 weeks, 6 months, 1 year, then annually
- Clinical and radiographic evaluation at each visit
- Assess: loosening, radiolucency, fracture, subsidence
- Minimum 1-year follow-up required for inclusion

Outcomes Assessed

- Primary: all-cause revision-free survivorship (Kaplan-Meier)
- Aseptic loosening revision rate
- KOOS-JR pre-op and 1-year post-op
- PASS and MCID achievement rates
- Radiographic: loosening, malalignment, subsidence
- MUA rate

Materials & Methods: Statistical Analysis

χ^2

Descriptive & Comparative Stats

Continuous variables: mean \pm SD; Student's t-test
Categorical variables: frequencies, %;
Chi-square or Fisher's exact test

KM

Kaplan-Meier Survivorship

All-cause revision as failure event
Log-rank test for between-group differences
95% confidence intervals reported

PSM

Propensity Score Matching

1:1 nearest-neighbor matching (without replacement)
Matching variables: age, sex, BMI, diabetes, smoking
Balance assessed via SMD (<0.1 = adequate)

PRO

Patient-Reported Outcomes

KOOS-JR scored 0–100 (100 = perfect function)
PASS threshold applied for symptom state
MCID threshold for clinically important improvement

Results: Patient Demographics

| Variable | Cementless (n = 183) | Cemented (n = 211) | p-value |
|-------------------------------|----------------------|--------------------|--------------------|
| Age, years | 68.0 ± 8.3 | 68.2 ± 9.1 | 0.80 |
| Female sex, n (%) | 121 (66.1%) | 141 (66.8%) | 0.97 |
| BMI, kg/m ² | 33.4 ± 6.8 | 33.3 ± 6.6 | 0.91 |
| Diabetes, n (%) | 35 (19.1%) | 41 (19.4%) | 1.00 |
| Current smoker, n (%)* | 6 (3.3%) | 73 (34.6%) | < 0.001* |
| Mean follow-up, years | 1.4 ± 1.1 | 2.7 ± 1.9 | < 0.001 |

*Significant difference in smoking status. All other baseline characteristics were well-balanced between groups.

Results: Clinical Outcomes & Revision Rates

1.6%

Cementless all-cause revision rate (n=3)

2.8%

Cemented all-cause revision rate (n=6)

p = 0.53

No significant difference in all-cause revision

0.5%

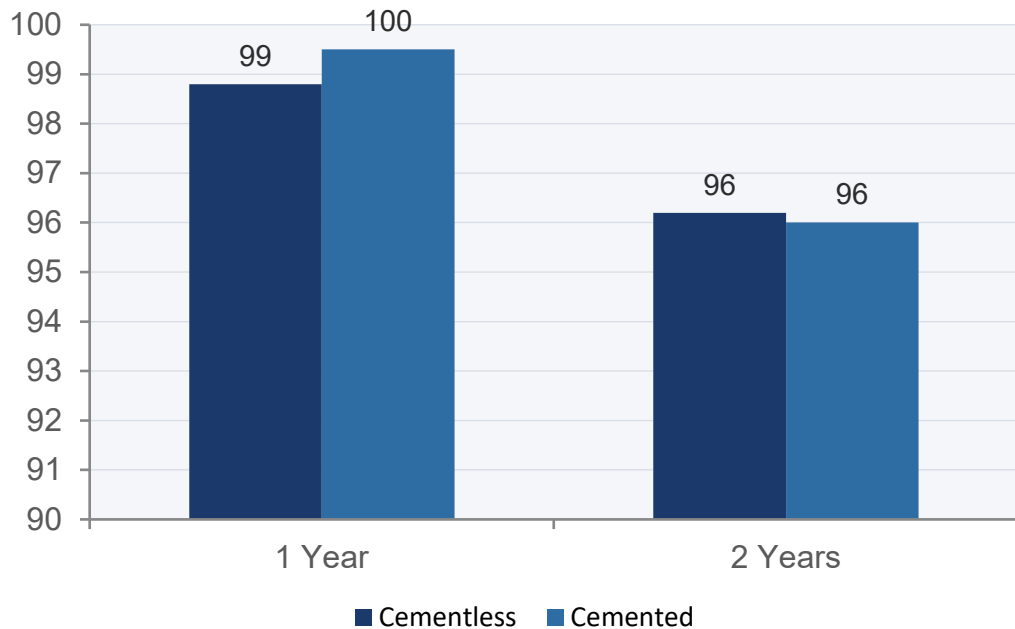
Aseptic loosening revision (both groups)

| Outcome | Cementless (n=183) | Cemented (n=211) | p-value |
|--------------------------------------|--------------------|------------------|---------|
| All-cause revision, n (%) | 3 (1.6%) | 6 (2.8%) | 0.53 |
| Aseptic loosening revision, n (%) | 1 (0.5%) | 1 (0.5%) | 1.00 |
| Time to revision, days (mean ± SD) | 419.3 ± 214.3 | 798.0 ± 861.2 | — |
| Manipulation under anesthesia, n (%) | 10 (5.5%) | 12 (5.7%) | 0.94 |

Table 2: Early Clinical Outcomes | No significant differences in revision or MUA rates between groups

Results: Kaplan-Meier Survivorship Analysis

Revision-Free Survivorship (%)



| Time Point | Cementless (95% CI) | n at risk | Cemented (95% CI) | n at risk |
|------------|---------------------|-----------|--------------------|-----------|
| 1 Year | 98.8% (97.1–100.0) | 134 | 99.5% (98.5–100.0) | 130 |
| 2 Years | 96.2% (91.2–100.0) | 29 | 96.0% (92.6–99.6) | 102 |

Key Finding

2-year all-cause revision-free survivorship was comparable between groups:

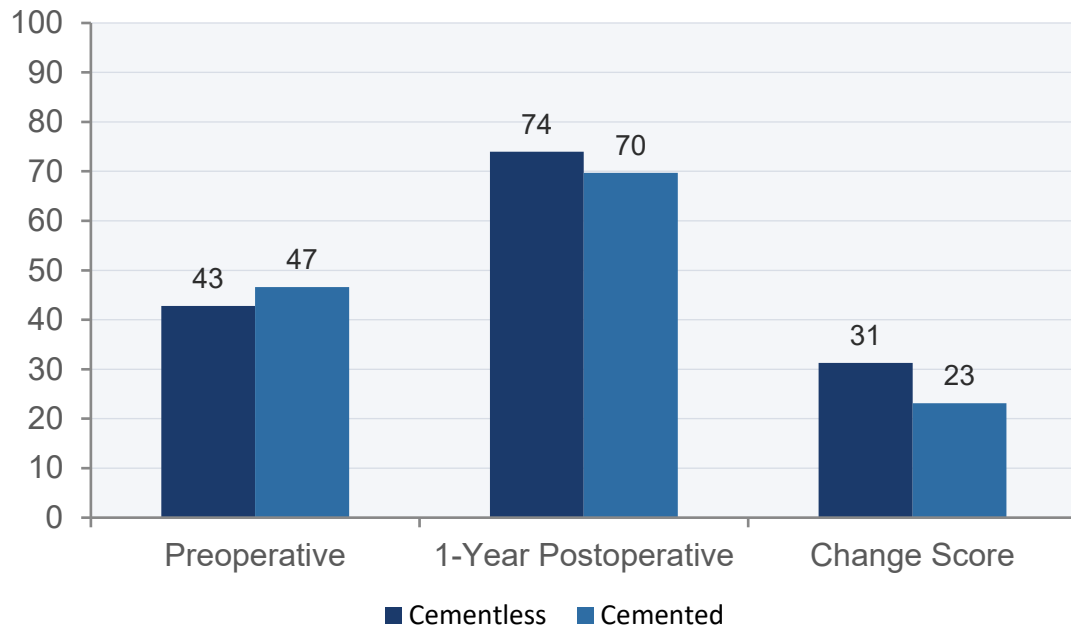
Cementless: 96.2%

Cemented: 96.0%

Log-rank $p = 0.93$ (no significant difference)

Results: Patient-Reported Outcomes (KOOS-JR)

KOOS-JR Scores (0–100)



| Outcome | Cementless | Cemented | p |
|----------------------|--------------------|--------------------|---------------|
| Pre-op KOOS-JR | 42.8 ± 15.8 | 46.6 ± 13.2 | 0.10 |
| 1-yr KOOS-JR | 74.0 ± 16.5 | 69.7 ± 13.5 | 0.07 |
| Change score* | 31.3 ± 23.2 | 23.1 ± 18.9 | 0.015* |
| PASS achieved | 56.5% | 43.7% | 0.12 |
| MCID achieved | 88.4% | 83.9% | 0.40 |

**Cementless group showed significantly greater improvement in KOOS-JR change score (p = 0.015)*

Results: Radiographic Outcomes & Propensity Score Matching

Radiographic Outcomes

Radiographic follow-up:

Cementless: 423.4 ± 186.5 days

Cemented: 988.8 ± 819.9 days

At final follow-up:

- No evidence of component loosening
- No malalignment or fracture
- All components radiographically stable vs. prior imaging
- Single aseptic loosening case confirmed in each group at revision

Propensity Score Matched Analysis

| Variable | Cement. (n=143) | Cement. (n=143) | SMD |
|------------------------------|--------------------|--------------------|---------------|
| Age, years | 68.4 ± 8.1 | 69.8 ± 8.8 | 0.17 |
| Male sex, n (%) | 37 (25.9%) | 35 (24.5%) | 0.03 |
| BMI, kg/m ² | 33.3 ± 6.8 | 32.9 ± 6.8 | 0.06 |
| Matched revision rate | 1.4% | 1.4% | p=1.00 |

2-year survivorship remained comparable after matching:
Cementless 95.2% vs. Cemented 98.7% (p = 0.30)

Discussion

Comparable Survivorship

Aseptic loosening and all-cause revision rates did not differ significantly between cementless and cemented tibial components, consistent with prior reports on keel-and-peg designs (1.0–2.7% at 2 years).

Implant Design & Osseointegration

The anatomic baseplate's Titanium alloy, 80% porosity, medialized keel, and anti-rotation pegs are designed to optimize load distribution and early biologic fixation.

Improved Functional Gains

The cementless cohort demonstrated a significantly greater improvement in KOOS-JR change score (31.3 vs. 23.1; $p=0.015$), suggesting potential functional advantages of this implant design.

Design-Specific Outcomes

A recent study of a different modern cementless baseplate reported higher early aseptic loosening (7% vs. 0.5%) at 12 months, underscoring that outcomes are likely design-specific rather than class-wide.

Limitations

Short follow-up with substantial attrition at 2 years ($n=29$ cementless), differences in smoking rates, surgeon variability in femoral/patellar choice, and selective robotics use.

Conclusion

✓ This modern anatomic cementless tibial baseplate demonstrated excellent early survivorship compared to modern cementless implants

✓ All-cause revision-free survivorship at 2 years was 96.2% (cementless) vs. 96.0% (cemented) with no significant difference .

✓ Aseptic tibial loosening revision rate of 0.5% in both groups — comparable to modern cemented TKA benchmarks.

✓ Cementless cohort demonstrated significantly greater functional improvement in KOOS-JR change score ($p = 0.015$).

✓ Radiographic stability confirmed at final follow-up, with no loosening, malalignment, or fracture detected beyond the single confirmed cases.

→ **Longer follow-up (ideally 5 years) in larger cohorts is warranted to confirm sustained durability.**

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