Compatibility of Retrograde Intramedullary Nails With Knee Prostheses

Richards AE, Deckey DG, Stein MK, Ryan SP, Schwartz AM, Seyler TM. Compatibility of Retrograde Intramedullary Nails With Knee Prostheses: A Comprehensive Analysis.

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Study type / level of evidence: Narrative/technical review synthesizing manufacturer specifications and prior compatibility studies into a compatibility matrix. Not a systematic review or meta-analysis; no clinical level of evidence.

Part 1 — Leopold Five-Minute Critical Appraisal

1. What kind of study and what design?

A technical narrative review. It consolidates manufacturer technical specifications and two foundational prior compatibility guides into cross-referenced tables matching retrograde intramedullary nails (RIMN) to specific TKA femoral components, plus a review of lateral distal femoral locking plates and nail-plate constructs.

2. Does it study an important question?

Yes. Periprosthetic distal femur fractures are increasing with the aging TKA population, and nail–prosthesis incompatibility (intercondylar box width, posterior notch position, closed boxes) is a genuine intraoperative pitfall. A current, consolidated compatibility matrix is practically valuable for preoperative planning.

3. To whom does it apply, and to whom not?

Surgeons treating supracondylar periprosthetic femur fractures above a well-fixed TKA who are considering retrograde nailing, lateral locked plating, or nail-plate constructs. The upstream fix-versus-revise decision (implant stability and bone stock) is assumed and not addressed.

4. Describe the methods — anything to watch for?

Data are derived from manufacturer specifications rather than clinical validation. 'Minimum intercondylar distance' is used as a static proxy, and the authors note that posterior notch position is often more limiting than width. There is no formal quality appraisal of sources and potential incompleteness (not all specifications are public). Practical workarounds — burr enlargement, polyethylene-plug removal in certain PS boxes, blocking screws — are appropriately flagged.

5. Were hypotheses/purposes clearly stated?

The purpose is explicit (consolidate and update compatibility guidance); a review of this type appropriately has no hypothesis.

6. Key results — any counterintuitive findings?

Compatibility is governed by nail diameter, driving-end diameter, and opening-reamer size versus the prosthesis minimum intercondylar width and notch geometry. The most versatile nails were the DePuy Synthes RFN-Advanced, Zimmer Biomet Phoenix, and Stryker T2 Alpha; the least were the Smith & Nephew TRIGEN Meta-Nail, Orthofix Centronail, and Stryker T2 A/R. Narrow cruciate-retaining femora (e.g., NexGen CR ~11.9 mm) and closed-box PS designs are problematic, though some PS boxes (e.g., Sigma) carry a removable polyethylene plug that permits nailing, and nails with a 10° distal bend yield better sagittal alignment.

7. Strengths?

A comprehensive, current, clinically actionable matrix spanning more than twenty manufacturers, inclusion of lateral plates and nail-plate constructs, and concrete planning pearls (blocking screws, burr, plug removal, distal-bend selection).

8. Weaknesses?

Not systematic and without risk-of-bias appraisal; no clinical outcomes or validation; static specification proxies; possible incompleteness; and the content will date as implants evolve. The recommendations are geometric, not outcome-based.

9. How does it fit with what is known, and what remains?

It updates and broadens the Thompson 2014 and Gerow 2022 compatibility guides and complements the comparative clinical evidence on RIMN versus distal femoral plating (Wall 2023 meta-analysis; Shin 2016; Magill 2021) and emerging nail-plate combination data (Bilodeau 2025). What remains is clinical validation of the recommended pairings and comparative reoperation outcomes.

10. Would it change your practice?

High practical utility — worth keeping the compatibility matrix on hand for preoperative planning of periprosthetic distal femur fractures. Confirm the femoral box geometry of the in-situ TKA (especially narrow CR and closed-box PS designs) before committing to a retrograde nail, and know the polyethylene-plug and burr workarounds. As a non-validated review, it informs planning rather than dictating the fixation choice.

Validity and Bias

Internal validity: As a narrative review it carries no formal internal-validity assessment; source selection and incompleteness are unaddressed and there is no clinical validation, so conclusions are engineering-geometric rather than outcome-derived.

External validity (generalizability): Broad device coverage aids applicability, but manufacturer specifications are not the same as in-vivo performance, and implant evolution will erode currency.

Principal biases: Selection/incompleteness bias (non-public or omitted specifications), publication bias not assessed, and proxy bias from static intercondylar measurements.

Part 2 — Comparison to the Existing Literature

Search method: PubMed searched across three windows — the past 20 years (2006–2026), the past 2 years (2024–2026), and the trailing 30 days (29 May–29 June 2026). Citations below include DOIs (source: PubMed).

Foundational / landmark context (20-year window)

The direct predecessors are Thompson 2014 (J Arthroplasty) and Gerow 2022 (J Orthop Trauma) compatibility guides, with clinical grounding from Han 2009 (Clin Orthop Surg, RIMN for periprosthetic supracondylar fracture) and Ricci 2015 on periprosthetic femur fracture management. Davis 2021 (J Orthop Trauma) describes the retrograde-nail-through-TKA technique.

Past two years (2024–2026)

Comparative evidence comes from Wall 2023 (OTSR systematic review/meta-analysis of RIMN vs distal femoral plating) and Kurtuluş 2024 (finite-element analysis of nail vs plate-screw constructs for periprosthetic fracture). Bilodeau 2025 (J Arthroplasty) reports that nail-plate combination fixation allowed early weight-bearing with low reoperation and revision rates — extending the constructs this review catalogs.

Trailing 30 days

No additional on-topic compatibility or comparative-fixation study was indexed in the trailing 30 days (to 29 June 2026); this review (Oct 2025) and Bilodeau 2025 represent the most current contributions.

Where this paper sits in the literature

This is the most up-to-date consolidated compatibility resource, superseding Thompson and Gerow in breadth and incorporating lateral plates and nail-plate constructs. It pairs with — but does not itself provide — the comparative clinical and biomechanical outcome evidence, so it is best used as a preoperative planning reference alongside the RIMN-versus-plating literature.

Key comparator references

1. Wall R, et al. Treatment of supracondylar periprosthetic femoral fractures with retrograde nailing vs distal femoral plating: systematic review and meta-analysis. Orthop Traumatol Surg Res 2022/2023;109:103489. doi:10.1016/j.otsr.2022.103489
2. Shin YS, et al. Similar outcomes of locking compression plating and retrograde nailing for periprosthetic supracondylar femoral fractures after TKA: a meta-analysis. Knee Surg Sports Traumatol Arthrosc 2016. doi:10.1007/s00167-016-4050-0
3. Bilodeau RE, et al. Nail-Plate Combination Fixation for Periprosthetic Distal Femoral Fractures Allows Early Weight-Bearing With Low Reoperation and Revision Rates. J Arthroplasty 2025. doi:10.1016/j.arth.2025.09.007
4. Kurtuluş B, et al. Finite element analysis of the stability of retrograde nail and plate-screw combinations for periprosthetic femoral fractures after TKR. Eur Rev Med Pharmacol Sci 2024;28. doi:10.26355/eurrev_202404_36032
5. Davis M, et al. Retrograde Intramedullary Nail for Distal Femur Fracture, Through a Total Knee Arthroplasty. J Orthop Trauma 2021;34(4):415–421. doi:10.1097/BOT.0000000000002169