Is there a difference in outcome of primary total knee arthroplasty when mobile bearing versus fixed bearing implants are used?

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Response/Recommendation:
The literature supports the notion that both mobile-bearing and fixed-bearing designs can achieve excellent outcomes. The theoretical advantages of mobile-bearing designs over fixed-bearing designs have not been substantiated in clinical practice. Consequently, we recommend that orthopedic surgeons select mobile- or fixed-bearing inserts based on their personal preferences and clinical judgment.

Level of Evidence: moderate

Rationale:
Fixed-bearing implants were introduced first and continue to represent the most common type used in total knee arthroplasty (TKA)[1,2]. These implants provide rigid fixation of the polyethylene insert within the tibial implant and have demonstrated satisfactory outcomes and long-term survival rates[3,4]. However, implant loosening in fixed-bearing designs has been theoretically attributed to higher contact stresses and polyethylene wear rates[5–7]. In response to these concerns, mobile-bearing polyethylene designs were developed. These designs aim to mitigate the drawbacks of fixed-bearing TKA by improving conformity and lowering contact stresses, thereby mimicking the kinematics of the knee and promoting a wider range of motion[8,9]. However, these advantages remain theoretical and have yet to be fully proven in vivo. Furthermore, mobile-bearing TKA can introduce unique complications, such as bearing dislocation[10].

Initial evidence suggested that mobile-bearing designs might promote better outcomes in functional scores and complications, but the differences observed were minimal[11]. Subsequent meta-analyses with mid-term follow-up refuted these findings, indicating no significant difference between mobile-bearing and fixed-bearing TKA[12–14]. However, recent studies have presented further contradictory results, and controversy continues regarding the superiority of mobile-bearing over fixed-bearing designs[15–18]. We conducted an updated review comparing mobile-bearing versus fixed-bearing TKA to address this ongoing debate. This analysis utilized a multi-modal approach to outcomes, including overall revision rates, aseptic loosening, knee function scores, and radiological outcomes.

Search Strategy
A comprehensive search in PubMed, Embase, Web of Science, and the Cochrane Library databases was done to identify randomized controlled trials (RCT) that compared mobile-bearing to fixed-bearing prosthesis designs. The search was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the 2020 PRISMA statement [19].

Search terms included “total knee arthroplasty” AND “mobile bearing” AND “fixed bearing” AND “randomized controlled trials.” The search was limited to RCT studies written in English that were published in the year 2000 or later and had at least two years of follow-up.

The search strategy resulted in 1,244 studies (1,240 from the database search and 4 articles from a manual reference search), of which 678 were excluded due to duplications. A total of 566 studies were screened by titles and abstracts, which resulted in 449 additional studies being excluded. A total of 117 studies were sought for retrieval and underwent full-text reviews, which led to an additional 47 studies being excluded. A total of 70 articles were included in this systematic review.

Functional Outcomes

The comparative analysis of functional outcomes between fixed-bearing (FB) and mobile-bearing (MB) total knee arthroplasty (TKA) reveals no significant long-term differences. Multiple studies have demonstrated no differences in patient-reported outcomes at two or three years postoperatively [20–39]. Similarly, evaluations at ten years postoperatively show no significant differences in Knee Society scores, knee flexion, or pain scores between the two types of prostheses [4,40–42]. Although several studies reported better outcomes for MB prostheses in the short term, this advantage was not sustained at three and five years, suggesting only temporary benefits [43–45]. Moreover, gait analysis and other functional metrics, such as range of motion and joint awareness, show no clear superiority of MB over FB TKAs in the mid to long term [3,8,16,44,46–66]. These findings indicate that the theoretical benefits of MB TKAs, such as improved kinematics and reduced wear, do not translate into significant clinical advantages for patients over FB TKAs in routine activities.

Radiological Outcomes and Implant Migration

Radiological outcomes and implant migration assessments show no significant differences between FB and MB TKAs over various follow-up periods[27,31,53,67]. Several studies indicate similar migration patterns and rates of osteolysis for both types of implants [8,42,68–70]. Long-term follow-ups reveal no significant differences in the prevalence of radiolucent lines or osteolysis, further supporting the radiological equivalence of the two prosthesis types [4,71,72]. Although there were occasional reports of higher migration rates for FB tibial implants compared to MB implants, these differences were not clinically significant and did not affect the overall survivorship or functional outcomes of the prostheses [23,41,73,74]. These consistent findings across various studies suggest that the choice between FB and MB TKAs does not impact radiological outcomes or the likelihood of implant loosening and migration.

Implant Survival

Due to the limitation of sample volumes in randomized controlled trials (RCTs), revisions were often reported as individual cases rather than as revision rates in some studies[48,51,54,66,75,76]. However, the implant survival data further support the equivalence of FB and MB TKAs. Studies with long-term follow-ups demonstrate no significant differences in overall survivorship between the two types of implants [42,71]. Although there were isolated

reports of higher revision rates in MB TKAs due to aseptic loosening and other complications, these instances were relatively rare and did not significantly affect the overall survival rates of the prostheses [17,40,77]. High flexion MB prostheses, while showing some early functional advantages, did not exhibit superior long-term survivorship compared to FB counterparts [3,4,22]. The comparable complication rates and implant survival outcomes across multiple studies indicate that both FB and MB TKAs are reliable options with similar long-term durability and safety profiles.

In conclusion, both mobile-bearing and fixed-bearing designs can achieve excellent outcomes. The choice between fixed and mobile bearing implants for TKA should be based on surgeon preference and experience with the selected implant, as the existing evidence does not indicate significant differences in functional outcomes, radiological results, complication rates, or implant survival between the two prosthesis types. Additional research to investigate long-term outcomes in real-world usage should be done using information from longitudinal registries.

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