Is there a difference in clinical outcomes between fixed bearing and mobile bearing unicompartmental knee arthroplasty?

Fatih Yıldız, Mustafa Alper İncesoy, Mustafa Şenyurt, Abtin Alvand, Efrain Diaz-Borjon, Neil Sheth

Response/Recommendation: Fixed-bearing and mobile-bearing implants provide similar clinical outcomes after medial unicompartmental knee arthroplasty.

Level of Evidence: Low

Rationale: There are numerous recent systematic reviews and meta-analyses in the literature comparing the outcomes of fixed-bearing (FB) and mobile-bearing (MB) implants in medial unicompartmental knee arthroplasty (mUKA).

We have conducted an umbrella review to synthesize evidence from the systematic reviews and meta-analyses to determine if there is a difference in outcomes of FB and MB designs. The study protocol was registered in PROSPERO (CRD42024532054). PubMed, Ovid MEDLINE, Cochrane Library and CINAHL were searched for potentially eligible studies from data inception to April 20, 2024. The study focused only on the systematic reviews and meta-analyses in English, which compared the outcomes of FB and MB UKA. Two of us independently screened titles and abstracts, reviewed full texts and extracted data. The initial search yielded 2,443 records, which were reduced to 887 studies after removing duplicates and 36 studies were selected for full-text review. Finally, the umbrella review included eight systematic reviews and meta-analyses [1–8]. The methodological quality of the included studies was rated as low for six studies and moderate for one according to AMSTAR 2 tool [9]. The included meta-analyses, published between 2009 and 2023, encompassed a variety of study designs, including retrospective, randomized controlled, and prospective studies. These studies varied considerably in sample size, ranging from 323 to 17,405 participants.

Functional outcomes were reported in 6 studies [1,2,4, 6–8]. One study demonstrated that FB had superior results compared to MB in terms of Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (WMD: -5.06, 95% CI: -6.53 to -3.6) and Knee Society Score (KSS) (WMD: -0.94, 95% CI: -1.59 to -0.29) for medial UKA[7]. However, the results were conflicting, with several studies reporting no significant difference between the two designs in mixed (medial and lateral) UKA populations [1,2,5,6]. The results for the range of motion (ROM) after UKA were also inconsistent, with one study favoring FB (WMD: -1.51, 95% CI: -2.84 to -0.18) [7] and others showing no significant difference between the designs [1,2,6,8].

Radiological outcomes were evaluated in 6 studies [1–4,7,8]. Two studies found that MB was associated with a significantly lower rate of bearing wear compared to FB (OR: 0.11, 95% CI: 0.02 to 0.61 and OR: 11.60, 95% CI: 1.52 to 88.57)[7,8]. Additionally, one study reported that more knees in the MB group had a neutral limb alignment than those in the FB group (OR: 2.63, 95% CI: 1.45–4.78)[7]. However, no significant differences were found between the two groups in terms of other radiographic outcomes, such as hip-knee-ankle angle (OR: 0.51, 95% CI: -3.03 – 2.01), femoral-tibial angle (OR: 0.60, 95% CI: -0.11 – 1.31), and postoperative radiolucent lines (OR: 1.46, 95% CI: 0.15 – 14.03 and OR: 0.8, 95% CI: 0.1 – 5.7) [1,2,7,8].

The umbrella review showed that there is no difference between the MB and FB designs in revision rates and survivorship for mUKA [1–4, 6-8]. However, in two of the meta-analyses by Cao et al. and Chang et al., the mean time for the reoperation was significantly shorter in the MB group than in the FB group [1,2]. Bearing dislocation was one of the reasons for early reoperation and revisions in MB groups [7,8].

FB and MB implants also showed similarities in the other outcomes including quality of life parameters, postoperative persistent pain, intraoperative tibial plateau

fracture, tibial component subsidence, periprosthetic fracture, aseptic loosening, deep infection, and progression of OA [1,2,4, 6–8].

This umbrella review demonstrates that the indications for revision differ between FB and MB mUKAs. FB implants, have a lower risk of bearing dislocation and longer time for revision, whilst MB offer a lower risk of bearing wear. The current review therefore concludes that FB and MB implants provide similar outcomes for mUKA, in terms of PROMs, ROM, and revision rates [2,7,8].

For the lateral compartment, use of a FB design is recommended because the knee joint is less constraint in the lateral side, which potentially increases the risk of bearing dislocation when a MB implant is used. In a meta-analysis by Wang et al., 5470 lateral UKAs in 26 studies were evaluated and the survivorship rate was found to be higher for FB than MB at early (OR: 0.96 [0.95 to 0.98], p=0.04) and mid-term (OR: 0.94 [0.93 to 0.96], p=0.01) follow-ups [5]. In another systematic review and meta-analysis, Abu Al-Rub et al. also found that FBs lasted significantly longer before needing revision when used for the lateral compartment (pooled rate of revision for 100 patient years for FBs was 2.2 [1.3 to 3.6] versus 0.7 [0.4 to 1.2] for MBs, $p < 0.01$) [3]. They concluded that MB have a four-fold higher risk of revision in comparison to FB if used for lateral UKA. The current review also concludes that FB implants provide superior outcome in terms of revision rates for lateral UKA.

Based on our underatdning of the litearure, there is no significant difference in patient-reported outcome measures, range of motion, or revision rates between the two bearing designs. The literature supports that mobile-bearing implants may offer a lower risk of bearing wear but higher risk for early revision because of bearing dislocation. For the lateral unicompartmental knee arthroplasty, use of a fixed bearing implant may provide better outcome because mobile bearing designs are associated with higher risk of all cause revision.

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