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Mobile bearing or fixed bearing? A meta-analysis of outcomes comparing mobile bearing and fixed bearing bilateral total knee replacements

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ABSTRACT

Background: To compare outcomes between mobile-bearing (MB) and fixed-bearing (FB) in bilateral total knee replacements.
Methods: The MEDLINE, EMBASE and Cochrane Library databases were searched. Randomized controlled trials of bilateral total knee arthroplasty with one of each design implanted were identified. Weighted mean differences (WMDs) and pooled risk ratios (RRs) were calculated using fixed- or random-effects models.
Results: Twelve studies were identified with a total of 807 patients and 1614 knees. All RCTs were of high quality with a low risk of bias. No statistical difference was found between MB and FB at 2- to 5-year follow-up in terms of America Knee Society score (WMD: −1.29, 95% CI: −5.65 to 3.06), pain score (WMD: −3.26, 95% CI: −10.45 to 3.93), range of motion (WMD: −4.16, 95% CI: −9.97 to 1.66), reoperation (RR: 1.00, 95% CI: 0.28 to 3.60), and radiolucent lines (RR: 1.51, 95% CI: 0.70 to 3.24). The results were similar at 1-, 5- to 8-, or >8-year follow-up. Patient's satisfaction (RR: 0.85, 95% CI: 0.54 to 1.34), and complication (≤2-year, RR: 0.55, 95% CI: 0.29 to 1.04; >2-year, RR: 1.0, 95% CI = 0.73 to 1.38) also showed no difference between two groups.
Conclusions: Based on this meta-analysis we are unable to detect the superiority of MB as compared to FB. More randomized trials with a larger sample size and longer follow-up are needed to evaluate these two kinds of prosthesis.
Level of evidence: Therapeutic Level II.

1. Introduction

Total knee arthroplasty (TKA) using well designed fixed-bearing (FB) prosthesis have been regarded as a reliable choice because of its good medium-term and long-term results [1–3]. Although the long-term wear, loosening, osteolysis and failure in fixation had been documented [4,5], its 10 year survivorship rate is 90% [6]. Mobile-bearing designs were introduced in the United States by DePuy (Warsaw, Indiana) in the 1980s, first with the meniscal-bearing concept, then followed shortly thereafter with the rotating platform design. Mobile-bearing total knee prostheses were designed to provide dual-surface articulation at both the upper and lower surfaces of the polyethylene insert. Highly congruent articulating surfaces result in reducing polyethylene contact stresses and reducing wear on the polyethylene insert. Other design goals include simplifying the surgical procedure because of the self-aligning nature of the implants and providing an improved, more natural prosthetic knee joint with better functional results [7–9], which enable younger patients to have more active lifestyles.

However the available randomized controlled trials comparing FB and MB TKRs suggested no significant differences in regard to prosthesis longevity or function [10,11]. Some published systematic reviews and meta-analyses have not shown the clear superiority of MB prosthesis in clinical outcomes and radiography outcome [12–15]. But controversy regarding the differences of clinical and radiological outcomes between FB and MB TKA exists.

Thus, different from previous reviews, only bilateral TKA were included in this review, in the premise of reducing bias induced by differences in gender, age, weight, status of health, diagnosis, activity level, surgical technique, and observer- and patient-related bias to the greatest degree. Therefore, this meta-analysis was conducted to summarize the best available evidence, and to investigate if there were any differences in range of motion and other important clinical outcomes between MB and FB in bilateral TKA.

2. Materials and methods

2.1. Search strategy

Electronic searches of PUBMED, MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Trials (CENTRAL) in The Cochrane Library, from inception to March 2013, using the search terms “total knee replacement” or “total knee arthroplasty”, and “mobile bearing” or “mobile platform” or “rotating platform”, and “fixed bearing” or “fixed platform”, were performed to identify randomized

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controlled trials (RCTs). Hand searches of bibliographies from published meta-analyses and review articles and proceedings booklets from conferences were also conducted to ensure inclusion of all pertinent studies for the preliminary review. The searches were not limited by language or publication status.

2.2. Eligibility criteria

We only included an RCT that (1) included patients with either osteoarthritis or rheumatoid arthritis undergoing bilateral TKA, (2) compared mobile bearing with fixed bearing prosthesis, and (3) reported clinically relevant results or radiological results.

2.3. Data extraction and quality assessment

Two reviewers (ZD.B. and L.L.) independently extracted data from each study. The data we collected included (1) the characteristics of the study: author, number of patients, type of prosthesis, length of follow-up and loss to follow-up, ratio of male and female, average age, and diagnosis of disease; (2) the characteristics of operative procedure: surgical approach, patellar resurface or not, the way of fixation, how to deal with posterior cruciate ligament (PCL) and surgery procedure; and (3) clinical results and radiological results: American Knee Society score (AKSS), pain score and range of motion (ROM), reoperation, patient satisfaction, complications, and radiolucent lines.

Risk of bias was assessed according to Cochrane Reviewer's Handbook guidelines (version 5.0.1), which included assessments of randomization methods, concealment of allocation, blinding, baseline balance of groups, loss to follow-up, intention to treat analysis, and complete outcome reported. Each item was a question, and the degree of risk was low, moderate and high in accordance with the answer yes, unclear and no. Total risk was decided by the highest risk in six items. Evidence quality was evaluated as high, moderate, low and very low quality according to well described GRADE protocol. Disagreements were resolved by consensus with 3 other investigators (JM.Z., QJ.W., XF.D.).

2.4. Statistical analyses

The meta-analysis was performed by RevMan5.0 software provided by the Cochrane Collaboration. Dichotomous outcomes were analyzed by calculating the relative risk (RR) while continuous outcomes were presented as a weighted mean difference (WMD). A fixed effects model was used to pool data from each trial. The 95% confidence intervals (CI) were presented for each analysis. Statistical heterogeneity was quantified using the chi-square test with significance being set at $P < 0.1$ and I-square (I^2) > 50%. When heterogeneity was present, a random effects model was calculated and a sensitivity analysis was performed by removing individual study from the data set and analyzing the effect on the overall results to identify sources of significant

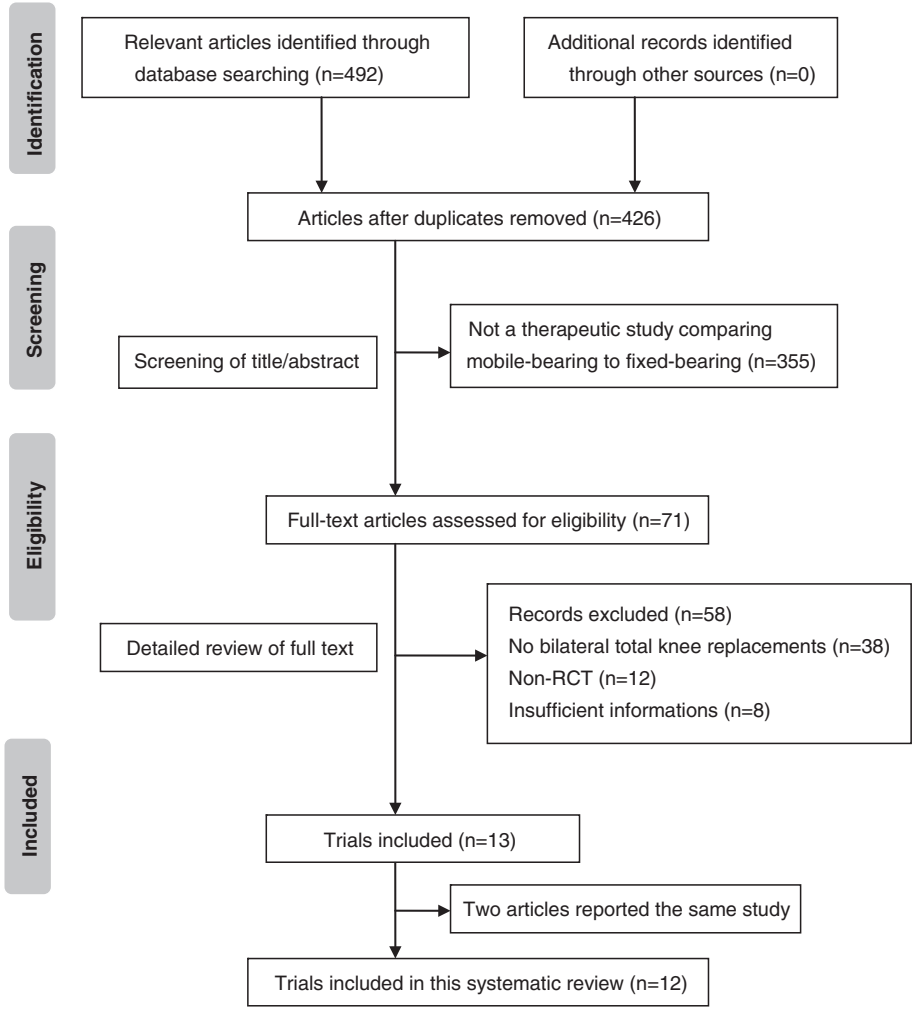

Fig. 1. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.