

Reconstructive Review

Mobile Versus Fixed Bearing Medial Unicompartmental Knee Arthroplasty: A Series of 375 Patients --Manuscript Draft--

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Abstract:	<p>Introduction: We sought to compare outcomes, complications and survival between mobile and fixed bearing medial unicompartmental knee arthroplasty (UKA) in a large multi-surgeon group.</p> <p>Methods: Medical records of patients who underwent a medial UKA were queried between March 2003 and August 2012. Variables investigated included final range of motion (ROM), type of complication, and overall survivorship.</p> <p>Results: 375 medial UKAs were analyzed (308 mobile bearing and 67 fixed bearing). Average time to follow-up was 47 months. Final ROM was comparable (mobile: 1-122°, fixed: 1-120°, $p = 0.34$). Complications occurred in 20/308 (6.6%) mobile bearing UKA and 5/67 (7.5%) fixed bearing UKA ($p = 0.77$). The most common complications in mobile bearing implants were progression of lateral compartment disease and component loosening. The complications in fixed bearing implants were arthrofibrosis and tibial plateau fracture. Overall survivorship differed, but not significantly (mobile: 94.8%, fixed: 96.9%, $p = 0.44$).</p> <p>Discussion: In this largest reported cohort series comparing mobile versus fixed bearing UKA, we found no significant difference in final clinical knee range of motion, rates of complications, and survivorship between the two bearing types.</p>
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Mobile Versus Fixed Bearing Medial Unicompartmental Knee Arthroplasty: A Series of 375 Patients

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Abstract

Introduction: We sought to compare outcomes, complications and survival between mobile and fixed bearing medial unicompartmental knee arthroplasty (UKA) in a large multi-surgeon group.

Methods: Medical records of patients who underwent a medial UKA were queried between March 2003 and August 2012. Variables investigated included final range of motion (ROM), type of complication, and overall survivorship.

Results: 375 medial UKAs were analyzed (308 mobile bearing and 67 fixed bearing). Average time to follow-up was 47 months. Final ROM was comparable (mobile: 1-122°, fixed: 1-120°, $p = 0.34$). Complications occurred in 20/308 (6.6%) mobile bearing UKA and 5/67 (7.5%) fixed bearing UKA ($p = 0.77$). The most common complications in mobile bearing implants were progression of lateral compartment disease and component loosening. The complications in fixed bearing implants were arthrofibrosis and tibial plateau fracture. Overall survivorship differed, but not significantly (mobile: 94.8%, fixed: 96.9%, $p = 0.44$).

Discussion: In this largest reported cohort series comparing mobile versus fixed bearing UKA, we found no significant difference in final clinical knee range of motion, rates of complications, and survivorship between the two bearing types.

Level of Evidence: Level IV, **Type of Evidence:** Therapeutic

Key Words: Unicompartmental knee arthroplasty, mobile bearing, fixed bearing, survivorship

Introduction

The unicompartmental knee arthroplasty (UKA) is a reliable surgical option for patients suffering from unicompartmental arthritis of the knee. As implant design and surgical technique have improved, so have survivorship and outcomes.^{1,2} Although lateral compartment^{3,4} and patellofemoral compartment⁵ arthroplasties have been investigated, the most common unicompartmental arthroplasty is medial.

In medial UKA designs, the bearing surfaces are either mobile or fixed. Proponents of mobile bearings argue that these devices provide superior conformity and improved tibiofemoral biomechanics, thus leading to natural joint motion and low wear rates.⁶ Advocates of fixed bearing implants argue for technical ease in implantation, especially in regards to ligamentous balancing.^{7,8}

Several retrospective and prospective studies have been performed comparing mobile versus fixed bearing components in medial unicompartmental knee arthroplasty.^{7,9,10,11} However, each component group was limited to approximately 20-50 participants. One meta-analysis has compared both designs, with pooled data from each bearing type, with no significant difference found in clinical outcome or complication rate between mobile and fixed bearing designs.¹²

The purpose of this study was to investigate the survivorship and complications between mobile and fixed bearing medial unicompartmental knee arthroplasties in a large multi-surgeon orthopaedic surgery group. Our hypothesis was that no significant differences would exist between the two component designs, in that both types of bearings would have similar survivorship and rates of complications.

Methods

Following institutional board review approval, medical records of all patients who underwent unicompartmental knee arthroplasty (UKA) at our institution using CPT code 27446 from March of 2003 to August 2012 were queried. Inclusion criteria included adult patients who underwent either fixed or mobile bearing UKA for isolated medial compartment arthritis with complete medical records. Lateral and patellofemoral UKA were excluded.

Clinical variables abstracted from charts included sex, age at time of index surgery, and type of component implanted (mobile versus fixed bearing). Postoperative parameters queried included length of follow up and final knee range of motion at the most recent follow up visit. Complications were defined as return trip to the operative room for any reason. Complications were investigated for type of complication, management of complication, necessity of component revision, and time to any component revision from index operation.

Statistical analysis was performed with respect to both groups. Two-tailed Students' t-test and chi-square analysis was used to compare parametric data of patient demographics, knee range of motion, complications, and survivorship. A Kaplan-Meier curve was constructed to compare survivorship using SPSS version 20 (Armonk, NY). A p value of <0.05 was considered to be statistically significant.

Results

From March 2003 to August 2012, 407 unicompartmental knee arthroplasties were performed at our institution by 12 surgeons. Of these, 4 were lateral compartment UKA, three were a patellofemoral UKA, and 25 had incomplete medical records. These patients were

excluded from analysis. This left 375 medial UKAs with complete medical records who underwent full analysis.

Of the 375 medial UKAs that were performed, 308 were mobile bearing and 67 were fixed bearing. All mobile bearing components were Biomet Oxford (Biomet, Warsaw, IN), performed by 10 surgeons. The 67 fixed bearing designs were 37 Genesis (Smith and Nephew, Memphis, TN) performed by 2 surgeons, 22 Journey (Smith and Nephew, Memphis, TN) performed by 2 surgeons, 7 Stryker (Mahwah, NJ) performed by 2 surgeons, and 1 Aesculap (Center Valley, PA) performed by 1 surgeon. All surgeons exclusively utilized mobile or fixed bearing implants except for three. These three performed all mobile bearing except 1 fixed bearing implant case each.

Average age at implantation was similar between both groups (mobile: 62 years, fixed: 59 years, $p = 0.12$). Sex of patients between groups differed, as 58% of mobile bearing UKA patients were female, compared to 70% female fixed bearing patients ($p = 0.06$). Average time to follow up was 46.75 months (45.4 mobile [range 1-68], 48.1 fixed [range 1-75], $p = 0.15$). At final follow up, overall average knee range of motion was 1-122° (1-122° mobile, 1-120° fixed, $p = 0.34$) (Table 1).

Complications occurred in 20/307 mobile bearing UKA (6.5%) and 5/66 (7.6%) fixed bearing UKA ($p = 0.77$). Complications in mobile bearing UKA included progression of lateral compartment disease (7), component loosening (4), bearing dislocation (3), tibial plateau fracture (2), infection (1), arthrofibrosis (1), implant subsidence without fracture (1), and inflammatory synovial disease progression (lipoma arborescens, 1). Complications in fixed bearing UKA included arthrofibrosis (3) and tibial plateau fracture (2).

Overall implant survivorship differed between the two implants, but not statistically (mobile bearing 94.8% vs fixed bearing 96.9%, $p = 0.44$). Component revision occurred in 16 mobile bearing implants. Bearing dislocation resulted in simple polyethylene exchange in 2 cases. The other 14 UKAs required conversion to total knee arthroplasty for the following reasons: progression of lateral compartment disease (4), component loosening (4), tibial plateau fracture (2), infection (1), repeat bearing dislocation (1), component subsidence (1), and inflammatory synovial disease progression (lipoma arborescens, 1). The other four complications underwent return trips to the operating room for manipulation under anesthesia (1) and arthroscopic debridement of lateral meniscal tear and loose body removal (3). In the fixed bearing UKA, 2 cases returned to the operating room for conversion to total knee arthroplasty for tibial plateau fracture, and 3 underwent manipulation under anesthesia for arthrofibrosis. A Kaplan-Meier curve was constructed to portray survivorship (Figure 1).

Discussion

With advances in implant design and surgical technique, unicompartmental knee arthroplasty has evolved as a safe and reliable intervention for patients suffering from unicompartmental knee arthritis.^{1,2} Several previous series have examined outcomes and complications associated with these implants, but their cohort numbers have been relatively low in relation to other arthroplasty literature.^{7,9,10,11}

Proponents of mobile bearing designs argue for a more normal restoration of knee kinematics, which may theoretically translate to better long term knee range of motion. Li et al found this to be false, as both mobile and fixed bearing patients undergoing kinematic analysis had similar ranges of motion.¹¹ In both of our groups as well, patients regained excellent range of

motion, with no statistical significance between the two (1-122° mobile, 1-120° fixed, $p= 0.34$). This also confirms other reports that found no difference in clinical outcomes,¹⁰ but we did not gather any validated functional scores.

Component loosening has been proposed to be one of the leading causes of conversion to TKA¹³. In mobile bearing implants, the motion and shear force transmission from the mobile bearing interface should theoretically lead to low rates of component loosening. In one of the largest comparative series, Emerson found a higher rate (16%) of loosening from tibial components in fixed bearing than in those with mobile implants (2%).⁹ In our series, the rate of loosening of mobile components was similar ($4/307 = 1.3\%$), however, none of our fixed bearing implants showed evidence of loosening at 4 year follow-up.

Some authors have argued that the mobile bearing implants may lead to earlier lateral compartment disease progression,⁹ and we have found this to be the case in our series. Four patients with mobile bearing devices required conversion to total knee arthroplasty, while none in the fixed bearing group were revised for progression of lateral compartment disease.

Tibial plateau fracture is also another known complication of UKA, and can occur intraoperatively, or is detected in the postoperative period.¹ We detected four tibial plateau fractures, with 2 in each group, and all were discovered in the postoperative period.

Several studies have reported survivorship rates of both mobile and fixed bearing implants. In fixed bearing implants, survivorship at 10-13 year has consistently been reported as 91-96%.^{1,13,14,15} Overall survivorship in mobile bearing implants has been reported at 85-98% at 10 year follow up.^{9,16} Our survival rates of mobile bearing 94.8% and fixed bearing 96.9% are consistent with these literature reports.

Several limitations exist in this study. First, the retrospective design leads the study to incomplete data and inherent biases. Second, we did not collect any validated functional outcome measures on these patients, which may have helped to better differentiate patient satisfaction and clinical outcomes. Third, a large proportion of our data is from mobile bearing implants, which was due to surgeon preference and outside the control of this retrospective review. A prospective matched data set may have more precisely defined differences between the two implant designs. Additionally, the groups are not matched in that a higher percentage of fixed bearing patients were female. Finally, the number of different surgeons and surgeon experience may play a confounding role in the heterogeneity of the data; however, this is representative of a multi-surgeon group and reflects modern practice.

In conclusion, we present the largest single series examining complications and survivorship between mobile and fixed bearing medial unicompartmental arthroplasties. No significant differences were found to exist between these two implants. Further studies which are prospective in nature and incorporate validated functional scores may be used corroborate these findings.

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References for Figures and Tables

Figure 1. Kaplan-Meier survivorship curve comparing mobile and fixed bearing unicompartmental knee arthroplasty

Table 1. Patient demographics, clinical outcomes, complications and survivorship between mobile and fixed bearing unicompartmental knee arthroplasty

Fig 1

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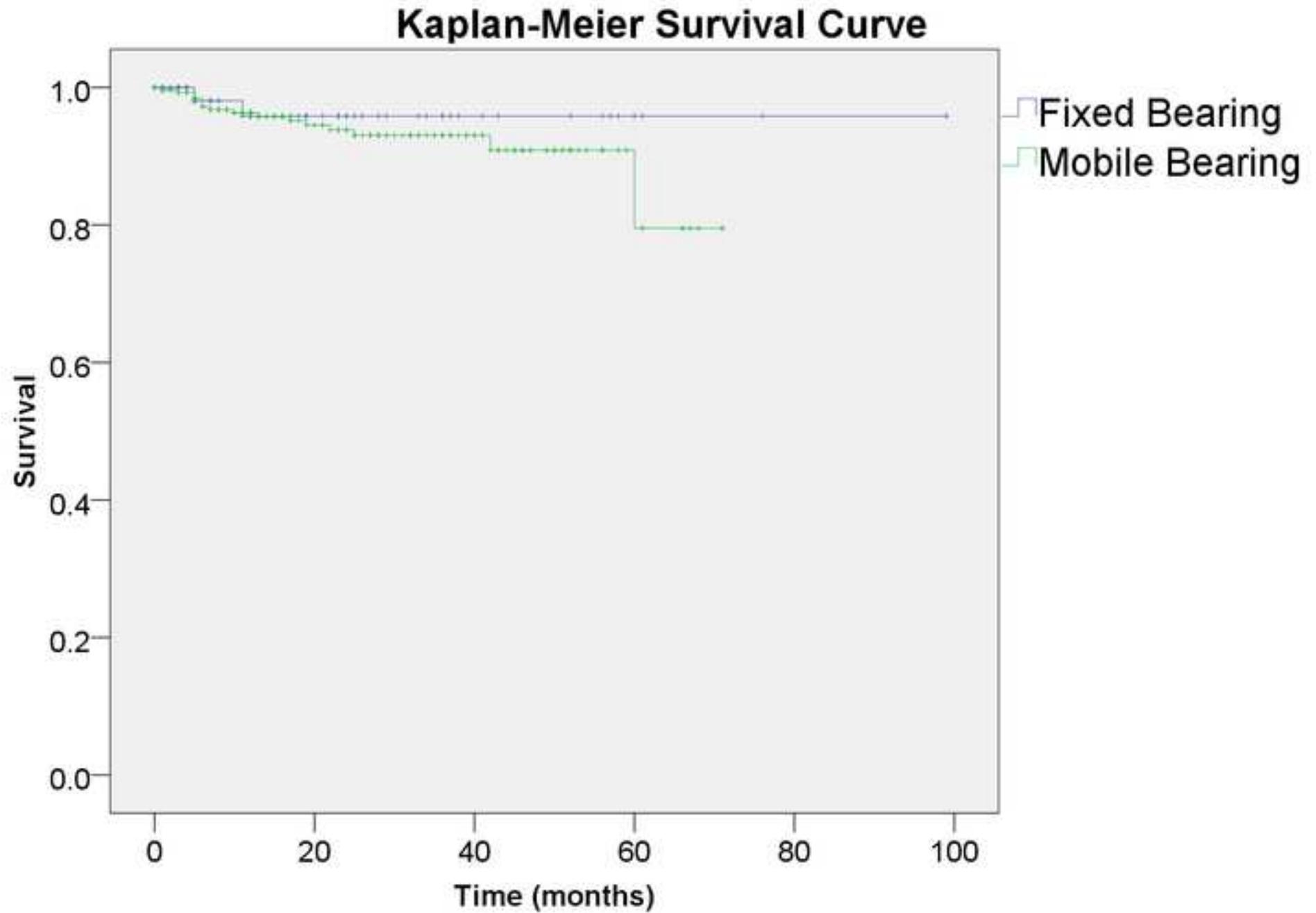


Table 1.

Patient demographics, clinical outcomes, complications and survivorship between mobile and fixed bearing unicompartmental knee arthroplasty

	Mobile	Fixed	p-value
Age at implantation (years)	62	59	0.12
Female patients (%)	58	70	0.06
Time to follow-up (months)	45.4	48.1	0.15
Average knee range of motion (degrees)	1-122	1-120	0.34
Complications (%)	6.5	7.6	0.77
Overall survivorship (%)	94.8	96.9	0.44