Comparison of fixed-bearing and mobile-bearing total knee arthroplasties: Short-term clinical results

Burak Kaymaz1, Cihan Sevinçhan2, Umut Hatay Gölge3, Gürdal Nusran1, Ferdi Gökse3, Erkam Kömürücü1, Mehmet Eroğlu3

1 Department of Orthopaedics and Traumatology, Çanakkale Onsekiz Mart University, Medical School, Çanakkale, Turkey
2 Department of Orthopaedics and Traumatology, Mardin Kızıltepe State Hospital, Mardin, Turkey
3 Department of Orthopaedics and Traumatology, Afyon Kocatepe University, Medical School, Afyon, Turkey

Abstract

Objectives: Mobile-bearing knee replacements were introduced as an alternative to fixed-bearing prosthesis to decrease the wear. Despite theoretical advantages of mobile bearings prosthesis, it is still controversial whether there is any clinically significant difference between the patients treated with fixed and mobile bearing prosthesis. The aim of this study is to compare the short-term clinical outcomes of fixed versus mobile-bearing prostheses.

Methods: Patients who were diagnosed as grade 4 gonarthritis and operated for total knee arthroplasty between years 2010-2014 were evaluated and 33 patients (40 knees) were included in the study. From hospital medical and radiological databases, age and gender of the patients, duration of operation, number of blood transfusions postoperatively and pre-operative range of motions (ROM) of the operated knees were recorded and all the patients were assessed with Knee Society Knee Score.

Results: Twenty-two knees (12 female, 10 male) were present in fixed bearing group (Group I) and 18 knees (13 female, 5 male) were present in mobile bearing group (Group II). There was no statistically significant difference between the groups in terms of pre-operative range of motions (ROM), post-operative range of motions (ROM), number of blood transfusions. Knee Society Knee Score was 167.7±23.4 in Group I and 178.1±22.4 in Group II. Mobile bearing prosthesis group was found to have better knee score and this difference was near to statistically significance (p=0.055).

Conclusions: Clinical outcomes of mobile bearing prosthesis seems to be better in short-term follow-up but long-term results should also be investigated before recommending the mobile bearing prostheses.

Keywords: knee prosthesis, mobile bearing, clinical outcome, fixed bearing.

Introduction

Total knee replacement is the gold standard treatment for end-stage knee arthritis today. But loosening and wear are two important problems and have emerged as the two most decisive factors influencing the longevity of knee prostheses. So that studies are presently focused on increasing the bone fixation and minimizing wear. One way to enhance this is to improve the stress distribution between the femoral and tibial components. Traditionally, the polyethylene-bearing surface is fixed to the tibial component. This has been used successfully in total knee replacement surgery with survival rates over 90% at a minimum 10-year follow-up (1-3). However, retrieval studies of fixed-bearing implants have identified high grade wear patterns (4) including delamination, pitting and scratching (5). To decrease the contact stresses (6, 7) and wear, mobile-bearing knee replacements were introduced as an alternative to fixed-bearing prosthesis (8). This type prosthesis design allow movement of the polyethylene insert relative to the tibial tray and this has been shown to result in less wear and subsequently less polyethylene-induced osteolysis (9) as well as decreasing patello-femoral contact stresses (10). Although these theoretical advantages of mobile bearings prosthesis have been reported, it is unclear whether there is any clinically significant difference between the patients treated with fixed and mobile bearing prostheses.

The aim of this study is to compare the short-term clinical outcomes of fixed versus mobile-bearing prostheses retrospectively.

Materials and Methods

A consecutive series of patients who were diagnosed as grade 4 gonarthritis and operated for total knee arthroplasty between years 2010-2014 were evaluated. The patients who had complete medical and radiologic records, with minimum one year follow-up were investigated. There were 53 patients (63 knees) operated for total knee arthroplasty with at least one year follow-up. PCL substituting prostheses were inserted in 20 patients (23 knees).
and PCL retaining prostheses were inserted in 33 patients (40 knees). Because the outcomes of fixed versus mobile-bearing prostheses were aimed to be compared, it was mandatory to exclude the effect of PCL substituting/retaining prosthesis design, so that the group with more patients that was PCL retaining group with 33 patients (26 female, 7 male) were included in the study. From hospital medical and radiological databases, age and gender of the patients, duration of operation and pre-operative range of motions (ROM) of the operated knees were recorded. And then these patients were called for control to the hospital and assessed with Knee Society Knee Score. The Knee Society clinical rating system has a separate knee score with 50 points for pain, 25 points for range of motion, and 25 points for stability. Points are deducted for flexion contracture, extension lag, and malalignment. A separate patient function score assigns 50 points for stair climbing and 50 points for walking distance, with deductions for walking aids. Direct radiographies of the operated knees of the patients were also taken and assessed in terms of radiolucency and osteolysis.

**Statistical Analysis:**

Statistical analysis was performed with the Statistical Package for Social Sciences version 19.0 (IBM Corp. Released 2010; IBM SPSS Statistics for Windows, Version 19.0 Armonk, NY; IBM Corp.). The normality of the continuous data was determined by the Shapiro wilk test and Mann-Whitney-U test was used in order to compare the groups. Differences were considered to be significant at p<0.05 for all tests (two-tailed).

**Results**

Twenty-two knees (12 female, 10 male) were present in fixed bearing group (Group I) and 18 knees (13 female, 5 male) were present in mobile bearing group (Group II). Mean age was 67.4±6.6 years in group I (54 to 80 y) and 66.0±5.8 years (55 to 75 y) in group II. Mean follow-up time was 23.2±9.3 months in group I (12 to 38 months) and 18.2±4.6 months (12 to 26 months) in group II. There was no statistically significant difference between the groups in terms of age and mean follow-up time.

In Group I, ROM of the knee joint improved from 87.9±10.5 degrees to 111.5±13.9 degrees and from 88.3±8.4 degrees to 114.8±11.1 degrees in Group II. Statistically significant difference was observed in both groups in terms of preoperative and postoperative ROMs (p<0.05).

Knee Society Knee Score at the last control was 167.7±23.4 in Group I and 178.1±22.4 in Group II. Mobile bearing prosthesis group was found to have better knee score and this difference was near to statistically significance (p=0.055).

There was no statistically significant difference between the groups in terms of pre-operative range of motions (ROM), post-operative range of motions (ROM), number of blood transfusions. But the mean operation time of Group II (122.3±5.2 minutes) was higher than Group I (115.2±7.7 minutes) and a statistically significant difference was determined between the groups in terms of operation time (p=0.002). (Table 1).

Assessment of the radiographies revealed that there was no loosening of the implants in both groups in short term follow-up and none of the patients needed revision surgery in this period (Figure 1).

**Discussion**

Mobile bearings are designed to allow movement of the polyethylene insert relative to the tibial tray so that reduce the loosening forces at the bone-implant interface and has been shown to result in less wear (9). Despite the theoretical advantages of using mobile bearings, previous comparative studies have identified little or no clinical benefit of using a mobile bearing. Kim et al. have studied simultaneous fixed and mobile-bearing knee replacements in the same patient and have found that total knee score, pain score, mean functional score and range of motion to be comparable in both groups 6 years post-operatively (11). Longer-term follow-up (13.2 years) confirmed

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age (years)</th>
<th>Follow-up time (months)</th>
<th>Pre-op ROM (degrees)</th>
<th>Post-op ROM (degrees)</th>
<th>Operation time (minutes)</th>
<th>Knee score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed bearing group</td>
<td>67.4±6.6</td>
<td>23.2±9.3</td>
<td>87.9±10.5</td>
<td>111.5±13.9</td>
<td>115.2±7.7</td>
<td>167.7±23.4</td>
</tr>
<tr>
<td>Mobile bearing group</td>
<td>66.0±5.8</td>
<td>18.2±4.6</td>
<td>88.3±8.4</td>
<td>114.8±11.1</td>
<td>122.3±5.2</td>
<td>178.1±22.4</td>
</tr>
<tr>
<td>P=0.54</td>
<td>P=0.14</td>
<td>P=0.91</td>
<td>P=0.47</td>
<td>P=0.002</td>
<td>P=0.055</td>
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</tbody>
</table>
similar outcomes in these 2 groups (12). Price et al. compared the fixed-bearing tibial component, with the mobile-bearing prosthesis and found slightly better knee and pain scores within the mobile-bearing group at 1 year. (13). McGonagle et al found no difference in terms of ROM, knee and pain scores between the fixed and mobile-bearing knee groups at 5 year follow-up (14). Hanson et al again found similar clinical outcomes in both groups (15). A meta-analysis and systematic review carried out by Smith et al. reviewed randomized controlled trials comparing clinical outcomes of fixed and mobile-bearing prosthesis and found no significant difference in Knee Society Scores, Hospital for Specialist Surgery Scores or range of motion between the 2 groups (16).

In our study, mobile bearing prosthesis group was found to have better knee scores. Although the difference was still statistically insignificant, we think that it was because of the limited patient number. P value was found to be 0.055 and it was near to statistically significance. By increasing the number of the patients, it could be possible to obtain a significant difference. This result was similar to short term results of Price et al who found better clinical outcomes in 1 year follow-up. Also mean operation time was found to be longer in mobile bearing prosthesis group. We think that this is because the surgeons are more accustomed to fixed bearing prosthesis surgery so that surgery time is shorter.

The main drawback of our study is the limited patient number as we mentioned above and short duration of follow-up. Also retrospective design of the study may be limitation.

**Conclusion**

In conclusion, the primary findings of this study suggest that clinical outcomes of mobile bearing prosthesis seems to be better in short-term follow-up but operation time increases in this group. Also long-term results should also be investigated before recommending the mobile bearing prosthesises instead of fixed bearing prosthesises.

**Figure 1.** Anteroposterior and lateral knee joint radiographies of a patient (Right knee with mobile bearing prosthesis and left knee with fixed bearing prosthesis).

**References**


