Can We Predict Kneeling after Knee Replacement?

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Abstract

Background: Over 90,000 knee replacements are performed annually in the NHS in increasingly younger patients with high functional demands. Patient satisfaction following this surgery continues to vary. Kneeling is a basic human function and is required in certain employment, religious worship, as part of cultural norms and in pursuit of recreation and routine daily activity. This study set out to identify simple patient factors that could predict kneeling in patients undergoing either total (TKR) or partial knee replacement (PKR). Materials and Methods: 162 patients (80 TKR, 82 PKR) were identified from the departmental database. Factors assessed included; range of movement, body mass index (BMI), oxford knee score (OKS) and kneeling ability (question 7 of OKS). Correlation and regression analysis were performed to identify association and prediction of kneeling at 12 months follow up. Results: Kneeling ability and overall function improved in both groups. Preoperative kneeling ability, BMI, comorbidity and postoperative range of movement correlated most closely with final kneeling ability in the TKR group. Similar findings were demonstrated in the PKR group. Successful kneeling after knee replacement was best predicted by the ability to do so preoperatively. Fixed flexion deformity negatively predicted kneeling after PKR. Conclusion: Tailoring preoperative counselling to the individual patient is vital. The use of a simple preoperative ability to kneel or the presence of a fixed flexion contracture may aid the treating surgeon to better inform of postoperative kneeling to an individual patient considering knee replacement surgery.

Keywords: Total Knee Replacement; Partial Knee Replacement; Kneeling ability; Knee Scores.

Introduction:

Symptomatic knee arthritis represents a significant world health challenge. At present, the lifetime risk of the developing painful knee arthritis is 45%, increasing to 60% in obesity. In the UK, this disease burden is reflected in the present volume of 90000 total knee replacements and 8,000 partial knee replacements performed annually on NHS patients. Of these, a third are younger than 65, the fastest expanding group requiring knee arthroplasty (1).

Knee replacement continues to increase annually in the developed world and at current pace, data from the USA suggests an increase of 600% in knee arthroplasty within the next twenty years (2). Patient reported satisfaction following knee replacement varies considerably and is not as high as following total hip arthroplasty (3). Rates of dissatisfaction after knee replacement are reported from between 20% to greater than 40% especially in younger individuals (1,4,5) often due to lingering pain and stiffness.

Our department uses the Oxford Knee score to capture patient satisfaction, one of several patient-reported outcomes measures (PROM) available. The
OKS has been shown to be the most site and disease specific tool in the assessment of outcomes following knee arthroplasty (2,6).

Kneeling is a fundamental human function and at its most basic, represents a transition point when moving from standing to lying down (3,7). Beyond this basic role, kneeling can be mandated as part of daily working life, in the pursuit and enjoyment of recreation as well as in many forms of religious worship and as part of floor-based cultures where significant time is spent in deep flexed kneeling. Kneeling after knee replacement is under represented in the literature. It has been demonstrated to be less achievable than the more consistent pain relief expected from arthroplasty (8). It has also been suggested that overall, men are better kneelers than women as well those who have had partial (PKR) rather total knee replacement (TKR) (8,9). In light of a rapidly increasing demand for knee replacement surgery, often in younger, heavier individuals who want to remain active and employable, the ability to counsel patients on their ability to kneel, as part of the more general functional attainment is important.

In this study we used pre and postoperative clinical assessment findings along with the Oxford knee score to investigate factors that might correlate to and predict postoperative kneeling ability in both TKR and PKR at one year follow up.

Materials and Methods

The departmental database was used to identify all participants. All patients who had received either a total or partial knee replacement between 2012 - 2014 were identified. These dates permitted a minimum of 12-month clinical follow up of all suitable patients. Patients were selected sequentially from January 2012 onwards. Two consultants of similar clinical experience and scope of practice operated on all patients in both study groups.

All TKR implants were cemented, P.F.C -Sigma rotating platform (RP) (Deputy Synthes, UK). All PKR implants were (medial) tibiofemoral compartment Oxford Partial Knee mobile bearing system (Biomet, UK). Implant alignment was assessed on postoperative weight-bearing Anteroposterior and lateral radiographs using the “Synapse” Picture Archiving and Communication System (PACS (Fujifilm Global)). Normal alignment of TKR and PKR was based on previously published work (10-12).

The study end point was defined as time elapsed in months from day of surgery to first routine annual outpatient clinical review. Minimum follow up was 12 months (12 -14). Patients who were discovered to have subsequently died were excluded. Patients who underwent revision knee surgery (any cause) in this time period were excluded. Patients who had previous PKR revised to TKR in this time period were excluded. Implants whose alignment was beyond normal range listed were excluded. The study was powered at p 0.8 a 0.05 based on previous literature (8) and a minimum sample size of 46 in TKR and 51 in PKR group respectively was generated. Following exclusions, a sample size of 162 patients (82 PKR, 80 TKR) was identified. TKR and PKR patients were both investigated to represent routine clinical practice.

Comparison between groups was not explicitly intended considering the aim of the study and the inherent differences between cohorts in the general population. Any differences between groups were highlighted for academic interest. The electronic version of individual clinical notes for each patient was obtained and analysed. Data was taken from multiple sources including the outpatient medical notes, pre-operative assessment record, operation note and the anaesthetic chart. Data was collated on Microsoft Excel 2007 as shown below. The OKS was assessed both pre-operatively and at 1-year review. Question 7 of the OKS pertains to kneeling ability.

Statistical analysis was performed using SPSS v21 (IBM). Data was first assessed for normal distribution using the Shapiro -Wilk test and Q-Q plots. The measures of central tendencies are described appropriately according to the distribution of the data. Parametric data is described using mean and range and non-parametric data is described with medians and interquartile ranges. The level of significance was deemed to be p<0.05. Student T- test/ANOVA
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(p-parametric) and Chi-squared tests (non-parametric) were used to assess differences between groups as appropriate. Correlation was assessed using Pearson’s moment correlation. Regression was assessed using multivariate analysis.

32 males and 50 females were in PKR group and 38 females and 42 males in TKR group. BMI and age were significantly higher in TKR group (p<0.05). Both groups reported similar knee function and kneeling ability. The pre and post-operative data for TKR and PKR are shown in tables 1 & 2 respectively.

**Results**

Regression modelling was performed for all pre-operative factors. For TKR preoperative ability to kneel was the best predictor of postoperative kneeling ability (coefficient 0.60, p=0.04) For PKR, pre-operative ability to kneel was a positive predictor (coefficient 0.59, p=0.02) and fixed flexion deformity was a negative correlation predictor (coefficient -0.73, p=0.16) of postoperative kneeling ability (Tables 3&4)

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<th>Factor</th>
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<td>Post op ROM</td>
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<td>Number of comorbidities</td>
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<td>0.05</td>
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<tr>
<td>Pre-op BMI</td>
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<tr>
<td>Pre-op OKS Q7</td>
<td>+ 0.24</td>
<td>0.03</td>
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<td>0.01</td>
</tr>
<tr>
<td>Pre-op OKS Q7</td>
<td>+ 0.21</td>
<td>0.05</td>
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<tr>
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Table (1) TKR pre and post-operative data

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<td>0.02</td>
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Table (2) PKR pre and post-operative data

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<tr>
<td>ROM</td>
<td>120 (20)</td>
<td>2.5 (15)</td>
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<tr>
<td>Total OKS</td>
<td>17.5 (36)</td>
<td>22.1</td>
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<tr>
<td>Knee OKS</td>
<td>0.2 (2)</td>
<td>2 (5)</td>
</tr>
</tbody>
</table>

Table (3) TKR Post-operative Kneeling correlation

Table (4) Post-operative Kneeling correlation – PKR
Data Point | Units/scale
---|---
Age | years
Sex | M/F
BMI | 0-50
Pre-operative range of movement | degrees
Pre-operative fixed flexion deformity | degrees
Pre-operative oxford knee score | 0-48
Pre-operative Question 7 OKS | 0-4
Implant used | TKR/PKR
Post-operative range of motion | degrees
Post-operative oxford knee score | degrees
Post-operative Question 7 OKS | 0-4

Discussion

Reported Kneeling ability and global knee function improved in both cohorts. TKR patients reported a marginally greater improvement in overall function from base line whilst PKR reported similarly superior improvement in kneeling ability. Correlation (Pearson) coefficients were investigated for age, sex, BMI, preoperative fixed flexion deformity, preoperative OKS, preoperative kneeling ability (OKS Q7) as well as range of motion for both TKR and PKR. In the TKR group, significant correlations were found between worsening postoperative kneeling ability and raised BMI, which supports previous conclusions in the literature (13,14). Patients with a high BMI especially those who carry a large amount of subcutaneous fat around the knee inevitably require greater soft tissue dissection in order to gain adequate access to the knee joint. As a consequence, skin sensation may also be altered (15) and maximal flexion blocked by posterior fat in the distal thigh/proximal calf which will all contribute to a reduced likelihood of kneeling.

Significant correlation was found between pre and postoperative kneeling ability in the TKR patients. Similar correlations were found in the PKR group. Regression analysis demonstrated that for TKR patients; the strongest positive predictor of kneeling at 1 year was the ability to kneel preoperatively. Similarly, for PKR patients it was found that preoperative kneeling ability was most closely predicted kneeling at 1 year but in addition to this, the presence of any preoperative fixed flexion deformity was found to be the most significant negative predictor of kneeling.

We are unable to find other published work predicting this outcome after knee arthroplasty. We suggest that because the reasons for an ability (or lack thereof) to kneel are intricate and multifactorial, the surgical intervention of knee replacement itself is unlikely to be the most important determining factor. As such we suggest that basing surgical prediction of kneeling on a patient’s preoperative ability to achieve it is a considered approach.

Conclusion

The use of simple preoperative ability to kneel and assessment of a fixed flexion contracture may aid the treating surgeon to better inform of postoperative kneeling to an individual patient considering knee replacement surgery.

Funding - Nil received

References

2. Kurtz S, Ong K, Lau E, Mowat F, Halpern M.
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