**Cementless Oxford Mobile Bearing Medial Unicompartmental Knee Replacement: A Minimum Five Year Follow-Up from a Non-Design Centre**

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**Highlights**

* Survival at a mean follow-up of eight years is 94.5%
* Median Oxford Knee Score at eight years was 42 (where 48 is the best score, equivalent 87.5%)
* The most common reason for early failure was tibial in origin – subsidence, fracture and malalignment.

**Abstract**

**Purpose**: Unicompartmental knee replacement (UKR) has well documented benefits over Total Knee Replacement (TKR) in the treatment of anteromedial osteoarthritis of the knee. There has been an increasing move from cemented to cementless UKR over the last decade. This non-design centre study looks at our early experience with the cementless Oxford medial partial knee replacement and provides medium term revision data as well as Patient Reported Outcome Measures (PROMs).

**Methods**: A cohort of 200 consecutive patients undergoing medial UKR using the cementless Oxford were identified. Cases were performed in a single centre under the care of one of four consultant knee surgeons. All patients were beyond the five year minimum timepoint following UKR surgery in order to produce medium term results at a mean of 7.9 years. Patients were identified from our knee group prospectively collected database following clinical governance approval for this study. Patients with less than five years post-operative follow-up were excluded. Eligible patients completed a postal questionnaire to collect PROMs: Oxford Knee Score, WOMAC and modified American Knee Society Score questionnaires in January 2020 and had their clinical records reviewed.

**Results**: Our study shows survivorship of 94.5% at a mean follow up of 7.9 years following surgery. There were 11 failures in total with a three percent risk of re-operation within the first 18 months following surgery. There was a sustained improvement in Oxford Knee Score being nearly 20 points higher than pre-op scores.

**Conclusions**: Our results provide further evidence that partial knee replacements using the cementless Oxford provide good subjective outcomes as well as survivorship. Whilst there may be a learning curve associated with learning new instrumentation, our revision rates are similar to those published in the National Joint Registry. This provides evidence of good clinical and survivorship outcome with partial knee replacement of the medial tibiofemoral joint using the Oxford uncemented mobile bearing implant.

**Level of Evidence**: III

**Keywords**: Unicompartmental Knee Replacement, Medial Mobile Bearing Cementless, Partial Knee, Oxford Microplasty,

**Introduction**

End stage anteromedial arthritis of the medial compartment of the knee can be treated with either unicompartmental knee replacement (UKR) or Total Knee Replacement (TKR), with increasing numbers of surgeons opting for UKR due to the improved functional outcomes, lower morbidity, mortality and shorter length of stay (1–4). Whilst UKR has been shown to result in a higher revision rate than TKR (5,6), UKR has demonstrated superior Patient Report Outcome Measures (PROMs) when compared to TKR (2,7). In addition, from a health economics perspective, UKR is cheaper and represents a more cost-effective treatment option when compared to TKR (1).

The New Zealand registry (where PROM scores are recorded in addition to revision data) shows that a patient with a very low Oxford Knee Score (OKS) (<20) was more likely to be revised early (less than six months post-operatively) than a TKR with the same OKS (63% revision rate in UKR vs 12% in TKR). This difference is believed to come from surgeons’ perception of the ease of revision of a UKR to TKR or a concern regarding incorrect patient selection at the primary arthroplasty(8).

UKR surgery has become increasingly common in the United Kingdom, representing 10% of all knee arthroplasties in 2017, the first time in double figures, and has continued to increase, representing 11.5% of all arthroplasties in 2019 (5). This increase in trend of UKR has also been reflected in other countries, with a rapid rise in many countries such as Denmark where 1317 UKRs were performed in 2016 (approximately 20% of all knee arthroplasties) compared to a total of just 81 UKRs in 2000 (approximately 3% of all knee arthroplasties) (9).

There has also been a growing level of interest in cementless implants amongst UKR surgeons. Cementless implants were introduced in order to improve fixation, as aseptic loosening and pain are the most common indication for revision of a UKR in the National Joint Registry (NJR) (5). Cementless implants help overcome this issue due to their osteointegration, perhaps accounting for the superior survivorship compared to their cemented counterparts in many series (10–12). Cementless or hybrid tibiofemoral UKRs now represent 2.0% of all knee arthroplasties in the NJR (5).

Cemented implants have long been seen as the gold standard in knee arthroplasty, with less tibial component migration in cemented TKR implants found in a Cochrane review when compared to cementless implants (13). However, the tibial component of a mobile-bearing UKR is subject to virtually exclusively compressive forces, unlike TKRs which are subject to rocking and shear forces. This makes cementless implants more attractive in mobile bearing UKRs in terms of osteointegration (14). In addition, the other theoretical benefit of cementless fixation is the reduction in the potential for third body wear due to loose cement.

Our unit is a high volume centre for UKRs and first started using cementless Oxford mobile bearing UKR (Zimmer Biomet, Bridgend, UK) in 2009. We investigated our initial experience with the cementless Oxford including our learning curve, moving over from the cemented phase III Oxford. Survivorship was our primary outcome measure and PROM data at a minimum of five years follow-up as secondary outcome measures.

**Patients and Methods**

All patients who had a UKR using the Cementless Medial Oxford that were a minimum of five years following their surgery were included in this study. Data collection started when the implant was first introduced in our department in 2009 and data was collected prospectively. The project was registered as a Service Evaluation with our Clinical Governance Department (CE84683).

Patients who had surgery after December 2014 were excluded to ensure a minimum of five years of follow-up. All procedures were performed under the care of one of four Consultant knee surgeons by either Consultant or trainee surgeons. At the time of the study not all surgeons were using the cementless Oxford exclusively for their partial knee replacements. No patients were excluded who had an uncemented Oxford implanted between April 2009 and the end of December 2014.

The primary outcome measure was implant survivorship and secondary outcome measures were PROM scores in the form of Oxford Knee Score (OKS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and a modified American Knee Society Score (mAKSS). The American Knee Society Score is modified in our unit to exclude some of the clinical scores in order to allow the score to be completed virtually by the patients. Postal questionnaires of PROM scores were sent out and collected between January and October 2020 giving a range of follow-ups, with all patients being at least five years post-surgery providing medium term results. Non-responders received one telephone call to maximise data collection. Patient demographics and their most recent clinical review letter relating to their knee replacement were recorded.

Any patient who underwent re-operation was considered a failure for the purposes of analysis and was thus withdrawn from subsequent timepoint analyses. A survival analysis was performed at 12 monthly intervals. A chi-squared analysis was used to assess variations between side and gender and a Pearson chi-squared analysis was used to assess for variation between the risk of revision and age.

**Results**

There were 200 UKRs performed between April 2009 and December 2014. The four consultant surgeons involved fell into the ‘high volume’ UKR users category, each performing above the recommended minimum of 13 cases per year and 20% of total arthroplasty cases deemed necessary for competence (15–17).

The average age at time of surgery was 61.4 years (39-82) with a mean follow-up of 7.9 years. 102 (51%) were right sided procedures and 91 (46%) of the UKRs were performed in females. 16 (8%) patients had died prior to PROM data collection but were included in the survival analysis. No deaths were related to the surgery and none of these patients had required a re-operation. Of those who died the range was 11 months post-surgery to 10 years with a mean mortality of 4.4 years post-surgery.

There were 11 patients of the 200 (5.5%) who required re-operation, with six (3%) of these being within the first 18 months after implantation. Following this the re-operation rate reduced and is in keeping with that seen in the NJR. Overall survivorship was 94.5% at 7.9 years. Table 1 shows the lifetable in our series and Figure 1 shows the cumulative survival curve.

More than half of the re-operations in our series were within the first 18 months as shown in Figure 2 In the majority of cases the reason for failure was tibial in origin. Overall, there were two tibial fractures, one tibial component that was mal-positioned requiring early revision and one tibial base plate subsidence. In addition to these there was one bearing dislocation and one case of infection.

Figure 2 shows all failures in our series. In addition to the early re-operations discussed above there was a further tibial subsidence in a patient on long term steroids, two further bearing dislocations and two patients who developed disease progression within the medium term requiring conversion to total knee arthroplasty.

Out of the 11 cases that required re-operation, the majority were revised to a total knee replacement, see Figure 3. One patient was treated with a bearing exchange (up-sized) only following a bearing dislocation. There were two additional patients who had sustained a bearing dislocation, one was treated with a revision to a TKR, the second with a manipulation followed by a subsequent bearing exchange prior to being revised to a fixed bearing tibial component (Vanguard M [Zimmer Biomet, Swindon, UK]). The early case of infection was treated with debridement washout and revised to an all-poly cemented Uniglide, [Corin Group, Cirencester, Gloucestershire, U.K.]). The remaining cases were all revised to TKRs: one of the fractures required a complex primary using a medial tibial plate and a stemmed tibial component with a medial tibial augment, five patients required a TKR with a tibial stem and two patients had standard non-stemmed primary implants.

As expected, there was no difference in re-operation rate between side of surgery or gender. Age did not affect survival in our cohort, see Table 2. If we combine “Died (in situ)” and “Alive (in situ)” then in our series it appears to show that revision rates are not greatly age dependent (Chi-square = 0.261, p = 0.904).

With regard to PROM data, out of the 200 patients eligible, the 11 patient who had re-operations were excluded,16 patients had died by the time of the study, and a further 39 patients did not respond to their questionnaires resulting in data from 134. Summary descriptive data for PROM data are given in Table 3. Pre-surgery and one-year follow-up data show statistically significant improvement in mean Oxford Knee Score (mean improvement 18.8, 95% CI 16.5 to 21.2, p < .001), a statistically significant improvement in mean American Knee Score (mean improvement 75.8, 95% CI 68.5 to 83.0, p < .001) and statistically significant improvements in mean WOMAC (mean improvement 18.0, 95% CI 15.5 to 20.5, p < .001). Pre-surgery and 8-year follow-up show statistically significant benefits in mean Oxford Knee Score (mean improvement 18.0, 95% CI 15.7 to 20.4, p < 0.001), a significant improvement in American Knee Score (mean improvement 67.7, 95% CI 59.7 to 75.2, p < .001) and in mean WOMAC (mean improvement 16.2, 95% CI 13.8 to 18.6, p < .001). Between 1-year post-surgery and 8-year post-surgery there were small non-significant changes in mean Oxford Knee Score (p = 0.552), mean American Knee Score (p = 0.078) and mean WOMAC (p = 0.174) as given in Table 3.

**Discussion**

Our overall survivorship is similar to those in the NJR report however we did experience a higher revision rate in the early post-operative period. This is likely to represent our unit’s learning curve with the cementless Oxford UKR, as this re-operation rate was not seen at any other time period after the initial 18 months of the study.

Our study showed no difference between age and failure rate, this has differed from a registry study by Gupta et al. They reviewed registry data for over 8700 Oxford-III UKRs from New Zealand and found that uncemented UKRs have superior implant survivorship compared to their cemented counterparts. This was in specific age groups and genders, with superior survivorship in the cementless groups in women under 65 years old and men aged 50-74 years (10).

The trend for lower revision rates in cementless UKR implants when compared to cemented counterparts seems to be supported by our study as well others previously published. Mohammed et al. found the cementless Oxford UKR to have a statistically lower revision rate compared to its cemented counterpart. This was the case in all causes for revision except peri-prosthetic fracture, which was higher in the uncemented group (11). A further registry study from the NJR also confirmed that uncemented Oxford UKR conferred a reduced revision rate for all causes by a quarter, irrespective of the volume of UKR cases performed by the surgeon (12). Another non-design centre study using the cementless Oxford has shown good survivorship, with 95.7% survival at five years, compared to our 94.5% at eight year. They also showed similar PROM scores to the data in our cohort with a median OKS of 43 at five years vs 42 at 8 years in our cohort (18).

The design centre in Oxford have published the results of their first 1000 cementless Oxfords. They have shown excellent survivorship at 96.6% at ten years. They also investigated the radiographic features in the cementless Oxfords, finding that the frequency of radiolucent lines under the tibial component was less of a feature than those in the cemented group (19). This evidence supports the introduction of the cementless implant to address concerns over aseptic loosening.

Those patients undergoing revision in our series were more likely to end up with stemmed implants than a primary TKR design. This differs from a previous study looking at revision from UKR to TKR. Jonas et al. found in a cohort of 45 patients undergoing revision from UKR to TKR only a third of patients required tibial stems. They also found no statistical difference in Oxford Knee Scores compared to an age, BMI and arthroplasty life matched cohort of primary TKRs (20). The reason for the difference in rates of stems required in our cohorts is unclear. It may represent a difference in implants used or modes of failure in the cementless UKRs.

**Conclusion**

Thisstudy gives further evidence from a non-design centre that the uncemented medial mobile bearing Oxford UKR produces both good survivorship and clinical outcomes in the medium term following surgery. There may be a learning curve associated with the use of the new implant and tibial component positioning appears to be a key step in avoiding early revision.

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**Table 1: Life Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Interval Start Time | Number Entering Interval | Number Withdrawing during Interval | Number of Terminal Events | Proportion Terminating | Proportion Surviving |
| 0 | 200 | 7 | 5 | .03 | 0.97 |
| 12 | 188 | 4 | 1 | .01 | 0.99 |
| 24 | 183 | 4 | 0 | .00 | 1.00 |
| 36 | 179 | 4 | 1 | .01 | 0.99 |
| 48 | 174 | 0 | 1 | .01 | 0.99 |
| 60 | 173 | 15 | 0 | .00 | 1.00 |
| 72 | 158 | 38 | 1 | .01 | 0.99 |
| 84 | 119 | 34 | 1 | .01 | 0.99 |
| 96 | 84 | 19 | 1 | .01 | 0.99 |
| 108 | 64 | 22 | 0 | .00 | 1.00 |
| 120 | 42 | 36 | 0 | .00 | 1.00 |
| 132 | 6 | 6 | 0 | .00 | 1.00 |

**Graph 1: Cumulative Survival Curve**



**Table 2: Age and Revision Relationship**

|  |  |  |
| --- | --- | --- |
|  | Category | Total |
| In-Situ | Died | Revised |
| Age | <= 55 | Count | 38 | 0 | 2 | 40 |
| % | 95.0 | 0.0 | 5.0 | 100.0 |
| 56 - 65 | Count | 78 | 4 | 6 | 88 |
| % | 88.6 | 4.5 | 6.8 | 100.0 |
| 66 + | Count | 47 | 12 | 3 | 62 |
| % | 75.8 | 19.4 | 4.8 | 100.0 |
| Total | Count | 163 | 16 | 11 | 190 |
| % | 85.8% | 8.4% | 5.8% | 100.0% |

**Figure 1: Reasons for Early failures (under 18months)**

**Figure 2: Reason for failures (whole series)**

**Figure 3:**

**Table 3: PROM Data Mean and Median Scores**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PROM | Number of patients | Pre-Op Mean and median Scores | 1 Year | 2020 Mean Results\* |
| Oxford Knee Score (0-48)48 Best | 114 | 20.319 | 39.142 | 38.342 |
| WOMAC (12-60) 12 Best | 108 | 36.338 | 18.415 | 20.115 |
| Modified Knee Society Score(0-150) 150 best | 115 | 51.850 | 127.6135 | 119.3135 |

\*(Mean 7.9yrs follow-up)