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Oxford partial knee replacement by microplasty instrumentation: Indian evidence

Mukesh Sancheti*

Department of Orthopaedics, Kingsway Hospitals, Nagpur, Maharashtra, India

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***Correspondence:**
Dr. Mukesh Sancheti,
E-mail: drmukeshsancheti@rediffmail.com

ABSTRACT

Background: There is increasing evidence in support of unicondylar knee replacement (UKR) as a superior surgical modality in a select group of patients of osteoarthritis knee. Oxford knee is one type of UKR with fully congruent, mobile bearing designed to minimize wear. This prospective study describes 5-year results of partial medial compartment knee replacement in 92 Indian cases by microplasty instrumentation.
Methods: All 92 cases were operated by a single surgeon. Mean follow up was 5 years. In all cases oxford mobile bearing medial unicondylar knee prosthesis was implanted using minimally invasive surgical technique and the cases followed up.
Results: Mean oxford score at the end of 5 year was 43. Patient satisfaction index at the end of 5 year was 98%. Mean maximum flexion was 125 degrees. Incidence of revision was 1.9. No deep or superficial infections were encountered. Average hospital stay was 3 days.
Conclusions: There are variations in Indian patients as per size of implants, stay and similarities regarding less blood loss, improved oxford knee score, good range of motion, less morbidity, higher postoperative patient satisfaction and early getting back to work. Oxford partial knee replacement by microplasty instrumentation done in carefully selected patients with proper surgical technique gives excellent functional outcome and superior patient satisfaction.

Keywords: Unicondylar knee replacement, Minimally invasive surgery, Total knee replacement, Osteoarthritis, Oxford knee score, American knee society score

INTRODUCTION

Life expectancy of Indian populace is increasing, due to better healthcare, amongst other reasons.[1] Prevalence of primary degenerative osteoarthritis (OA), which is mostly related to aging, is also increasing with increase in the general senility.[2,3] It is also associated with a variety of both modifiable and non-modifiable risk factors, including: obesity, lack of exercise, genetic predisposition, bone density, occupational injury, trauma, and gender.[4] Knee joints are the most common and worst affected. With the change in perception towards quality of life, more patients are seeking help at earlier stages of OA knee with respect to surgical intervention.

Most of the surgeons in India still prefer total knee replacement because of patients mostly coming at advanced stages of arthritis and prevailing misconceptions, along with lack of proper training in performing partial knee replacement. Worldwide, there is more and more evidence in support of unicondylar knee replacement (UKR) as a superior surgical modality in select group of patients. Oxford knee is one type of UKR with fully congruent, mobile bearing designed to minimize wear.[5] Further, evidence suggests that minimally invasive surgical approach with phase 3 oxford knee instrument tation results in quicker recovery and improved function.[6]

The purpose of the present study was to find out early results and differences in Indian patients suffering from

unicompartmental OA undergoing UKR in terms of functional outcome, patient satisfaction and rehabilitation.

METHODS

Study design

A 7 years long, hospital based prospective observational study was carried out between February 2013 and April 2020 at a tertiary care hospital in Central India.

Selection criteria

All age, sex and weight category patients included, Isolated anteromedial compartment OA knee with bone touching bone on varus stress x-ray and adequate (minimum 4 mm) gap on lateral side in valgus stress x-ray, no posterior subluxation on lateral x-ray (which implies non-functioning anterior cruciate ligament ACL), intact posteromedial cartilage tibia, No mediolateral subluxation on AP x-ray (which implies non-functioning ACL), no patellar subluxation on sky line x-ray or arthritis more than grade 2, patients with adequate knee size (because in Indian patients sometimes size is so small that even AA tibia overhangs posteriorly and medially), patients with symptoms predominantly on the medial joint line (as the patient satisfaction is traditionally believed to be low if symptoms are more anteriorly or laterally after surgery), patients with inflammatory arthritis like rheumatoid were excluded due to progressive nature of the disease, patients with progressive neurological problems were excluded, patients with any recent or present joint infection or with source of infection like urinary tract infections (UTI), boils were excluded.

Approval from the institutional ethics committee was obtained before the start of the study. Informed written consent was elicited from each patient before participation in the study. A total of 97 patients were thus finally enrolled in the study, after application of the mentioned selection criteria. The patients underwent oxford unicondylar partial knee replacements (UKRs) by microplasty instrumentation using a minimally invasive surgical approach.

Surgical technique

Minimally invasive incision and exposure was used. Incision started around one cm medially from the upper end of patella and extended up to medial border of tibial tuberosity. Fascia over vastus medialis was cut. Subvastus approach was used by cutting medial parapatellar retinaculum and lifting vastus medialis laterally. Margins of medial tibial condyle were exposed and cleared taking care of not releasing too much of soft tissue. Medial meniscus was removed. Osteophytes were removed from tibia, femur and intercondylar notch. For further progression, ACL has to be functionally and anatomically intact. If not, the procedure was abandoned and TKR was done. Few other surgeons do decide to continue with UKR even in the ACL deficient knee, if the lateral compartment is good, by reducing slope. First tibial cut is taken, which should be as near to ACL insertion as possible, but precaution needs to be taken not to cut ACL fibres. Saw should be parallel to anatomical axis of tibia and should not tilt medially, laterally, anteriorly or posteriorly. Femoral cuts were then taken using intramedullary guide and MIS instrumentation. Flexion-extension gap balancing was done by milling. After final sizing, implants were cemented and appropriately sized mobile poly insert was used.

Following outcomes were evaluated using standard protocol preoperatively and on follow ups at 3 months, one year, 2 years and 5 years: (1) Preoperative and postoperative pain, deformity, stability, range of motion, restriction of day to day activities using oxford knee score (OKS) and American knee society score (AKSS).[7,8] (2) Patient satisfaction index (3) Intraoperative blood loss (4) Requirement of postoperative analgesia (5) visual analogue scale (VAS) (wong baker faces pain rating scale)[9] (6) Postoperative complications like instability, infection, pain, wound dehiscence etc. (7) Average length of hospital stay

OKS was measured on the scale of 0 to 48 preoperatively and at regular intervals mentioned above. In all 12 questions were asked to patients each carrying 0 to 4 points with better scores with more points.[7]

American knee society score (AKSS) was measured both objectively and functionally.[8] Objective AKSS (AKSS-O) was measured on the scale of 0 to 100 which included pain, range of movement, stability, flexion contractures, extension lag and alignment pre- and post-operatively at regular intervals as mentioned above. Functional AKSS (AKSS-F) was measured on the scale of 0 to 100 which included walking, stairs and functional deductions. The follow-up outcome assessment was done for all the difficult to trace participants on a best-effort basis.

Patient satisfaction was measured using american society patient satisfaction index on the scale of 0 to 40.[10] in all 5 questions were asked, each carrying 0 to 8 points with a better score with more points.

All the patients were evaluated before admission by the author. All the required preoperative blood investigations, anaesthesiologist's opinion and physician fitness were completed on out-patient basis. The patients were admitted and underwent surgery on the same day. Duration of surgery was measured from incision to the end of closure. Blood loss was recorded by the number of sponges required and collection in the suction chamber. Most of the patients were mobilised out of bed on day one of surgery itself.

Out of 97 cases, a total of 92 knees were successfully followed up, evaluated and included for final analysis. Five cases were lost during follow ups. The data was

analysed using SPSS (version 20); by applying paired t-test & ANOVA wherever applicable.

RESULTS

The present study entailed outcome assessment of unicondylar knee replacement (UKR) in 92 cases of osteoarthritis of knee. Out of 92 cases, 58 were females and 34 were males and the age group varied between 45 to 82 years. Total patient number was 77, out of which 15 underwent bilateral UKR at different times and not simultaneously. The weights of patients varied between 50 kg to 90 kg at the time of presentation. Most cases required very small size of implants; with 80 out of 92 requiring A or AA (smallest) tibial components, 11 required B size and only one required C size tibial component. Later during surgery little overhang on medial and anterior side was experienced in a few cases, which was less than 2 mm and thus clinically insignificant. Preoperatively, few patients who were suitable candidates for UKR were advised TKR, as the author felt that their knee size was too small for available UKR implants and such patients were excluded from the study. Pre- and post-operative X-ray images of a prototypical case are illustrated in (Figure 1).

Figure 1: (A) pre-op AP view (B) pre-op lateral view, (C) post-op AP view (D) post-op lateral view of X-ray images of a prototypical case

All the cases were assessed preoperatively and followed up at 3 months, one year, 2 years and 5 years with outcomes being assessed at each visit. At 3 months follow-up, the mean preoperative OKS of 25.28+3.28 was observed to increase up to 41.5+3.84 (an average gain of 16.24 points), the difference being statistically significant ($p<0.01$). Similarly, the AKSS-O increased from mean preoperative score of 75.05+11.54 to 91.90+6.08 at 3 months post-surgery, a significant increase of 16.85 points; and the AKSS-F increased from 62.36+10.35 to 88.03+6.38, the gain (+25.67) again being highly significant ($p<0.01$) (Table 1).

At the follow-up at one year, the mean OKS was observed to be 43.54+2.17; a mean increase of 18.26 from before surgery. The mean scores of AKSS-O and AKSS-F were 97.23+5.42 and 94.1+4.75 respectively, the differences from the respective preoperative scores being significant ($p<0.01$) (Table 2).

Table 1: Pre & post UKR comparison at 3 months follow-up.

Scale	Pre-operative score (Mean± 2SD)	Post-operative score at 3 months (Mean± 2SD)	Difference (Mean ± 2SD)	P value
Oxford knee score	25.28± 3.28	41.52± 3.84	16.24± 4.3	<0.01
AKSS-O	75.05± 11.54	91.90± 6.08	16.85± 14.12	<0.01
AKSS-F	62.36± 10.35	88.03± 6.38	25.67± 10.92	<0.01

Table 2: Pre & post UKR comparison at 1-year follow-up.

Scale	Pre-operative Score (Mean± 2SD)	Post-operative Score at 1 year (Mean± 2SD)	Difference (Mean ± 2SD)	P value
Oxford knee score	25.28± 3.28	43.54± 2.17	18.26± 3.42	<0.01
AKSS-O	75.05± 11.54	97.23± 5.42	22.17± 12.78	<0.01
AKSS-F	62.36± 10.35	94.1± 4.75	31.74± 10.92	<0.01

The patients were again followed up at 2 years. The OKS, AKSS-O and AKSS-F scores consolidated further at 44.98 +1.83, 101.74+4.79, and 93.99+5.53 respectively, all the differences from preoperative scores being statistically significant (Table 3).

At the final 5 years follow-up, the three scores remained significantly better than preoperative status. The OKSS score further improved to 46.1±1.73, while AKSS scores remained more or less at the 2 years follow-up level only (Table 4).

The Patient Satisfaction Index was also assessed preoperatively and at each follow-up. It improved significantly from a preoperative mean of 16.2 to 30.63 in 3 months and 34.78 in 1 year postoperatively. The index scores then stabilized and remained constant till 5 years follow-up for all the patients (Table 5).

Table 3: Pre & post UKR comparison at 2-year follow-up.

Scale	Pre-operative score (Mean± 2SD)	Post-operative score at 2 year (Mean± 2SD)	Difference (Mean± 2SD)	P value
Oxford knee score	25.28 ± 3.28	44.98 ± 1.83	19.70 ± 3.34	<0.01
AKSS-O	75.05 ± 11.54	101.74 ± 4.79	26.69 ± 11.7	<0.01
AKSS-F	62.36 ± 10.35	93.99 ± 5.53	31.63 ± 10.99	<0.01

Table 4: Pre & post UKR comparison at 5-year follow-up.

Scale	Pre-operative score (Mean± 2SD)	Post-operative score at 5 year (Mean± 2SD)	Difference (Mean± 2SD)	P value
Oxford knee score	25.28± 3.28	46.1± 1.73	20.82± 3.47	<0.01
AKSS-O	75.05± 11.54	101.74± 4.79	26.69± 11.7	<0.01
AKSS-F	62.36± 10.35	94.1± 4.75	31.74± 10.92	<0.01

Table 5: Patient satisfaction index- pre- and post-operative scores comparison.

Scale	Patient satisfaction index score (Mean±2SD)	Difference from pre-operative score (Mean±2SD)	P value
Pre-operative score	16.2±5.6	-	-
Post-operative score at 3 months	30.63±5.03	14.44±7.33	<0.01
Post-operative score at 1 year	34.78±4.71	18.59±7.28	<0.01
Post-operative score at 2 years	34.78±4.71	18.59±7.28	<0.01
Post-operative score at 5 years	34.78±4.71	18.59±7.28	<0.01

The intraoperative blood loss was measured by adding collection in the suction chamber and the number of sponges required. No case required more than one sponge during surgery. Collection in the suction chamber minus saline used for wash was calculated. Blood loss was not more than 100 ml in any case. All cases received 2 doses of one-gram tranexamic acid, first half hour before incision and second at three hours after surgery. All cases received intraoperative a cocktail infusion in soft tissue before closure. The cocktail included ropivacaine, buprigesic, adrenaline, ketorolac and normal saline (50 ml). No steroid or tranexamic acid was used in cocktails. On the day of surgery, the patient received three doses of intravenous analgesia, either diclofenac or paracetamol, depending upon the renal status of the patient. From the second day all intravenous medications were stopped and oral analgesics were given. No pregabalin or gabapentin molecules were used in any of the participants. Pain score in all the patients was less than 4 on VAS.

In all two complications were noted. One case had poly dislocation and the other had fracture medial tibial condyle, both occurred within 3 months of surgery. Both were managed by the primary consultant. Poly dislocation case was managed with revision surgery, wherein poly exchange with bigger size was undertaken. The patient did well after that at the subsequent follow-ups. The case of fracture medial tibial condyle was managed conservatively with long knee brace and non-weight bearing, as the patient was not willing for revision surgery. Fortunately, the fracture healed completely without any complications and follow-up was good at 1, 2 and 5 years. The average length of stay was normally distributed 2 to 5 days for all the patients, not unduly prolonged for any of the participants.

DISCUSSION

The present study entailed comprehensive study of patients with uni-compartmental OA of knee who underwent UKR by both objective as well as subjective criteria; by assessing and comparing functional outcome, patient satisfaction and rehabilitation. A total of 92 carefully selected cases of osteoarthritis of knee were enrolled and underwent UKR and the data of various outcomes analysed. The age group of participants (45-82 years) was on the expected lines, as the disease process is known to aggravate in the latter half of life only. Although anatomical age did vary, the patients were selected depending upon their physiological status. Youngest patient was of age 45 and oldest 82, both with good results after surgery. In the author's view, UKR is not an interval procedure as considered by many. It is a definitive procedure and no age is contraindication as results are good and long lasting if you follow selection criteria and surgical steps properly. Female preponderance in the present study is also in line with the available evidence with respect to the universal sex ratio for knee arthritis, providing further validity to the observations.

OKS as an assessment tool is to be solely completed by the participants, as was done in the present study. The emphasis with OKS is firmly on day to day activities (function) and patient symptomatology (pain).[7] This particular score does not include other objective parameters like alignment, deformities, laxity etc. Most of the patients suffering from isolated medial compartment arthritis are not able to do routine day to day activities because of pain. In the present study, the preoperative OKS was mostly below 30 across participants (mean- 25.28). As decent pain relief was achieved with surgery, the average score increased significantly, mostly above 40 in most of the patients, at three months follow up (mean- 41.52). The average score was further seen to increase consistently at 1, 2 and 5 years, indicating progressive decrease in pain and ease in function in toto post-surgery. This is similar to or better than the observations of previous researchers. Luscombe KL et al, in their 2 years review, had achieved a mean Oxford Knee Score of 38.3; while in the study by Liddle AD et al, the mean OKS increased from 21.9 to 37.5.[11,12] The results probably outdo those that would have been achieved with total knee replacement, but this can be confirmed by randomized controlled trials only.[13-15]

The knee society clinical rating system/American knee society score (AKSS) assessment tool was filled up by the primary author.[8] It is one of the few outcome measures that include assessment of clinical measures that are deemed important in terms of implant survival and functional outcomes.[16,17] Most of the cases in the present study had AKSS-O in the range of 70 to 80 preoperatively (mean- 75.05). Exclusion criteria in our study excluded patients with severe varus or flexion deformities with range of motion also being good in most of the patients before surgery. The patients mostly had pain as chief complaint in their day to day activities. AKSS-O gives more weightage to alignment, instability and range of motion and in our patients, due to strict exclusion criteria, these were not significantly affected. Postoperatively AKSS-O improved significantly in most of the patients and ranged between 90 to 100 at 3 months (mean 91.90). The AKSS-O score improved further and was in the range of 95 to 105 at 1 year (mean- 97.23), 2 years (101.74) and 5 years (mean 101.74) follow ups. This fares better in comparison with most of the previous similar studies; like the findings of Pandit HG et al who had observed the mean AKSS-O score to be 47.4 preoperatively with subsequent scores at 88.7 (1 year) and 86.4 (5 years) respectively; and of Mohammad HR et al who had noted the mean AKSS-O score at 89.1 after 10 years of follow-up.[18,19]

The AKSS-F behaves more as OKS, as it is based on the patient's functional capabilities and symptomatology. As in most of the patients in the present study had pain and inability to do day to day activities as their main complaint, AKSS-F scores were low as compared to AKSS-O before surgery. The AKSS-F scores ranged between 55 and 65 preoperatively (mean- 62.36). After surgery the score improved significantly in most of the patients mainly because of pain free day to day activities; with mean scores of 88.03, 94.1, 93.99 and 94.1 at three months, one, two and five years respectively. Pandit et al in their similar study reported the AKSS-F scores at 68.7 preoperatively and 89.4 and 86.1 at one year and five years respectively; comparison indicating our results to be marginally better.[18] Mohammad HR et al noted the AKSS-F of 80.4 at ten year follow-up, which again is corroborative of findings of present study.[19]

Patient satisfaction index remains one of the most important criteria to judge outcome after knee replacement.[20] The scores improved significantly from a preoperative mean of 16.2 to 30.63 at 3 months follow up and reached 34.78 at one-year follow-up, indicating dramatic patient satisfaction after UKR. Most of the patients felt their knees as natural after surgery as before.

The average length of stay was ranging between 2 to 5 days. This wide range is due to most of the patients belonging to remote areas where no home nursing care or emergency medical help is available, leading them to prefer staying at hospital for extra duration. Patients from nearby areas who can reach hospital in an emergency were discharged on the second day of surgery without any complications. Thus, in Indian scenario day care partial knee replacement remains difficult, but as home nursing care reaches remote places as well, it may become possible in the near future.

Intraoperative blood loss was very less in all patients and none of them required blood transfusion, considering minimum bone cut and soft tissue release. No drain was required in any patient either. Contrary to popular belief in India that knee replacement is a very painful surgery, most of our patients of UKR were able to do straight leg raising (SLR) and walk on day one of surgery with or without support. Most of them were able to sleep on the day of surgery with IV analgesia and intraoperative cocktail infusion. None of them required IV analgesia on day two and all of them were on oral analgesics. Post operatively pain measurement was done on VAS scale which was less than 4 in all patients.

Two complications were noted. One patient had posterior poly dislocation at two months of surgery while sitting cross legged. Patient was re-operated and poly was exchanged with more thickness (4mm to 5mm). One possibility is, that it is very common in India to sit cross legged, squat and kneel for prayer, positions which could result in dislocation. After this complication, the author had been little hesitant to proactively suggest these activities after surgery. But, on due review, the author concluded that in this complication the reason for dislocation is more likely to be improper size of poly in first surgery and not because of patient sitting cross legged post-surgery. The second complication was of medial tibial condyle fracture in a patient at ten weeks of surgery. Patient did give a history of the fall; but the author feels

that fracture was not due to fall but faulty surgical technique, by not taking vertical tibial cut properly and notching the posterior tibial cortex. Patient was advised to undergo revision surgery but she refused. Hence the patient was managed conservatively with long knee brace and non-weight bearing for 8 weeks.

Fortunately, fracture united without any complication and the patient is able to do most of her day to day activities without hindrance. Both complications happened in early cases underlining the importance of the learning curve on surgeon's side. It is the improper technique which, at times, is responsible for most of the complications and not the procedure itself in patients with proper indications and falling in the selection criteria.

It was noted that most of the patients required the smallest size of implants, which may be due to more female patients or relatively smaller sample size. Indian patients' knees are smaller as compared to western population, it seems! It is still recommended to judge size of patients' knees preoperatively, so that there are no surprises intraoperatively.

CONCLUSION

Oxford partial knee replacement by microplasty instrumentation done in properly selected patients with proper surgical technique gives excellent functional outcome and superior patient satisfaction.

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