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Functional outcome of Unicondylar Knee arthroplasty in Unicompartmental osteoarthritis

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Abstract
Osteoarthritis is accepted as a major public health problem and is one of the major causes of impaired function that reduces quality of life worldwide. Pain relief, improved joint function, and joint stability are the main goals of therapy. Currently, the primarily surgical methods of treating unicompartmental knee arthritis include high tibial osteotomy, unicompartmental knee arthroplasty and conventional total knee arthroplasty. However, with the increasing concerns regarding the finite life span and post-operative functional recovery of these aforementioned procedures, the indications for UKA in the treatment of medial osteoarthritis were expanded. Advantages of UKA compared to TKA include decreased morbidity, smaller incisions, decreased blood loss, preservation of normal knee kinematics, rapid recovery, and shorter length of stay following surgery. 30 patients who met the inclusion criteria underwent Unicondylar Knee Arthroplasty and functional outcome was assessed using VERBAL pain score and WOMAC Score. Mean improvement in flexion at knee was 20^0, internal rotation was 0.73^0, external rotation was 7.70^0 and there was no deterioration in extension at knee at 1 year follow-up. There was decrease in mean VERBAL pain score and improvement in WOMAC score. Unicondylar Knee Arthroplasty has better functional outcome in terms of short surgical scar, short duration of surgery, short hospital stay, less blood loss, early mobilization, improved range of motion, lesser rate of complications.

Keywords: Unicondylar knee arthroplasty, unicompartmental, osteoarthritis

Introduction
Osteoarthritis (OA) is a common chronic condition resulting in pain, fatigue, functional limitations, increased healthcare utilization and high economic costs to society [1]. The burden of OA is projected to increase, due in part to obesity and population aging [2]. While the prevalence of OA increases with age [3], there is a growing recognition that OA affects people at younger ages in view of sedentary life style, diabetes mellitus, hypertension, obesity. Approximately 25 % of persons aged 55 years or above have had knee pains in a month in last 10 years. A typical symptom of knee osteoarthritis (OA) is medial knee pain. There are a number of surgical options for treating medial unicompartmental OA of the knee, including high tibial osteotomy (HTO), unicompartmental knee arthroplasty (UKA), and total knee arthroplasty (TKA). TKA and UKA are both utilized to treat unicompartmental Osteoarthritis. TKA has long been considered as the gold standard operative intervention for knee arthritis. UKA is a new option when Osteoarthritis is confined to one compartment [4, 5]. Initially, the trend of UKA was decreasing due to low survivorship and early reports of UKA implant survival were not promising. However, recent studies with newer generation UKA implants have shown 10-year survival rates of >95%. Indications for UKA are unicompartmental OA or femoral avascular necrosis with intact patellofemoral and lateral compartments. Other factors that favour the use of UKA are age over 60 years, low patient activity demand, relatively low body mass index (BMI), and minimal pain at rest. The range of motion (ROM) arc should be >90°, with flexion contracture of <5°, and <10° axial malalignment that can be passively corrected to almost neutral. Contraindication for UKA has been pre-existing patellofemoral joint degeneration and anterior cruciate ligament (ACL) deficiency. The most common cause of failure was loosening of the components followed by progressive degeneration in the nonreplaced components and then by polyethylene wear [6]. If case selection is good and indications of UKA are appropriate and accurate techniques used by expert and experienced

surgeon, UKA is simpler, recovers quicker and there are various advantages such as small incision, minimal soft tissue resection, shorter operative time, less blood loss, less chances of infection, better bone stock conservation (important consideration for future conversion to total knee replacement), option to convert to bicondylar replacement if there is involvement of opposite compartment, rapid and more predictable recovery, more post operative range of motion and overall higher patient satisfaction [7]. The reasons HTO being not utilized nowadays are high rates of peroneal palsy, joint line distortion, malunion/non union, patella baja [8, 9]. The aim of our study is to assess the functional outcomes in UKA by various parameters on short term basis and the research question being does Unicondylar Knee Arthroplasty (UKA) have good functional outcome in form of early recovery and physical rehabilitation?

Material and Methods

A prospective longitudinal study was carried out at a tertiary centre at New Delhi and was conducted over a period of 2 years from October 2016 to September 2018 which included 30 patients with Unicompartmental knee Osteoarthritis diagnosed clinically or either by diagnostic arthroscopy or Magnetic Resonance Imaging (MRI). Patients with isolated unicompartmental osteoarthritis, cruciate intact knee, fixed flexion deformity <5 degrees active ROM >90 degrees, varus deformity <15 degrees were included in the study. Exclusion Criteria being an ACL deficient knee, rheumatoid arthritis, patellectomy patients(absent patellofemoral mechanism), bicompartmental osteoarthritis, fixed flexion deformity >5 degrees, active ROM <90 degrees, varus deformity >15 degrees.

An informed written consent, a detailed clinical history, clinical examination and serial functional findings using a pre-designed proforma were performed for all the participants. Ethical clearance was obtained. Mobile bearing type implants were used from similar providers and all surgeries were performed by same surgeon. Routine blood investigations and radiographs in true Anteroposterior (AP) and true lateral [Figure 1] and skyline views were taken. We used mobile bearing type implants. After routine pre operative assessment, patient was given either spinal or general anaesthesia and then positioned supine with limb hanging on the side of table. An unsterile pneumatic tourniquet applied to the thigh with pressure ranging to 120-150mmHg above patients' systolic BP. Surgical procedure started with medial parapatellar incision (~7-8cms), para patellar fat pad excised and patella reflected laterally to reach the joint. An excessive medial release can result in the need to overcorrect the varus knee into valgus to obtain appropriate ligament tension. Overcorrecting knee alignment into valgus has been shown to accelerate cartilage wear in the lateral compartment and adversely affect survivorship. Bony preparation starts with the osteophyte removal followed by tibial resection, matching the native tibial slope. In a normal knee, the tibia rotates with flexion and extension around a fixed axis. Making this tibial cut first creates a reference point in flexion and extension that helps determine proper anatomic positioning of the femoral component. It is important to remember that the tibial cut is the basis for the remainder of the bone preparation, so it is critical that this cut be perpendicular to the long axis of the tibia in the coronal plane. Once the tibial cut is made, flexion and extension gaps are assessed with the use of spacer blocks. A common scenario in the medially arthritic knee is for the extension gap to be larger than the flexion gap, typically the result of distal bone and cartilage loss. The posterior medial femoral condylar bone, and often the articular cartilage, may be preserved in medial compartment arthritis. In this setting, it takes a larger spacer block to fill the extension gap than it takes to fill the flexion gap. Once distal and posterior femoral resections have been made, the gaps can be rechecked to ensure they are symmetric. The gaps at this stage should equal the thickness of the femoral component plus the composite tibial thickness with 1 mm of additional laxity to avoid excess ligament tension. Once the gaps are balanced and the joint line is re-established, then the distal femoral and proximal tibial preparations are completed. A trial reduction is carried out to confirm proper alignment, ligament tension, and range of motion. Final components are then implanted [Figure 2]. Post op X-rays are taken [Figure 3].

Post operatively intravenous antibiotics were continued for first 2 days and then changed to oral antibiotics for next 10-12 days. Drain was placed in all the patients to calculate the amount of blood loss. First dressing with drain removal was done on 3rd post-operative day and patients used to be discharged after 2 days of hospitalization post-operatively. Mobilisation of ankle joint, active toes movements were started on the same day of surgery, knee bending exercises, quadriceps static exercises for 1st two post op days and then dynamic quadriceps exercises were taught to the patients. Suture removal was done on day 14. Patients were followed up [Figure 4] on 1st week, 2nd week, 4th week, 8th week, 3rd month, 6th month and 1 year and patients were assessed for pain using verbal pain score, ROM of the knee joint, clinical examination and the post op radiographs and finally WOMAC score was calculated and recorded.

Fig 1: Anteroposterior view of knee (in standing position) and lateral view showing reduced medial joint space

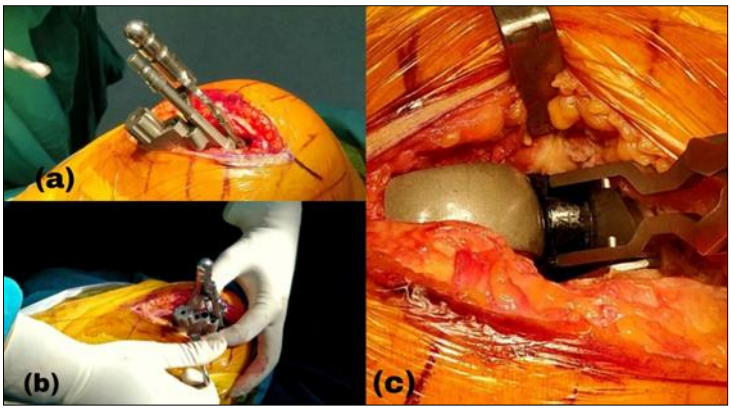

Fig 2: a) and b) Showing jig for femoral condylar preparation, c) placement of meniscal bearings

Fig 3: Post operative X-ray (AP and Lateral views) with implant in situ.

Fig 4: Follow up of the patient at 6 weeks showing a) extension and b) flexion at knee respectively and follow up at 1 year showing c) extension and d) flexion at knee respectively.

Statistical analysis

The study observed pre operative and post operative functional score was 51.1±.18.6 and 86.8±12.3 respectively. Taking this value as reference, the minimum required sample size with 90% power of study and 5% level of significance is 5 patients. To reduce margin of error, total sample size taken is 30. Paired t-test/ Wilcoxon ranked sum test, Chi-Square test and Fisher's exact test were used where necessary. A p value of <0.05 will be considered statistically significant.

Results

In this study, we gave our primary concern in patient selection and all surgeries were performed by same surgeon and with same implants. 63% (19 out of 32) patients were in between 55-60 years of age with mean age being 59.67. The male and female ratio was 1:1. The mean surgical time was 63 minutes (ranging from 50-70 minutes) and mean tourniquet time was 50 minutes. Average length of surgical incision was 8.05 cm ranging from 7 to 8.5 cm. The average blood loss was 116.67 ml intra operatively (110ml-120ml) and 127.66 ml post operatively (110ml-140ml) per patient. Total average blood loss per patient was ~245 ml. The mean time of weight bearing and walking with walker was 2 days and that of without walker was 7.8 days. The mean time of hospital stay was 2.87 days where 16 out of 30(54%) patients were discharged on post op day 2, 8 out of 30(27%) were discharged on post op day 3 and rest were discharged on 5 post of days. The only complication being a female patient out of 30 had tibial plate migration after 6 weeks of postop. She was taken for surgery and re-exploration was done and fixed under spinal anaesthesia. Average pre op flexion at knee was 107.83^0(107.83 ± 7.51) and it was improved to average of 137.83^0(137.83 ± 7.15) at 1 year follow op. Almost equal flexion achieved at post op week two as compared to pre op values, p value <0.0001. The mean internal rotation preoperatively was 6.87 ± 1.94SD and increased to 8.6 ± 1.19SD at 1 year follow-up, p value was 0.564. The value is insignificant, as internal rotation contributes very little in the functionality of knee. The mean external rotation preoperatively was 27.17 ± 3.75SD and increased to 34.87 ± 2.61SD, with p value 0.0001. There was a progressive increase in the external rotation in subsequent follow-ups till 1 year. Mean improvement in flexion at knee was 20^0, internal rotation was 0.73^0, external rotation was 7.70^0 and there was no deterioration in extension at knee at 1 year follow-up. The mean Verbal Pain Score at post op day 1 was 8.80 ± 0.66SD and decreased to 0.33 ± 0.61SD at 1 year follow up (P value <0.0001). 28 out of 30(~93%) patients had score ≤5 at 4 weeks follow-up. 2 out of 30 patients (~7%) had persistent knee pain with verbal pain score of 2 without any justifiable cause. The mean WOMAC score preoperatively was 57.69 ± 11.31SD and has increased in subsequent follow-ups and the mean WOMAC score at 1 year follow-up was found to be 86.67 ± 6.09SD with significant p value of <0.0001. All the parameters were in significant range of statistical analysis and thereby mark a good functional outcome after follow-up of 1 year.

Discussion

Currently, with the increasing concerns regarding the finite life span and post-operative functional recovery of these aforementioned procedures, the indications for UKA in treatment of medial osteoarthritis were expanded and remains widely debated. Variable outcomes and uncertain efficacy were associated with the introduction of UKA in the 1970s. As a result, total knee arthroplasty (TKA) became the surgical standard of treatment for knee osteoarthopathy. Improvements in patient selection, enhanced surgical techniques, and advanced UKA implant designs have now yielded survivorships comparable with TKA. UKA has now gaining popularity in the western world. In the United States alone, the incidence of UKA has increased 3-fold compared to TKA (32.5% v/s 9.4%) between 1998 and 2005. There is an apparent need to understand all modifiable and non-modifiable determinants of patient outcome associated with UKA as it becomes a more utilized treatment option for a rapidly growing patient population. Advantages of UKA compared to TKA include decreased morbidity, smaller incisions, less blood loss, preservation of normal knee kinematics, rapid recovery, and shorter length of stay following surgery.

In our study we sought to describe profile of 30 patients with unicompartmental osteoarthritis treated by Unicondylar knee replacement. In this study we have prospectively studied the functional outcomes of UKA in unicompartmental OA and the outcomes were evaluated by and any associated complications were noted. In our study, age range was 55 – 60 years, with 63% in 55-60 years age group and 37% in 61-65 age group with mean age 59. This age is slightly above what other studies have shown in western world. In year 2017, Siman H *et al.* [10] studied UKA and TKA comparison and concluded that due to its less invasive nature, patients older than 65 undergoing UKA demonstrated faster initial

recovery when compared to TKA, while maintaining comparable complications and midterm survivorship. UKA should be offered as an option in the elderly patient who fits the selection criteria for UKA. Young patients have more chances of revision surgeries and poor outcomes and survivorship as compared to old population. Our study was unable to comment on same due to short follow-up period.

In our study, male to female ratio was 1:1 and is statistically significant (p-value <0.05). But when compared to other studies, it was always on higher side, as OA incidence is higher in post menopausal females due to high estrogen and high bone resorption. In year 2016, Elke Jeschke *et al*. [11] studied data of 20946 unicondylar replacements and found out of them 60.3% were females. The probable bias in Indian population could be due to less female attention regarding heath issues in Indian families and unwillingness for surgery.

In our study, mean surgical time was 63 minutes (50-70) and mean tourniquet time was 50 minutes (40-55). Surgeries of 15 patients were done in time less than or equal to 60 minutes and rest 15 in time more than 60 minutes. Almost 100% patients of the operated patients had tourniquet time <60 minutes and we have found that duration of surgery had no statistical significance. There was no information regarding surgery time in the existing literatures. In our study, and mean blood loss Intra op was 116.67 ± 15.83SD (in ml). In year 2003, K Y Yang *et al*. [12] studied early functional outcomes in minimally invasive UKA and concluded that mean surgical time was 80 mins, average blood loss was 203 ml and knee flexion at 6 months follow up found to be 122^0. This study is comparable to our thesis and thus marks a positive result in favour of UKA. In our study 24 out of 30 patients(80%) were discharged in less than or equal to 3 days and only 6 patients (20%) got discharged on 4^{th} or 5^{th} day post surgery. This clearly indicates the hospital stay post surgery has a significant finding in our study. All patients started weight bearing with walker on 2^{nd} post op day and 26 out of 30 patients (~87%) started walking without support on 7^{th} post op day and remaining 4 patients had to start weight bearing without support on the day of suture removal i.e., 2 weeks post op due to persistent pain at stitch line.

The mean Flexion at Knee was 107.83±7.51SD preoperatively and reached to 137.83 ± 7.15SD at 1 year of follow-up. The p value has significant range (0.0001). Almost all patients (29 out of 30) reached to preoperative range of flexion at 2 weeks of follow-up with p value 0.915. 30 out of 30 patients had full extension at knee joint preoperatively and that remained full extension at 6 months follow-up. The extension at knee joint did not halt post surgery.

There is decrease in mean VERBAL pain score, decreased from 8.80 at 1^{st} post op day to 0.33 at 1 year follow-up. There was mean improvement of 28.98 in WOMAC score from 1^{st} post op day to 1 year of follow up. This clearly is in favour of our study and indicates betterment in the functional outcomes of the patients.

Limitations of the study being small sample size, profile of patients was limited to those who came to tertiary care center leading to selection bias, follow-up for short duration. Further research can be done with a long term follow up, large sample size in Indian population, a comparative study with TKR or cruciate sparing TKR can be done.

Conclusion

UKA has good results and a comparable outcome with the literature and previous studies and has proved to have better functional outcome in terms of short surgical scar, short duration of surgery, short hospital stay, less blood loss, early mobilization, improved range of motion**,** lesser rate of complications**.** Besides that, we observed betterment in the predefined scores of functional outcome (WOMAC score and VERBAL Pain Score). Our Study showed Satisfactory postoperative results were achieved in the UKA group in terms of social function and mental health, and the patients were able to achieve early rehabilitation and return to their previous life activities. UKA is the ideal option for patients who wish for the earliest possible return to social and recreational activities.

Declaration of Interest: None

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