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Comparison Of Functional Outcomes Of Unicondylar Knee Arthroplasty In Patients With Osteoarthritis In Younger And Older Than 60 Years Of Age

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Abstract:
Background: *Knee replacement, either total or partial, is the most commonly used procedure for advanced symptomatic osteoarthritis refractory to conservative management. There is still continuing debate regarding the best treatment for unicompartmental osteoarthritis of the knee especially in young patients. Therefore, the aim of this study was to assess comparability of clinical and functional outcomes of unicondylar knee arthroplasty in younger (≤ 60 years) versus elderly (> 60 years) age groups.*
Materials and methods: *We did retrospective comparative study on 125 patients (150 knees) of primary degenerative anteromedial osteoarthritis (Kellgren-Lawrence Grade 3-4) who underwent Oxford Unicondylar Knee Arthroplasty from 2015 to 2021. The patients were divided into 2 groups, age less than or equal to 60 years group and more than 60 years group. Clinical and functional outcomes compare between both groups at postoperatively six weeks, three months, six months and twelve months. P-values of ≤0.05 was considered statistically significant.*
Results: *There were no statistically significant difference seen in parameters like Surgery duration, blood loss, and improvement in range of motion in both groups. Length of hospital stay, pain score, and time needed for independent walking & for outdoor activities was significantly lower in younger age groups. Knee scores like Knee Society Score (clinical & functional) and Oxford Knee score were significantly improve postoperatively in both groups but no statistically significant difference was seen. Two elderly patients developed superficial wound infection and one patient developed aseptic loosening and was converted to total knee replacement.*
Conclusion*: The oxford unicondylar (partial) knee arthroplasty can be performed in both under 60 and over 60 years of age patients with isolated medial compartment arthritis. Partial knee arthroplasty can be performed in younger patients with good clinical and functional outcomes.*
Keywords: *Knee joint, Osteoarthritis, Partial arthroplasty, Unicondylar arthroplasty.*

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I. Introduction

Knee osteoarthritis (OA) is one of the most common types of arthritis, affecting millions of people worldwide and being a leading cause of knee pain and locomotive disability among adults.[1-3] Knee replacement, either total knee arthroplasty (TKA) or partial (Unicondylar) knee arthroplasty (UKA), is the most commonly used procedure for advanced symptomatic osteoarthritis refractory to conservative management.[4] Unicondylar knee arthroplasty is usually limited to a single compartmental symptomatic osteoarthritis, especially isolated antero-medial compartmental osteoarthritis.[5-7]

There is a body of literature that established UKA is an effective mode of treatment for anteromedial OA in elderly patients. But there are very few published studies of UKA in young osteoarthritic patients. There is continuing debate regarding the best treatment for young patients with unicompartmental osteoarthritis of the

knee. Therefore, the aim of this study was to assess the comparability of clinical and functional outcomes of unicondylar knee arthroplasty in younger (≤ 60 years) versus elderly (> 60 years) age groups.

II. Patients And Methods

We did a retrospective comparative study to compare the post-operative functional outcome of the Oxford Unicondylar Knee Arthroplasty surgery in younger and elderly age groups patients. We included a total of 150 knees (100 unilateral and 25 bilateral) from 125 patients (35 males and 90 females). They were diagnosed with primary degenerative anteromedial osteoarthritis (Kellgren-Lawrence Grade 3-4) with intact lateral compartment and ACL ligament. Patient with more than 15° of fixed flexion deformity, non-correctable varus (>15°) or valgus (> 5°), tri-compartmental or lateral compartmental arthritis, inflammatory/infective/post-traumatic arthritis, knee with ACL deficiency, associated hip pathology, articular bone loss requiring wedges and extension stem, poor local skin conditions and a history of previous high tibial osteotomy were excluded. The patients were divided into 2 groups. Group A includes patients with an age ≤ 60 years (n = 70 knees) and Group B includes patients with an age > 60 years (n = 80 knees). All the patients were operated on between 2015 and 2021 by a single senior orthopaedic surgeon at a single center, with the same approach.

All patients were well examined pre-operatively, the surgical procedure was explained, and well informed written consent for surgery was obtained. Regional anaesthesia (Combined Spinal Epidural) was used in all patients. A high-thigh well-functioning pneumatic tourniquet of adequate size was applied to all patients, and tourniquet pressures was set to 150 mmHg above the patient's systolic blood pressure before the incision. Partial knee replacement was done with a Zimmer Biomet phase-3 mobile bearing prosthesis (Oxford knee).

Surgery duration, blood loss, pre- and post-operative range of motion, number of blood transfusions (average units), length of hospital stay (days), pain score using Visual Analogue Scale (VAS scale), functional scores using Knee Society Score (KSS), Oxford Knee Score (OKS), and any complications were recorded and compared for both groups at six weeks, three months, six months and twelve months postoperatively. The Wilcoxon rank-sum test was used for the statistical evaluations of numerical data and the Z-test was used for the statistical evaluations of non-numerical data. A P-values of ≤0.05 was considered statistically significant.

III. Results

We includes a total of 125 patients (150 knee cases) and divided into two groups (Table 1). There were no statistically significant differences seen in terms of mean age (58.3 ± 2 years v/s 68.4 ± 4 years), average blood loss (100 ± 15 ml v/s 110 ± 18 ml) and average duration of surgery (56 ± 10 min v/s 62 ± 8 min). One patient in group B required post-operative blood transfusion (1 unit Packed Red Cells), whereas no one in group A required blood transfusion.

Relatively less blood loss and a shorter duration of surgery was observed in the younger age group. The average length of hospital stay was significantly lower in younger patients (3 ± 1 days) compared to elderly patients (4 ± 1 days). The average correction in range of motion was 9 ± 5 and 11 ± 5, the mean improvement in VAS was 6.5 ± 1 and 5.8 ± 1 points, the mean correction in mechanical axis of the knee was 8 ± 3° (average preoperative 170°, average postoperative 178°) and 10 ± 2° (average preoperative 171.5°, average postoperative 179 ± 2°) at one-year follow-up for young and elderly age group patients, respectively. The rehabilitation period was significantly shorter in the younger age group (P < 0.05). The average time needed for independent walking was (20 ± 3 days v/s 25 ± 5 days) and the average time taken to resume outdoor activities was (42 ± 6 days v/s 48 ± 8 days). Significant improvement was seen both in clinical and functional knee scores at one-year follow-up in both groups, but no significant difference was seen in both groups. In Group B, two patients developed superficial wound infection and were managed conservatively with isolated dressing alone. Neither of them required re-exploration of surgical wound nor had recurrence till last follow up. No wound infection was noted in the younger age group. One patient developed aseptic loosening after 10 months postoperatively and was converted to total knee replacement. No one in either groups developed any other major complications like mobile bearing dislocation, medial tibial plateau fracture, deep vein thrombosis, pulmonary embolism, iatrogenic fracture, periprosthetic fracture, joint stiffness, etc. till last follow up.

Table 1. Patient related clinical and radiographic outcome parameters included in study.

Parameter	Group A	Group B	P-value
Total Patients	60	65	
Number of Knees	70	80	
Mean Age (years)	58.3 ± 2	68.4 ± 4	P < 0.05
Gender			
Male	15	20	
Female	45	45	
Blood Loss (ml)	100 ± 15	110 ± 18	P > 0.05
Surgery Duration (minutes)	56 ± 10	62 ± 8	P > 0.05
Number of Blood Transfusions (average units)	0	1	P > 0.05

Length of Hospital Stay (days)	3 ± 1	4 ± 1	P < 0.05
Range of Motion (Mean ± SD)			
Pre-op	110.30 ± 8.34	105.71 ± 7.27	
Post-op 6 weeks	112.00 ± 5.42	108.95 ± 7.10	
Post-op 3 months	118.43 ± 6.55	115.75 ± 6.98	
Post-op 6 months	122.43 ± 6.70	117.40 ± 7.45	
Post-op 12 months	125.50 ± 5.63	120.67 ± 8.45	
Improvement in Range of Motion	9 ± 5	11 ± 5	P > 0.05
Pain Score (VAS) (mean ± SD)			
Pre-op	8.5 ± 0.80	8.7 ± 0.75	
Post-op 6 weeks	3.0 ± 0.70	4.5 ± 0.65	
Post-op 3 months	2.3 ± 0.49	3.2 ± 0.51	
Post-op 6 months	1.5 ± 0.51	1.7 ± 0.46	
Post-op 12 months	1.2 ± 0.40	1.3 ± 0.36	
Improvement in VAS	6.5 ± 1	5.8 ± 1	P < 0.05
Improvement in Mechanical Axis (mean ± SD)	8 ± 3°	10 ± 2°	P > 0.05
Average time needed for independent walking (days)	20 ± 3	25 ± 5	P < 0.05
Average time needed for return to work (days)	42 ± 6	48 ± 8	P < 0.05

Table 2. Knee Scoring Distribution.

Knee Score	Group A	Group B	P-value
Knee Society Score (KSS)			
Clinical Knee Score (mean ± SD)			
Pre-op	30.50 ± 5.5	26.25 ± 7.8	
Post-op 6 weeks	66.74 ± 4.6	63.22 ± 3.5	
Post-op 3 months	75.80 ± 5.6	74.54 ± 4.5	
Post-op 6 months	87.65 ± 3.4	85.92 ± 4.1	
Post-op 12 months	92.54 ± 2.3	90.45 ± 2.7	P > 0.05
Functional Knee Score (mean ± SD)			
Pre-op	32.65 ± 7.5	28.25 ± 5.8	
Post-op 6 weeks	65.74 ± 4.8	64.22 ± 3.3	
Post-op 3 months	75.55 ± 6.6	71.64 ± 3.6	
Post-op 6 months	88.15 ± 2.4	87.12 ± 6.1	
Post-op 12 months	91.59 ± 4.3	90.05 ± 2.1	P > 0.05
Oxford Knee Score (OKS) (mean ± SD)			
Pre-op	21.45 ± 8.5	20.28 ± 3.8	
Post-op 6 weeks	32.17 ± 1.4	30.52 ± 4.3	
Post-op 3 months	39.65 ± 4.6	37.69 ± 5.7	
Post-op 6 months	41.85 ± 5.4	40.62 ± 4.8	
Post-op 12 months	44.59 ± 4.6	43.35 ± 2.2	P > 0.05

IV. Discussion

Osteoarthritis (OA) is one of the most common chronic joint diseases in the elderly. In India, its prevalence ranges from 17 to 60.6%, and it is more prevalent in the urban population than in the rural.[8] Various modes of treatment, both medical and surgical, have surfaced and have been tried to decrease the suffering due to degenerative joint diseases of the knee. The most effective and successful treatment for advanced osteoarthritis is knee replacement, either total knee arthroplasty (TKA) or partial (Unicondylar) knee arthroplasty (UKA). High tibial osteotomy (HTO) is also an alternative treatments for single compartment osteoarthritis in the younger age group, but many studies reported ten-year survival (28% to 80%) and functional outcome for HTO are generally worse than those seen with UKA and TKA.[9,10]

Unicondylar knee arthroplasty is usually limited to a single compartment symptomatic osteoarthritis, especially isolated antero-medial compartmental osteoarthritis. In 1989, Kozinn et al. suggested that the best candidates for UKA are patients with age more than 60 years old and weight less than 180 pounds (82 kgs), not extremely physically active or heavy laborers with isolated medial compartment disease.[11,12] But advances in operative technique (microplasty), better understanding of disease process and introduction of mobile bearing implants has expands the indications of UKA.[13] Price et al. suggested that the Oxford UKA can produce similar results to TKA in younger osteoarthritic patients.[14] Compare to TKA, UKA have many advantages like small incision, less blood loss, limited quadriceps disruption, more preserves bone stock, minimal morbidity, less complications, short rehabilitation time, improved knee kinematics and better functional outcome.[15-18] In UKA, patient have sense of "feeling more normal" when compared with TKR because UKA does not violate the non-affected parts of the knee, it only resurfaced the medial articular compartment.[19,20] In addition, revision surgery in UKA also less complicated compare to TKA, this may be an important consideration for the younger patient who may require at least one revision in their lifetime.[20,21] In many studies, UKA has been proved with good clinical outcome in terms of parameters like pain relief, better knee kinematics, improved knee functional scores and post-surgery range of motion[6,22] but still many surgeons consider UKA as a niche option for a limited number

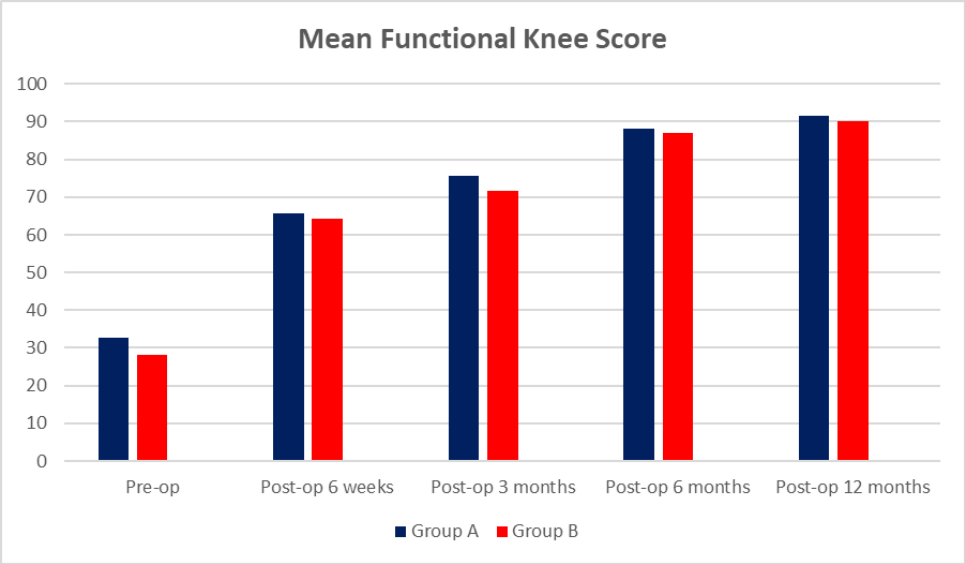
of patients. There are very few published studies of UKA that compare functional outcome in young patients versus elderly patients. Hence present study was designed to assess comparability of clinical and functional outcomes of oxford unicondylar knee arthroplasty in patients with anteromedial osteoarthritis who were ≤ 60 years of age at operation and to compare the results with those of patients > 60 years of age.

The surgery duration usually depends on the Surgeon-related factors, surgical approach, surgery technique, and experience of the surgeon. In this study, all cases were operated by the same surgeon, using the same surgical technique, so this confounding factor was eliminated. Therefore, we didn't found any statistically significant difference in average surgery duration (56 ± 10 minutes and 62 ± 8 minutes), and average blood loss (100 ± 15 ml and 110 ± 18 ml) between younger and elderly age groups, respectively.

In any symptomatic patient of OA, the primary aim of any surgical intervention is to provide a pain-free range of motion. In this study, initially at 6 weeks post-operatively pain relief was better in younger age group patients, but after that no significant difference was seen at the end of three months, six month and one year. Both groups showed significant improvement in range of motion (9 ± 5 and 11 ± 5, respectively) when compared to preoperative ROM, but the average range of motion was statistically significantly better in the younger age group compared to elderly age group patients. It was also seen that the patients with low preoperative range of motion had less range of motion at final follow-up. This result shows that preoperative range of motion can be a determinant of postoperative range of motion. The study by Laubenthal KN et al.[23] stated that the minimal pain-free range of motion needed to perform activities of daily living is about 110°. Both groups achieved a ROM greater than 115° at 3 months' follow up. Several studies also reported significant improvement in ROM postoperatively in patients who underwent Oxford UKA, both in younger age groups[24-26] as well as in elderly age groups.[27,28] We feel that the possible reason for improved ROM in all patients irrespective of age is that UKA allows debridement of the entire knee joint while preserving the bone stock, the lateral meniscus, ACL, PCL, articular cartilage of the uninvolved compartment, and less damage to the extensor mechanism.

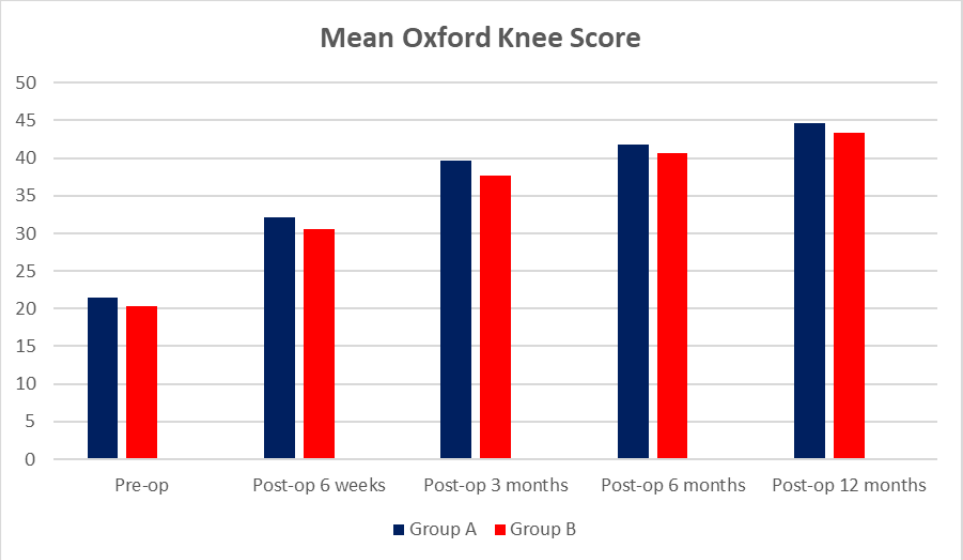
In the present study, functional assessment was done using Knee Society score (KSS). It includes two components 1) a clinical score that describes pain, range of motion, and alignment; and 2) a functional score that describes functions such as walking and stair climbing.

Many studies reported excellent results with an average knee score of around 90 in elderly patients over 60 years of age with degenerative osteoarthritis who underwent Oxford UKA.[29] But there is limited literature regarding the use of this procedure for younger, active patients less than 60 years of age. Kort et al.[24] and Schai et al.[30] did Oxford phase-3 UKA in patients under 60 years and reported the average knee score of 90.52 and 93, respectively. There are very few studies that directly compare two age groups to each other. Tabor et al.[31] found slightly higher average KSS scores and functional scores in younger age group patients, but overall, clinical results were not significantly affected by age. Price et al.[14] compared the two groups and found that patients < 60 years of age had a 91% 10-year survival rate and patients > 60 years of age had a 96% 10-year survival rate. They concluded that patients with an age >50 years should not be considered as a contraindication to UKA. In our study, we found a slightly better KSS score in the younger age group, but there was no significant difference between both age groups at final follow-up. At one year follow-up, clinical and functional knee scores were graded as excellent (>90 points) in the younger group versus good (80-90 points) in the elderly group, thus better pain relief and functional improvement among the younger population (Graph 1).



Graph 1: Comparison of mean Functional Knee Score between younger and elderly age groups.

The Oxford knee score (OKS)[32] is a patient-based questionnaire which involves a series of 12 questions, and their response scores range from 0 (worst) to 4 (best) for each, giving a total range of 0–48. Pandit et al.[28] found significant improvement in mean OKS from 18 pre-operatively to 39.2 post-operatively with an average follow-up of 7 years in the elderly (> 60 years) age group patients operated with phase 3 Oxford UKA. Luscombe et al.[33] also reported similar results. Streit et al.[25] did Oxford UKA in young and active patients with age ≤ 60 years and showed a significant improvement in mean OKS from 23.6 pre-operatively to 41.6 post-operatively at 5 years follow up. They concluded that Minimally invasive Oxford medial UKA is a reliable and effective in young and active patient cohort providing high patient satisfaction at mid-term follow-up. In our study mean OKS were comparable in both age groups at final follow-up and no statistically significant difference was found. In elderly age group patients OKS were on slightly lower side this could be due to decrease functional activity with advancing age (Graph 2).



Graph 2: Comparison of mean Oxford Knee Score between younger and elderly age groups.

Length of hospital stay mainly depends on the patient's fitness, surgical approach and the hospital's rehabilitation program. More extensive surgical approach cause more postoperative pain, delay patient's mobilization and prolong hospital stay. We did UKA by minimally invasive surgical approach (microplasty approach) which preserve soft tissue biology, cause minimal injury to the quadriceps muscle, the patella is not dislocated, and the synovial reflections of the suprapatellar pouch remain intact, these all factors leads to diminish postoperative pain and allow the knee to recover rapidly. We applied same rehabilitation program in both groups. Price et al.[14] stated that rate of recovery after short-incision UKA was 3 times faster than after TKR. Forrest et al.[34] stated that the patients age at time of surgery is statistically significant correlated with length of hospital stay. In their study elderly patients with associated comorbidities mostly diabetes mellitus required longer hospital stay. Munin et al.[35] also reported similar finding suggesting that age is the factor that has the greatest effect on length of hospital stay. In our study, we found that in elderly age group patients hospital stay was slightly higher (4 ± 1 days) as compared to younger age group (3 ± 1 days) but this was not statistically significant. Comparative longer hospital stay in elderly age group patient was most probably due to multiple comorbidities associated with elderly age. The duration of stay, however was not found statistically significant in both age groups which indirectly reflects good recovery even in elderly age group.

Rehabilitation period was shorter in younger patients. The time taken for independent walking was 20 ± 3 days in younger subgroup verses 25 ± 5 days in elderly subgroup. However, for return to work and return to outdoor activities, a significantly quicker recovery was seen in younger subgroup.

In this study, two patients in elderly age group developed superficial wound infection and were managed conservatively. One patient developed aseptic loosening after 10 months post-operatively and was converted into total knee replacement. No one in either groups developed any other major complications. Proper patient selection, excellent surgical technique, minimal invasive nature of surgery, well definite postoperative protocol and early mobilization are helps in reducing the major complications in postoperative period.

V. Conclusion

The oxford unicondylar (partial) knee arthroplasty can be performed in both under 60 and over 60 years of age patients with isolated medial compartment arthritis. Both groups showed excellent results and there was no statistically significantly difference in clinical outcome and survival rate. We believe that age is not a contraindication to using the Oxford UKA to treat patients with anteromedial osteoarthritis of the knee. Partial knee arthroplasty can be performed in younger patients with good clinical and functional outcomes.

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