Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 1 January 2023

Research Article

"Clinical Outcomes of Mobile Meniscal Bearing Unicondylar Knee Replacement in Medial Compartment Osteoarthritis Knee, A Prospective Study"

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Received: November 22, 2022

Published: December 12, 2022

Abstract

Osteoarthritis can be efficiently described as a group of distinct overlapping diseases which may be attributed to variety of etiological factors, but present with similar biologic, morphologic and clinical outcomes. The disease process may not only affect the underlying articular cartilage but may progress gradually to involve the entire joint including the subchondral bone, capsule, ligaments, synovial membrane and periarticular muscles. In severe progression of disease, knee joint completely loose cartilage and the periarticular bone and soft tissue structures may present with changes which may cause joint pain, swelling and disability.

Keywords: Clinical Outcomes; Mobile Meniscal; Unicondylar Knee Replacement; Osteoarthritis Knee

Introduction

With the continued rise in the mean age of general population, the social implication of OA is steadily increasing [1]. Worldwide, OA is the 4th most common cause of disability and is the most common cause of musculoskeletal pain and disability in knee joint. Earlier OA was known as the disease of elderly affecting those above the age of 65 years, however, now it is increasingly diagnosed in the younger people in the age group of 35-55 years [3]. OA is the precipitating diagnosis for more than 90% of knee arthroplasty surgery, undertaken worldwide [2].

Secondary OA of knee can be due to an underlying pathology which may include trauma leading to damage of articular cartilages, developmental conditions, systemic metabolic diseases, endocrine diseases, bone dysplasia's and inflammatory arthropathies. Secondary OA may manifest earlier in younger generation than primary OA, however, distinction between the two may not alter the clinical practice and therapeutic choices.

Knee OA may involve all three compartments of knee; however, early OA may present with changes in either medial, lateral or patellofemoral compartment alone. Medial compartment of knee is most commonly involved as the body weight passes through the medial compartment. The articular surfaces of medial and lateral tibio-femoral articulations are completely separate from one another and so the disease may present with progression in only one compartment.

While completely rendering the other compartment normal. In such a situation, unicompartmental knee replacement is a logical choice as compared to total knee replacement, while leaving the normal compartment untouched from the surgical intervention.

Arthroplasty is an orthopedic surgery where the articular surface of musculoskeletal joint is replaced, remodeled or realigned. Knee arthroplasty is the most common orthopedic surgery and is expected to grow by more than 600% to 3.48 million procedures by 2030, according to an estimate by Kurtz., *et al.* [3]. Main aim of the surgical intervention is to restore normal joint function and prevent further degenerative changes. Total knee replacement is accepted as the gold standard procedure for symptomatic arthritis of knee. Unicompartmental Knee Replacement (UKR) replaces only the diseased compartment of knee, thus preserves the native ligaments and soft tissue stabilisers of knee joint. UKR has been reported to have better clinical and functional outcomes than TKR, also decreasing the overall morbidity and mortality, representing normal knee kinetics. The Tibial axial rotation and femoral rollback more closely resembles normal knee anatomy as compare to TKR, reported by Petit., *et al.* [4]. Patient undergoing UKR, reported to their normal physical activities earlier and had less joint pain with greater functional outcome.

High Tibial Osteotomy (HTO) is an alternative surgical intervention for UKR. However, in appropriate cases, UKR had better long-term survival with quick recovery and lesser pain. However,

disease progression to both the compartments of knee may further present with need to perform Primary TKR. However, revising a UKR into primary TKR is far easier then revising a TKR, per se [5].

Unicompartmental Knee Replacement was initially introduced in 1950's as an alternative to Total Knee Replacement. The first truly modern Unicompartmental knee designs were the St. Georg Sled systems (1969) and Marmor Modular Knee system (1972) [6]. In 1974, Goodfellow and O'Connor developed the concept of 'Oxford Knee' [7]. It had a femoral component with a spherical articular surface, a metal tibial component which was flat and had a polyethylene mobile bearing, spherically concave above and flat below, interposed between them. The Oxford device was fully congruent at both interfaces throughout the range of movement. These features of the Oxford knee remain unchanged till date. A combination of poor prosthetic devices and instrumentation and poor patient selection in the earlier days lead to many failures. Due to high failure rates, Unicompartmental Knee Replacement as completely abandoned throughout the world by late 1980's. However, in the last 15 years, there has been resurgence of UKA, as many studies suggested that UKA is at par to TKR in appropriately selected patients [8].

The Oxford knee prosthesis are less ideal for Lateral compartment replacement as the lateral compartment is more mobile due to increased elasticity of the ligaments of the lateral compartment as compared to the medical compartment and a 10% rate of early dislocation of the bearing is reported.

Materials and Methods

The proposed study was conducted in the department of Orthopedics and Joint Replacement, Dr. B. L. Kapur Memorial Hospital, New Delhi after obtaining clearance from the ethical committee. Informed consent was taken from the subjects participating in the study.

Study design

Interventional Prospective Clinical Study

Study population

Patients coming to the outpatient department of Dr. B.L. Kapur Memorial Hospital with primary Osteoarthritis with indication for Mobile Meniscal bearing Unicondylar knee replacement were studied over a period of 22 months.

Sample size

Lisowski., *et al.* 2015 obtained the mean difference of AKSS between post op and preop follow ups as 25 ± 45.79. At the same follow-ups they reported the mean difference in OKS to be 15.5 ± 20.4. Assuming these values as reference, the minimum required sample size at 5% level of significance and 80% power was obtained as follows

Parameter	Sample size (*n*)
AKSS	26
OKS	14

Table a

Hence, we propose to collect sample of at least 26 patients for this study.

Statistical tests

The quantitative variables were expressed as mean ± SD and compared using paired t-test. Association between variables were assessed using Chi-square test. A p-value < 0.05 was considered statistically significant. Statistical Package for Social sciences (SPSS) version 16.0 were used for statistical analysis.

Calculations

Parameter	Δ	σ	*z* 2.5% At α = 5%	Φ (1- β) β = 20% i.e., power = 1 - β = 80%	Sample size (*n*)
AKSS	25	45.79	1.96	0.842	26
OKS	15.5	20.4	1.96	0.842	14

Table b

Inclusion criteria

Subjects were included in the study on the following basis

- Symptomatic patients of Anteromedial Osteoarthritis of knee (AMOA) who failed to respond satisfactorily to the conservative management.
- Full thickness loss of articular cartilage with or without loss of bone in the medial compartment, corresponding to Ahlbacks grade of 2,3 and 4 [9].
- The ACL should be viable with its synovial covering with no longitudinal splits or break in their continuity
- Full thickness of articular cartilage in the lateral compartment should be preserved. A small chondral ulcer on the medial side of lateral femoral condyle can be ignored for this study [9].
- There should be normal functionality of the Medial collateral ligament. The varus deformity should be correctable at $20^0$of knee flexion indicating the viability of MCL.

Exclusion criteria

- Patients with Patellofemoral arthritis
- Involvement of Lateral compartment of knee
- Fixed Deformities like Varus, Flexion.
- Secondary arthritis due to trauma, infection and inflammation.
- Functionally compromised ACL

Methodology

- All patients included in the study were subjected to a thorough clinical evaluation. Proper history was recorded and they were included in the study after satisfying the inclusion and exclusion criteria.
- All routine blood investigations were done as per pre anesthetic requirements. Xray and MRI was done to further evaluate.

Clinical history

Detailed history was obtained from each subject. Patients were inquired about the onset of pain, its duration, radiation and course. Any association of pain with daily living activities like squatting, sitting cross legged, climbing stairs were noted. Factors aggravating and relieving the pain and involvement of other joints in the body had a special mention. Patients were inquired about any decrease in Range of motion and its association with crepitus or abnormal movements, like locking and give away of knee were noted. A detailed history was obtained to rule out previous causes of inflammation, infection or trauma. History was taken for any comorbidities and its treatment. Past, Personal and Family history was taken in detail as well.

Clinical evaluation

After history taking, patients were counselled about the requirement for a detailed systemic and joint examination. Examination was done under supervision of senior faculty. All examinations were performed in broad day light with proper exposure of the affected limb.

Inspection

Patient was inspected from Front side and back for any swelling, redness, sinus, scar marks, deformity, muscle build and attitude of the limb.

Palpation

Temperature, tenderness, Crepitus, complete range of motion, ligamentous stability and other measurements were noted.

X Rays

Anteroposterior View

- Patient was asked to stand on both legs and an anteroposterior Xray was taken. Bone on bone articulation can be demonstrated on the medial side due to loss of articular cartilage.

Lateral View

- Extent of posterior bony erosion on the tibial plateau was demonstrated. It was also helpful in determining the presence of osteophytes, if any.
- Stress Views [10].

Anteroposterior valgus and varus stress views were taken to check for the thickness of articular cartilage. Varus stress views demonstrated full thickness loss of medial articular cartilage and valgus stress views demonstrated the condition of articular cartilage on the lateral side. Scannogram of both knee was done to demonstrate the mechanical and functional axis.

Magnetic resonance imaging

Plain MRI was done to evaluate the status of cruciate ligaments, cartilage and collateral ligaments.

Parameters for evaluation of clinical outcomes

Patients who were selected for the study after satisfying the clinical and radiological examinations, were further subjected to evaluation on following parameters.

- **Oxford Knee Score** [11]**:** It is a patient-based scoring system which evaluates the outcome after Knee replacement. It has 12 questions with each question scoring from 0 to 4 points. All the scores are eventually added up and the final score ranges from 0 (worst) to 48 (best).
- **The American Knee Society Score (AKSS)** [12]: is a clinician-based score which is further divided into 2 components: Objective and functional. Each score ranges from 0 to 100 points each and the differentiation into two components eliminates the influence by variables like comorbidities and advancing age.

The Objective AKSS evaluates pain in a total of 50 points, stability of knee in 25 points and other 25 points for range of motion. A knee with no pain, good alignment in extension and stability with atleast 125^0range of motion scored 100 points.

Flexion contracture, poor alignment and loss of extension were subjected to deductions in the score. The Functional AKSS walking distance in a total of 50 points with other 50 points for climbing and descending stairs. Maximum score is awarded to individuals who can walk long distances without any support and can climb and descend stairs normally. Use of walking aids and difficulty in climbing and descending stairs subjected to decorations in the score.

- **WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index)** [13]**:** Score was developed for use among patients with knee OA. The WOMAC consists of 24 items divided in 3 subclass:
  - **Pain (5 items):** during walking, climbing stairs, in bed, sitting or lying and standing.
  - **Stiffness (2 items):** after first walking and later in the day.
  - **Physical function (17 items):** stair rise, rising from sitting, standing, bending, walking, getting in/out of the car, shopping, putting on/taking off socks, rising from bed, lying in bed, getting in/out of bath, sitting, getting on/off toilet, heavy household duties, light household duties.

Preoperative preparation of the patients

All the patients were subjected to Pre-anesthetic check ups one day before surgery and were reviewed again before shifting to the Preop room. Anesthesia and surgical consents were obtained a day before surgery after counselling the patients thoroughly about the procedure and need for post-op observation. Patients were kept NPO six hours before surgery and part preparation of the entire involved limb was done in the ward with betadine scrub. Blood products, where required, were reserved in the blood bank. Antibiotic sensitivity testing was done before shifting the patient to the Operation Theatre. Patients were administered antibiotic half an hour before the start of surgical intervention.

Surgical Steps [14]

Limb Positioning

Limb was draped on a thigh support with knee free to flex fully without any obstruction in the range of motion. Tourniquet was inflated according to the systolic Blood pressure.

Incision

Incision was made with knee in flexion of 90^0. A medial parapatellar incision was taken from the medial margin of patella and extended 3cm distal to the joint line. The incision was deepen through the joint capsule extending 2cm proximally to the joint line into the vastus medialis. Proximal part of the tibia was exposed with careful dissection. Medial menisci was excised and care was taken to not release any fibers of the MCL. Patella was subluxated and the retro patellar fat pad was excised. Osteophytes if any, were removed from the tibial plateau, infront of ACL insertion and around patella. Osteophytes present around the MCL and the posterolateral margins were also carefully removed.

Tibial plateau resection

Femoral sizing spoon was inserted usually starting with 1mm which usually helped to achieve proper tension of ligaments. Size of spoon was gradually increased as and when required. After placing a correct femoral sizing spoon in the medial compartment, a tibial saw guide was applied with its long axis parallel to the long axis of Tibia and was clamped to the spoon with the help of a G clamp. The tibial saw guide was then pinned to the tibial surface and the G clamp along with the spoon was removed. The tibial surface was then resurfaced using the vertical and horizontal cuts. The saw was kept parallel to the guide during vertical cuts. A retractor was used to retract the MCL during horizontal cuts.

Femoral resection

A hole was drilled in the intramedullary canal of the femur which is situated 1cm anteriorly to the PCL attachment and 2-3mm lateral to intercondylar notch. Intramedullary rod was secured and knee flexed to $90^0$of flexion. Size of femoral drill guide was checked and was attached to the intramedullary rod with the help of intramedullary link. Two drill holes were made in the distal medial femoral condyles with anterior hole being 4mm and distal hole being 6mm. The posterior resection guide was then secured in the drill holes and the posterior femoral resection was done. After removing the guide, the remaining medial menisci were removed. The femoral surface was then milled with spigot as the guide in 6mm drill hole.

Flexion and extension gaps

The femoral and tibial components were secured in their respective grooves and then the gaps were measure using the feeler gauge. The flexion gap was checked in 100^0 of flexion with easy sliding of the feeler gauge without exerting pressure on the surrounding soft tissue structures. The feeler gauge was then removed and the knee was flexed to $20^0$to check for the extension gap. Amount of excess bone to be milled was then decided by deducing the difference between flexion and extension gaps. Any excess bone on the anterior and posterior surface and osteophytes were removed to ensure that there is no impingement.

Tibial Plateau - final preparation

Appropriate size tibial plateau was then secured in such a way that its posterior margin was flush with the posterior cortex. It was made to be flush with the medial margin with less than 2mm of overhang. Tibial plateau was then pinned at its medial surface and a kneel cut saw was introduced to take cuts.

Trial implantation

Once all the cuts were taken, trial femoral and tibial components were secured with an appropriate size meniscal bearing. Knee was examined for its range of motion and valgus stress test in $20^0$of flexion. The component position was checked for any impingement and restoration of normal tension across the ligaments was achieved. Once the position of the components was confirmed, the trial implants were removed, and the surface of the bone was roughened using a drill hole.

Final cementing of the components

The tibial component was secured first after applying cement on the tibial surface and ensuring its uniform distribution. The Tibial component was then impacted using a right-angled impactor. Excess cement was removed using a Woodson curette. The Femoral component was then secured in its position and a feeler gauge was inserted at $45^0$of knee flexion to ensure proper setting of cement. After the cement was completely set, the feeler gauge was removed, and the femoral and tibial components were cleaned. The desired size meniscal bearing was then secured on the tibial plateau. The wound was closed in a usual manner after thorough lavage of the knee joint.

Post-operative care and management

Postoperative management is of utmost importance for a successful outcome after surgery. Vital charting was done on a regular basis to check for Blood pressure, heart rate, urine output and fever if any.

Patient was started with soft diet which was slowly converted to normal diet as per the scenario. Nutrition plays a very important role in the postop period and a proper diet was encouraged. Patient was started on antibiotics for Gram positive and Gram negative blanket coverage. Analgesics and anti-inflammatory drugs were started.

Physiotherapy was started from 2nd post op day. Quadriceps strengthening, active toe movements and continue passive movements exercises were encouraged. Drain was removed on 2nd postop day and wound was dressed as well.

Mobilization was initiated on 3rd postop day and toilet training was done to ensure gradual improvement in range of motion.

Skin stapler were removed on 14th postop day and the patient was encouraged to continue exercises under supervision of physiotherapist, till they feel comfortable to ambulate without any support or supervision.

Post Op follow up

Patients were followed up at 2 weeks, 6 weeks, 3 months and 6 months postoperatively. Serial X-rays, Oxford Knee score, American knee society score both Objective and functional and the Western Ontario and McMaster Universities Osteoarthritis Index scores were noted at follow ups.

Final clinical evaluation was done at 6 months and the functional scores were evaluated.

Post-operative assessment of implant placements

Postoperative serial radiographs were taken without any variation in Xray beam angulations to produce comparable radiographs for assessment [15].

Anterior projection

Xray were taken in an anteroposterior direction with patient supine on the table. Beam of Xray and leg were manipulated to obtain end on appearance of the tibial component. Varus and Valgus alignments of the component were evaluated in relation to the long axis of tibia.

Lateral projection

Xray were taken in lateral view after 25^0-$40^0$of knee flexion such that the tibial component appeared edge on with both femoral condyles overlapping each other. Flexion and extension alignments of the component were evaluated in relation to the posterior cortex of Femur. A 7^0postero-inferior slope was taken as neutral due to its normal occurrence.

Evaluation

Obtained data was thoroughly evaluated and tabulated.

Proper informed consent was obtained before including the subject in the study. They were counseled about the subsequent process and were free to leave study at any desired moment. The study was carried out with utmost confidentiality of the subjects and was approved by the Ethical committee at Dr.B.L.Kapur memorial hospital, New Delhi.

Results and Discussions

A total of 26 consecutive knees with symptoms of medial compartment Osteoarthritis which underwent Mobile meniscal bearing Unicondylar Knee Arthroplasty in our Institute at Dr.B.L.Kapur Hospital were studied prospectively for their functional and clinical outcomes with a mean follow up of 6 months.

Demographics

Sex distribution

The sample consisted a total of eighteen females and eight males in our study with distribution of 69.2% and 30.8% respectively.

Sex	Frequency	%
F	18	69.2%
M	8	30.8%
Total	26	100%

Table 1: Gender distribution in present study.

Age

The mean age of our patients was 57.38 ± 6.43 with 11.5% aged between 41-50 years, 57.7% were between 51 and 60 years and the remaining 30.8% above 60 years.

Age Groups	Frequency	%
41 - 50 yrs	3	11.5%
51 - 60 yrs	15	57.7%
61 - 70 yrs	8	30.8%
Total	26	100%
Mean ± SD	57.38 ± 6.43	
Min - Max	44 – 70	
Median (IQR)	57.50 (53.00 - 62.25)	

Table 2: Age distribution in present study.

Knee Side	Frequency	%
L	13	50.0%
R	13	50.0%
Total	26	100%

Table 3: Distribution of Limb side in present study.

Limb distribution

Right knee consisted of 50% of our patients with an equal distribution of 50% on the left side.

ACL status

- ACL examination was done preoperatively by Lachmans and Anterior drawer test to check for its laxity. None of the patients had any of the two tests positive.
- MRI was done to recheck the status of ACL preoperatively to check for any tears or degenerative changes.
- MRI of 3 patients showed degenerative changes while MRI of 2 patients indicated partial degree tear in the substance.

However, intraoperatively ACL of all the patients was found to be intact and its integrity maintained.

Functional and clinical outcomes

OXFORD knee score

The mean Oxford score improved significantly in our patients from 16.96 ± 4.26 preoperatively to 29.42 ± 3.88 two weeks postop, 37.96 ± 3.77 six weeks postop, 41.73 ± 3.66 3months postop and 45.77 ± 2.16 at the end of 6 months postoperatively. (p value < 0.05).

Oxford Knee Score	N	Mean ± SD	p value
Pre-Op	26	16.96 ± 4.26	<0.05
2weeks	26	29.42 ± 3.88	
6weeks	26	37.96 ± 3.77	
3months	26	41.73 ± 3.66	
6months	26	45.77 ± 2.16	

Table 4: Mean OKS scores at preop, 2weeks postop, 6weeks post op, 3months postop and 6months postop.

OKS		Mean Difference	Std. Error	p value	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pre-Op	2weeks	-12.462*	0.956	<0.05	-15.405	-9.518
	6weeks	-21.000*	0.93	<0.05	-23.862	-18.138
	3months	-24.769*	1.008	<0.05	-27.872	-21.666
	6months	-28.808*	0.845	<0.05	-31.409	-26.207
2weeks	6weeks	-8.538*	0.582	<0.05	-10.331	-6.746
	3months	-12.308*	0.701	<0.05	-14.466	-10.149
	6months	-16.346*	0.661	<0.05	-18.38	-14.312
6weeks	3months	-3.769*	0.334	<0.05	-4.798	-2.74
	6months	-7.808*	0.49	<0.05	-9.316	-6.3
3months	6months	-4.038*	0.424	<0.05	-5.344	-2.733

Table 5: OKS Mean difference, Standard error and confidence Interval (95%) noted during.

American knee society score-objective

The American Knee Society score depicted significant improvement from 48.12 ± 5.55 preoperatively to 69.23 ± 7.63 two weeks postop, 85.15 ± 6.66 six weeks postop, 90.40 ± 5.83 three months postop and 95.54 ± 4.23 at the end of six months postoperatively. (p-value <0.05).

American knee society score - functional

The Functional American Knee Society Score preoperatively was 34.42 ± 15.25. The score at 2 weeks postoperatively was lower than the preop score with a mean of 29.23 ± 8.44. However, the score significantly improved from 29.23 at 2 weeks post op to 65.19 ± 15.78 six weeks postop, 82.31 ± 10.12 3months postop and 90.96 ± 7.87 at the end of 6 months postoperatively. (p-value <0.05).

American Knee Society Score	N	Mean ± SD	p value
Pre-Op	26	48.12 ± 5.55	<0.05
2weeks	26	69.23 ± 7.63	
6weeks	26	85.15 ± 6.66	
3months	26	90.40 ± 5.83	
6months	26	95.54 ± 4.23	

Table 6: Mean AKSS-O scores at preop, 2weeks postop, 6weeks post op, 3months postop and 6months postop.

AKSS-Objective		Mean Difference	Std. Error	p value	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pre-Op	2weeks	-21.115*	1.361	<0.05	-25.306	-16.925
	6weeks	-37.038*	1.253	<0.05	-40.896	-33.181
	3months	-42.923*	1.208	<0.05	-46.64	-39.206
	6months	-47.423*	1.093	<0.05	-50.787	-44.059
2weeks	6weeks	-15.923*	0.953	<0.05	-18.855	-12.991
	3months	-21.808*	0.903	<0.05	-24.587	-19.028
	6months	-26.308*	1.088	<0.05	-29.657	-22.958
6weeks	3months	-5.885*	0.416	<0.05	-7.166	-4.603
	6months	-10.385*	0.738	<0.05	-12.657	-8.112
3months	6months	-4.500*	0.541	<0.05	-6.166	-2.834

Table 7: AKSS-O Mean difference, Standard error and confidence Interval (95%) noted during subsequent follow ups.

American Knee Society Score (Functional)	N	Mean ± SD	p value
Pre-Op	26	34.42 ± 15.25	<0.05
2weeks	26	29.23 ± 8.44	
6weeks	26	65.19 ± 15.78	
3months	26	82.31 ± 10.12	
6months	26	90.96 ± 7.87	

Table 8: Mean AKSS-F scores at preop, 2weeks postop, 6weeks post op, 3months postop and 6months postop.

AKSSF		Mean Difference	Std. Error	p value	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pre-Op	2weeks	4.615	3.396	0.630	-5.838	15.069
	6weeks	-30.769*	4.176	<0.05	-43.623	-17.915
	3months	-47.885*	3.702	<0.05	-59.28	-36.489
	6months	-56.538*	3.603	<0.05	-67.629	-45.447
2weeks	6weeks	-35.385*	2.8	<0.05	-44.004	-26.766
	3months	-52.500*	3.141	<0.05	-62.168	-42.832
	6months	-61.154*	3.262	<0.05	-71.194	-51.114
6weeks	3months	-17.115*	1.843	<0.05	-22.79	-11.441
	6months	-25.769*	2.265	<0.05	-32.741	-18.797
3months	6months	-8.654*	0.811	<0.05	-11.151	-6.156

Table 9: AKSS-F Mean difference, Standard error and confidence Interval (95%) noted during subsequent follow ups.

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) Score

The WOMAC score suggested a significant improvement in the functional outcomes of all patients postoperatively. The score was 70.27 ± 13.41 preoperatively and 4.73 ± 4.85 at the end of 6 months. (p-value <0.05).

Implant placement

Femur

Flexion/Extension

The Postoperative radiographic evaluation suggested that twenty-two femoral components were in flexion with three in neutral position and one in extension. All the components were within the acceptable limits of femoral alignment. The mean alignment of the femoral component was in $2.53^0$of flexion ranging from 8.3^0flexion

Womac Score	N	Mean ± SD	p value
Pre-Op	26	70.27 ± 13.41	<0.05
2weeks	26	35.62 ± 15.17	
6weeks	26	17.96 ± 9.81	
3months	26	9.58 ± 6.54	
6nonths	26	4.73 ± 4.85	

Table 10: Mean WOMAC scores at preop, 2weeks postop, 6weeks post op, 3months postop and 6months postop.

WOMAC	WOMAC	Mean Difference	Std. Error	p value	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pre-Op	2weeks	34.654*	2.85	<0.05	25.881	43.427
	6weeks	52.308*	2.451	<0.05	44.762	59.853
	3months	60.692*	2.399	<0.05	53.309	68.076
	6months	65.538*	2.512	<0.05	57.805	73.272
2weeks	6weeks	17.654*	1.524	<0.05	12.962	22.345
	3months	26.038*	2.038	<0.05	19.764	32.313
	6months	30.885*	2.555	<0.05	23.02	38.749
6weeks	3months	8.385*	0.945	<0.05	5.476	11.293
	6months	13.231*	1.44	<0.05	8.797	17.665
3months	6months	4.846*	0.646	<0.05	2.857	6.835

Table 11: WOMAC Mean difference, Standard error and confidence Interval (95%) noted during subsequent follow ups.

Femur Flexion/Extension	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Implant in Flexion	Preop	16.72	47.68	31.59	22	<0.05
	Postop	45.68	95.31	92.27		
Implant in Neutral	Preop	19	50	51.66	03	<0.05
	Postop	46	96.66	81.66		
Implant in Extension	Preop	16	49	45	01	<0.05
	Postop	47	97	90		

Table 12: Femur Flexion/Extension with Mean OKS/AKSS-O/AKSS-F.

Femur	Flexion/Extension
Mean ± SD	(-)2.53 ± 2.39
Min - Max	(-)8.3 - 1.8
Median (IQR)	(-)2.25 [(-)3.33 - (-)1.25]

Table 13: Femur Flexion/ Extension descriptive analysis.

to $1.8^0$of extension. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients with p value < 0.05.

Varus/valgus angulation

The Postoperative radiographic evaluation suggested that nineteen femoral components were in varus with three in neutral position and four in valgus. All the components were within the acceptable limits of femoral alignment. The mean alignment of the femoral component was in $1.67^0$of varus ranging from 6.7^0varus to $2.1^0$of valgus. The mean OKS, AKSS-O and AKSS.

F improved significantly for all the patients with p value < 0.05.

Medial/lateral fit

The Postoperative radiographic evaluation suggested that twenty-two femoral components were central in position. Three components were placed 1mm medially, while a solitary component was placed 1mm laterally. All the components were within the acceptable limits of femoral alignment. The mean alignment of the femoral component was central in position. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients with p value < 0.05.

Femur Varus/Valgus	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Implant in Varus	Preop	16.68	46.89	34.21	19	<0.05
	Postop	45.26	95.73	89.73		
Implant in Valgus	Preop	17.75	51.75	45	04	<0.05
	Postop	47	93.25	92.5		
Implant in Neutral	Preop	17.66	51	21.66	03	<0.05
	Postop	47.33	97.33	96.66		

Table 14: Femur Varus/ Valgus with Mean OKS/AKSS-O/AKSS-F.

Femur	Varus/Valgus
Mean ± SD	(-)1.67 ± 2.09
Min - Max	(-)6.7 - 2.1
Median (IQR)	(-)1.80 [(-)3.13 - 0.00]

Table 15: Femur Varus/ Valgus descriptive Analysis.

Femur Mediolateral Fit	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p-Value
Central	Preop	16.5	47.27	34.09	22	<0.05
	Postop	45.77	95.04	91.36		
Medial 1mm	Preop	20	55.33	33.33	03	<0.05
	Postop	45.66	97.66	88.33		
Lateral 1mm	Preop	18	45	45	01	<0.05
	Postop	46	100	90		

Table 16: Femur Mediolateral Fit with Mean OKS/AKSS-O/AKSS-F.

Femur Medial/Lateral Fit	Frequency	%
Central	22	84.6%
Lateral 1mm	1	3.8%
Medial 1mm	3	11.5%
Total	26	100%

Table 17: Femur Mediolateral Fit Descriptive Analysis.

Femur Posterior Fit	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Flush	Preop	17.04	48.13	30.43	23	<0.05
	Postop	45.82	95.82	91.30		
1mm Overhang	Preop	15	48	52.5	02	<0.05
	Postop	44	95	85		
2mm Overhang	Preop	19	48	30	01	<0.05
	Postop	48	90	95		

Table 18: Femur Posterior Fit with Mean OKS/AKSS-O/AKSS-F.

Posterior fit

The Postoperative radiographic evaluation suggested that twenty-three femoral components were flush to the posterior border. Two components had an overhang of 1mm, while one had an overhang of 2mm.All the components were within the acceptable limits. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

Femur Posterior Fit	Frequency	%
1mm Overhang	2	7.7%
2mm Overhang	1	3.8%
Flush	23	88.5%
Total	26	100%

Table 19: Femur Posterior Fit Descriptive Analysis.

Tibia

Varus/valgus angulation

The Postoperative radiographic evaluation suggested that twenty-one tibial components were in varus while five were in valgus. Twenty-three components were within the acceptable limits while five were outside the acceptable norms. The mean alignment of the tibial component was in $2.59^0$of varus ranging from 12.1^0varus to $4.3^0$of valgus. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients, including those outside the acceptable limits with p value < 0.05.

Tibia Varus/ Valgus	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Implant in Varus	Preop	18.6	47.4	31	21	<0.05
	Postop	46	94.4	88		
Implant in Valgus	Preop	20.18	48.28	35.23	05	<0.05
	Postop	45.71	95.80	91.66		
Within Limit	Preop	16.71	48.80	33.57	23	<0.05
	Postop	45.95	95.19	92.14		
Outside Limit	Preop	18	45.2	38	05	<0.05
	Postop	45	97	86		

Table 20: Tibia Varus/valgus with Mean OKS/AKSS-O/AKSS-F.

Tibia	Varus/Valgus
Mean ± SD	(-)2.59 ± 3.71
Min - Max	(-)12.1 - 4.3
Median (IQR)	(-)2.90 [(-)4.43 - (-)0.60]

Table 21: Tibia Varus/Valgus Descriptive Analysis.

Slope

The Postoperative radiographic evaluation suggested that sixteen tibial components had a posterior slope while ten had an inferior slope. Twenty-two components were within the acceptable limits while four were outside the acceptable norms. The mean alignment of the tibial component had a superior slope of 1.63^0ranging from $8.9^0$of superior slope to $7.3^0$of inferior slope. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients, including those outside the acceptable limits with p value < 0.05.

Tibia Slope	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Superior Slope	Preop	17	48.3	30	16	<0.05
	Postop	46.02	96.93	92.18		
Inferior Slope	Preop	16.9	47.8	41.5	10	<0.05
	Postop	45.3	93.3	89		
Within Limit	Preop	17.27	48.18	35.68	22	<0.05
	Postop	45.63	95.31	90.90		
Outside Limit	Preop	15.25	47.75	27.5	04	<0.05
	Postop	46.5	96.75	91.25		

Table 22: Tibial Slope with Mean OKS/AKSS-O/AKSS-F.

Tibia	Slope
Mean ± SD	(-)1.63 ± 3.73
Min - Max	(-)8.9 - 7.3
Median (IQR)	(-)1.95 [(-)3.10 - 0.83]

Table 23: Tibial slope Descriptive Analysis.

Medial fit

The Postoperative radiographic evaluation suggested that nineteen tibial components were flush to the medial border. Six components had an overhang of 1mm, while one had an overhang of 2mm. All the components were within the acceptable limits. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

Tibia Medial Fit	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Flush	Preop	16.8	48.6	36	19	<0.05
	Postop	45.3	95.9	90		
1mm Overhang	Preop	17.5	46.5	29.16	06	<0.05
	Postop	47.33	94.33	94.16		
2mm Overhang	Preop	16	45	35	01	<0.05
	Postop	46	100	95		

Table 24: Tibial Medial Fit with Mean OKS/AKSS-O/AKSS-F.

Tibia Medial Fit	Frequency	%
1mm overhang	6	23.1%
2mm overhang	1	3.8%
Flush	19	73.1%
Total	26	100%

Table 25: Tibial Medial Fit Descriptive Analysis.

Lateral fit

The Postoperative radiographic evaluation suggested that all twenty-six tibial components were flush to the lateral border. All the components were within the acceptable limits. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

Tibia Lateral Fit	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Flush	Preop	16.96	48.12	34.42	26	<0.05
	Postop	45.77	95.54	90.96		

Table 26: Tibial Lateral Fit with Mean OKS/AKSS-O/AKSS-F.

Tibia Lateral Fit	Frequency	%
Flush	26	100.0%
Total	26	100%

Table 27: Tibial Lateral Fit Descriptive analysis.

Anterior fit

The Postoperative radiographic evaluation suggested that seventeen tibial components were flush to the anterior border. Seven components were 1mm short, while two components were short by 2mm and 3mm respectively. All the components were within the acceptable limits. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

Posterior fit

The Postoperative radiographic evaluation suggested that twenty-two tibial components were flush to the posterior border. Four components had an overhang of 1mm. All the components were within the acceptable limits. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

Tibia Anterior Fit	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Flush	Preop	16.52	50.77	33.23	17	<0.05
	Postop	45.35	95.17	90.29		
1mm Short	Preop	17.85	50.85	30	07	<0.05
	Postop	46.28	96.57	92.85		
2mm Short	Preop	25	48	60	01	<0.05
	Postop	48	100	85		
3mm Short	Preop	10	53	60	01	<0.05
	Postop	47	90	95		

Table 28: Tibial Anterior Fit with Mean OKS/AKSS-O/AKSS-F.

Tibia Anterior Fit	Frequency	%
1mm short	7	26.9%
2mm short	1	3.8%
3mm short	1	3.8%
Flush	17	65.4%
Total	26	100%

Table 29: Tibial Anterior Fit Descriptive analysis.

Tibia Posterior Fit	Duration	Mean OKS	Mean AKSS-O	Mean AKSS-F	Number	p Value
Flush	Preop	16.95	48.04	33.63	22	<0.05
	Postop	45.68	95.09	92.72		
1mm Overhang	Preop	17	48.5	38.75	04	<0.05
	Postop	46.25	98	87.25		

Table 30: Tibial Posterior Fit with Mean OKS/AKSS-O/AKSS-F.

Tibia Posterior Fit	Frequency	%
1mm Overhang	4	15.4%
Flush	22	84.6%
Total	26	100%

Table 31: Tibial Posterior fit Descriptive analysis.

Meniscal bearing

The meniscal bearing was found to be central in postoperative radiographs of all patients with a significant improvement in mean scores of OKS, AKSS-O and AKSS-F.

Summary of implant positioning

Femur	Total Range	Mean
Flexion/Extension	8.3^0 Flexion to 1.8^0 Extension	2.53^0 Flexion
Varus/Valgus	6.7^0 Varus to 2.1^0 Valgus	1.67^0 Varus
Medial/Lateral Fit	1mm Medial to 1mm Lateral	0.5mm Medial
Posterior Fit	Flush to 2mm Overhang	1mm Overhang
Tibia		
Varus/Valgus	12.1^0 of Varus to 4.3^0 of Valgus	2.59^0 Varus
Slope	8.9^0 of Superior slope to 7.3^0 of inferior slope	1.63^0 Superior Slope
Medial Fit	Flush to 2mm Overhang	0.3mm Overhang
Lateral Fit	Flush	Flush
Anterior Fit	Flush to 3mm Short	0.4mm Short
Posterior Fit	Flush to 1mm Overhang	0.15mm Overhang
Meniscal Bearing	Central	Central

Table 32: Descriptive analysis of Implant positioning.

Discussion

Unicondylar Knee Arthroplasty is an upcoming surgical procedure with many recent advances in prosthetic designs, better instrumentation and enhanced surgical precision and skills. Patient selection criteria have been a cornerstone in the advancement of successful UKA. Such a criteria was first given by Kozin., *et al.* which were further increased by Berend and Lambordi. There have been various recent publications which modifies the patient selection criteria. Hamilton., *et al.* [16] (2017) excludes lateral osteophytes from contraindications whereas Adams., *et al.* [17] (2017) reported that presence of PF chondromalacia does not affect the functional outcome significantly. Medial compartment Osteoarthritis, intact integrity of ACL, preserved full thickness lateral cartilage, flexion deformity less than 15^0 and a fully correctable intra articular varus deformity are some of the criteria laid down by the Oxford group.

UKA requires a minimal incision, associated with less requirement of blood products, decreased recovery period with minimal rehabilitation process, is cost effective, gives successful functional outcomes and has improved survival rates. Price., *et al.* reported that there was no significant difference in the survival rates of patient above and below sixty years of age undergoing UKA. Murray., *et al.* published that survival rates do not decrease with increased BMI and reported 98% survival in operated 143 knees after a mean follow up of 7.6 years.

This study was conducted to study the functional and clinical outcomes of Unicondylar Knee Arthroplasty with a mobile meniscal bearing, prospectively, in 26 patients with a mean follow up of six months. A detailed report on our study and its relevance with published literature is discussed ahead.

Functional scores

Oxford knee score (OKS)

The mean Oxford score improved significantly in our patients from 16.96 ± 4.26 preoperatively to 29.42 ± 3.88 two weeks postop, 37.96 ± 3.77 six weeks postop, 41.73 ± 3.66 3months postop and 45.77 ± 2.16 at the end of 6 months postoperatively. (p value < 0.05). Nineteen of our patients had severe osteoarthritis while seven other had moderate to severe osteoarthritis as per Oxford knee grading.

Carr., *et al.* [20] studied 121 patients and reported a mean Oxford score of 40 over a period of 3.8 years.

Yoshida., *et al.* [18] studied functional outcome of 1279 Oxford knees and found that the mean OKS improved from 22.3 preoperatively to 40.1 at final follow up after 5.2 years.

Pandit., *et al.* [19] reported a mean OKS score of 40 in 1000 Oxford knees with a mean follow up of 10 years with excellent outcome in 55% of patients.

American knee society score

The Objective American Knee Society score depicted significant improvement from 48.12 ± 5.55 preoperatively to 69.23 ± 7.63 two weeks postop, 85.15 ± 6.66 six weeks postop, 90.40 ± 5.83 three months postop and 95.54 ± 4.23 at the end of six months postoperatively.

The Functional American Knee Society Score preoperatively was 34.42 ± 15.25. The score at 2 weeks postoperatively was lower than the preop score with a mean of 29.23 ± 8.44. However, the score significantly improved from 29.23 at 2 weeks post op to 65.19 ± 15.78 six weeks postop, 82.31 ± 10.12 3months postop and 90.96 ± 7.87 at the end of 6 months postoperatively. The score considers the functional abilities like walking, climbing stairs and using walking aid. AKSS-F score of our patients decreased in the initial follow up of 2 weeks as they were still in the initial phase of rehabilitation. However, the score increased from 6 weeks onwards and suggested a favorable functional outcome. Rees., *et al.* [20] observed a similar pattern in their study on 104 knees over a period of 1 year.

Rajashekar., *et al.* [21] studied AKSS in 135 Oxford knees with a mean follow up of 5.8 years and observed a significant improvement with mean AKSS-O of 92.2 and mean AKSS-F of 76.2 at the end of follow up.

Pandit., *et al.* [22] observed a significant improvement in AKSS-O and AKSS-F from 68.7 and 47.4 preoperatively to 89.4 and 88.7 1year after UKA.

Kort and Emerson[23]reported a significant increase in AKSS to 90.5 and 92 at the end of follow up.

Western Ontario and McMaster universities osteoarthritis index (WOMAC)

The WOMAC score suggested a significant improvement in the functional outcome of all the patients postoperatively. The score was 70.27 ± 13.41 preoperatively and 4.73 ± 4.85 at the end of 6 months. Betterment of WOMAC score indicated that pain and stiffness decreased significantly and physical function increased comprehensively six months after undergoing UKA. Liswoski., *et al.* [25] (2011) demonstrated a similar improvement of WOMAC score in patients undergoing Oxford UKA with a p-value < 0.05.

Implant alignment and its significance on functional score

Already published data from previous publications suggest that successful outcome of UKA depends on the congruity of the implants. Such implants encounter minimal issues like mispositioning and thus improve the overall survival rates and longevity of the operated knee. Designers have suggested a range of positions in which the implant can be placed. Placement of implants within this range have yielded excellent results for both functional and clinical outcomes. Oxford UKA surgical manual suggests various implant position, their size and acceptable criteria as viewed on Xray (both AP and lateral views). It describes 6 parameters for Tibia, 4 for Femur and 1 for meniscal bearing.

Postoperative radiographic analysis suggested that most of our implants were placed within the acceptable range as suggested by previous literature. Slope of four and Varus/Valgus alignment of five Tibial components were outside the acceptable limits in our study. Implants which were outside this range did not show any deterioration and were associated with equally comparable clinical and functional outcomes. This further enhanced the importance of strict patientselection criteria, correct placement of implants and experienced surgical skills for favorable results.

Degrees of Varus, Flexion and Superior slope were denoted by a negative sign (-) with their opposite ranges like Valgus, Extension and Inferior slope being denoted with a positive sign in our study.

Femoral component flexion/extension

All the femoral components in our study were with-in the acceptable limits of 5^0extension and 10^0flexion with twenty-two femoral components fixed in flexion, three in neutral position and

Femur	Acceptable range	No. of subject's outside acceptable range in our study
Flexion/Extension	<10^{0}flexion - <5^{0}extension	None
Varus/Valgus	<10^0 varus - <10^0 valgus	None
Posterior Fit	Flush or <4mm overhang	None
Medial/Lateral Placement	Central	None
Tibia		
Slope	7^0 - (-5^0)	04
Varus/Valgus	<5^0 varus - <5^0 valgus	05
Lateral Fit	Flush	None
Medial Fit	Flush or <2mm overhang	None
Anterior Fit	Flush or <5mm short	None
Posterior Fit	Flush or <2mm overhang	None
Meniscal Bearing		
Xray marker central and parallel with Tibial placement		None

Table 33: Implant positioning within and outside the Acceptable Range.

one in extension. The mean alignment of the femoral component was in 2.53^0 of flexion ranging from 8.3^0 flexion to 1.8^0 of extension. The mean OKS improved remarkably from 16.72 preop to 45.68 postoperatively for the implants fixed in flexion and from 16 to 47 postoperatively for those fixed in extension (p value < 0.05). Shakespeare., *et al.* [26] (2005) achieved a femoral component alignment within the acceptable range in 91.96% of patients with a mean flexion of 0.2^0. Gulati., *et al.* [29] (2009) achieved a 100% placement of femoral components with-in the acceptable limits with a mean extension of 0.8^0. They found no remarkable difference between the OKS scores of patients with implants placed within the acceptable range of flexion or extension. Clarius., *et al.* [30] (2010) reported a mean flexion of 2.1^0 with 68% of femoral component placed within the acceptable range. Parmaksizoglu [31] (2010) achieved a mean flexion of 0.5^{0}in femoral component with equally encouraging functional outcome in both groups with implant placed in flexion or extension. The flexion/extension position of the femoral components has been associated with many variations which can be attributed to the sagittal alignment of the IM rod which is associated with erroneous placement as compared to the coronal plane. Some attribute the error to the short and thin IM rods.

Femoral component - varus/valgus

All the femoral components in our study were within the acceptable range of 5^{0}varus and 5^{0}valgus with nineteen femoral components placed in varus, three in neutral position and four in valgus. The mean alignment of the femoral component was in 1.67^{0}of varus ranging from 6.7^{0}varus to 2.1^{0}of valgus. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients with p value < 0.05.

The mean OKS improved remarkably from 16.68 preop to 45.626 postoperatively for the implants fixed in varus and from 17.75 to 47 postoperatively for those fixed in valgus (p-value <0.05).

Shakespeare., *et al.* [26] (2005) achieved a 100% placement of femoral components within the acceptable range of varus and valgus in 224 patients with a mean varus of 0.51^0. Gulati., *et al.* [27] (2009) reportedly achieved placement of 98.6% of femoral components within the acceptable limit with a mean varus of 1.4^0 OKS significantly improved in both the groups with implant placed in varus or valgus, within the ascertained limits.

Clarius., *et al.* [23] (2010) achieved the recommended range of alignment in 96.7% of patients with a mean varus of 2.8^0.

Mullaji., *et al.* [32] reported that 14% of knees were in varus and 11% in valgus post UKA. The OKS, however, suggested a favorable outcome.

Femoral component - mediolateral alignment

All the femoral components in our study were within the acceptable range of 1mm medial and 5mm lateral placement with twenty-two femoral components placed centrally, three implants placed 1mm medially and one placed in 1mm lateral position. The mean alignment of the femoral component was 0.5mm of medial placement. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients with p value < 0.05. The mean OKS improved remarkably from 16.5 preop to 45.7 postoperatively for the implants fixed in central position, from 20 to 45.66 postoperatively for implants placed 1mm medially and from 18 to 46 postoperatively for those fixed 1mm laterally (p-value < 0.05).

Shakespeare., *et al.* [26] (2005) reported an average of 0.2mm medial placement of the femoral components.

Clarius., *et al.* [28] (2010) achieved central placement of femoral component in twenty-two percent of knee with a mean placement of 1.2mm medially.

Femoral component - posterior fit

All the femoral components in our study were within the acceptable range of Flush to 4mm overhang with respect to the posterior border with twenty-three femoral components being flush with the border. Two components had an overhang of 1mm, while one had an overhang of 2mm. The mean alignment of the femoral component was 1mm of overhang with a range from flush to 2mm Overhang. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

The mean OKS improved remarkably from 17.04 preop to 45.82 postoperatively for the implants which were flush with the posterior border, from 15 to 44 postoperatively for implants overhanging 1mm from the posterior border and from 19 to 48 postoperatively for those fixed with 2mm overhang (p-value <0.05).

Shakespeare., *et al.* [26] (2005) observed asimilar result with a mean overhang of 0.8mm.

Clarius., *et al.* [28] (2010) reported a mean overhang of 1.2mm with no stark difference between the OKS and AKSS of those outside the limit with those within the range.

Tibial component - varus/valgus angulation

In our study we observed that twenty-three tibial components were within the acceptable limits of 5^0 valgus and 5^0varus with five components fixed outside the acceptable range. The Postoperative radiographic evaluation suggested that twenty-one tibial components were in varus while five were in valgus. The mean alignment of the tibial component was in 2.59^0 of varus ranging from 12.1^0 varus to 4.3^0 of valgus. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients, including those outside the acceptable limits with p value < 0.05.

The mean OKS improved from 18.6 to 46 postoperatively for implants placed in varus while it increased from 201.8 to 45.71 postoperatively in those placed in valgus. OKS also improved for those placed outside the ascertained range from 18 to 45 postoperatively when compared to those within limit where the OKS improved from 19.39 to 45.855 postoperatively with p < 0.05.

Shakespeare., *et al.* [26] (2010) studied a total of 224 patients for the placement of tibial component who underwent Unicondylar Knee Replacement and found a mean position of 1.8^0 of varus. 99% of the knees were within the acceptable limits.

Poor placement of Tibial jig and big learning curve have been found to have huge impact on the erroneous varus placement of the tibial component. It has been described as the most common mis positioning of an UKR component. Gulati., *et al.* [27] (2009) recorded a mean tibial alignment of $2.1^0$of varus with the recommended range achieved in 91.5% of knees. The OKS score improved significantly for those at the extreme range of the acceptable limits similar to the those well within the range.

Clarius., *et al.* [28] (2010) achieved a mean position of 4.4^0 of varus with 98.36% of knees within the acceptable limit. They considered a range of 10^0 varus and 5^0 valgus.

Tibial component - slope

In our study we observed that 22 tibial implants were within the acceptable limit of 7^0inferiorslope to 5^0superior slope. Sixteen tibial components had a posterior slope while ten had an inferior slope. The mean alignment of the tibial component had a superior slope of 1.63^0 ranging from 8.9^0 of superior slope to $7.3^0$of inferior slope. The mean OKS, AKSS-O and AKSS-F improved significantly for all the patients, including those outside the acceptable limits with p value < 0.05.

The OKS score improved significantly from 17 to 46.02 postoperatively in implants with superior slope in comparison from 16.9 to 45.3 postoperatively for those with inferior slope. OKS improvement was also seen in those outside the limit from 15.25 to 46.5 postoperatively with p < 0.05.

Muller., *et al.* [33] (2004) studied the influence of accuracy of implant positioning on functional outcomes post UKA. Implants in 97% of the knees were found to be within the acceptable range.

Shakespeare., *et al.* [26] (2005) recorded a mean slope of 5.7^0 posteroinferiorly with 100% of the implants placed within the stipulated limit.

Gulati., *et al.* [27] (2009) reported a mean superior slope of 1.9^0 with tibial slope of 7^0consideredas neutral position due to its normal anatomical finding. Implants were found to be within the acceptable range in 92.4% of knees as compared to 84.6% observed in our study. Posterior slope of the Tibial components is an important variable as it influences the long-term outcome significantly [34].

Tibial component - medial fit

In our study, we observed that all the Tibial components were within the acceptable limits of Flush to less than 2mm Overhang with a mean of 0.3mm Overhang. Nineteen Tibial components were flush with the medial border while six components having an overhang of1mm and one component placed with overhang of 2mm. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

The mean OKS improved significantly from 16.8 to 45.3 postoperatively in patients with implants flushed to the medial border, from 17.5 to 47.33 postoperatively in those with 1mmoverhang and from 16 to 46 postoperatively in those with 2mm of overhang with p-value <0.05.

Shakespeare., *et al.* [26] (2005) observed a similar result with a mean overhang of 0.6mm.

Clarius., *et al.* [28] (2010) demonstrated a mean under-hang of 0.1mm. Implant in 55% knees werewithin the acceptable range. No difference was observed in the OKS of those outside the limit from those within.

Tibial component - lateral fit

We observed that all the Tibial components in our study were flush with the lateral border. The OKS, AKSS-O and AKSS-F improved significantly for all the patients (p-value < 0.05).

Clarius., *et al.* [28] (2010) observed a similar lateral fit with no implant outside the acceptable range.

Tibial component - anterior fit

We observed that all tibial implants in our study were within the acceptable limit with respect to the anterior border ranging from being flush to less than 3mm short with an average of 0.4mm short. Seventeen of our components were flush with the anterior border with seven components placed 1mm short, while two components were short by 2mm and 3mmrespectively. The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

The mean OKS score improved significantly from 16.52 to 45.35 postoperatively for all the implants placed flushed with the anterior border. The OKS improved from 17.85 to 46.28 postoperatively in knees with implants 1mm short, from 25 to 48 postoperatively in those with implant placed 2mm short and from 10 to 47 postoperatively in knees with implant placed 3mmshort with p-value < 0.05.

Shakespeare., *et al.* [26] (2005) observed a similar finding with a mean under-hang of 0.4mm while 24 knees were outside the acceptable range.

Clarius., *et al.* [28] (2010) recorded a mean under-hang of 1.7mm with 61% of the knees within the acceptable limits. OKS and AKSS improved significantly in both the groups.

Tibial component - posterior fit

The Tibial component was found to be within the acceptable limit of being flush to the posterior border to less than 2mm of Overhang in our study. We observed a mean of 0.15mm of overhang with the range from being flush to 1mm overhang. Twenty-two tibial components were flush to the posterior border, comprising 84.6% while Four components had an overhang of 1mm.The mean OKS, AKSS-O and AKSS-F improved significantly for all these patients with p value < 0.05.

The mean OKS improved from 16.95 to 45.68 postoperatively in patients with implant flushed to posterior border while similar improvement was seen in those patients where the implant was fixed in 1mm overhang from 17 to 46.25 postoperatively with p-value < 0.05.

Shakespeare., *et al.* [26] (2005) reported a mean under hang of 0.6mm with 33% of implants placed outside the acceptable limits.

Clarius., *et al.* [28] (2010) published that only 23% of the implants were placed within the acceptable limits. However, OKS and AKSS improved significantly in both the groups.

Meniscal bearing

Meniscal bearing was placed centrally in all of our patients.

Muller., *et al.* [26], reported 7% of bearing placed outside the acceptable range. However, OKS improved significantly in both the groups.

Conclusion

1. Oxford Knee Score (OKS), American Knee Society score Objective and Functional (AKSS-O and AKSS-F), and the Western Ontario and McMaster Universities index (WOMAC) scores improved significantly after Unicondylar Knee replacement with Oxford Knee over a period of six months. Scores increased exponentially from six weeks to three months with a marginal improvement from three months to six months.
2. Pain and Stiffness decreased in all patients with increased range of motion at the end of follow-up after 6 months in all patients after UKA.
3. Walking improved considerably with the need for walking aids decreasing efficiently over the period of six months after UKA in all patients.
4. Sitting Cross Leg ability improved after UKA in all patients.
5. Femoral Flexion/Extension and Tibial Varus placement within the acceptable range is technically demanding.
6. Range of motion is increased considerably in all patients after UKA.
7. Unicondylar Knee replacement with prosthetic components placed outside the acceptable range are associated with significant improvement in functional scores and clinical outcome.
8. UKA is associated with decreased postop morbidity and faster recovery with minimal rehabilitation process.
9. Strict patient selection criteria can yield significant outcome after Unicondylar Knee replacement.

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