



EVALUATION OF CLINICAL AND SURGICAL OUTCOME OF TOTAL KNEE ARTHROPLASTY IN VALGUS KNEE-A PROSPECTIVE STUDY

Orthopaedics

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ABSTRACT

Objectives: To evaluate the clinical and surgical outcomes of total knee replacement in preoperative valgus deformed knees using knee society clinical and functional scores, WOMAC score and to assess improvement in HKA angle and postoperative complications. **Materials and Methods:** A prospective study of 20 patients with varying degrees of valgus deformity at knee who satisfied the inclusion criteria were included in the study which was done over a period of 2 years between January 2021 to January 2023. Patients were followed up postoperatively and were assessed using knee society clinical and functional scores and WOMAC scores at 6 weeks, 3 months, 6 months and 12 months. **Results:** The mean age of the participants in the present study was 61.70 ± 5.77 . 17 (85.0%) of the participants had Grade 4 OA. The mean Duration of Surgery (Minutes) was 94.50 ± 9.99 . The mean HKA Angle (Pre-Operative) was -9.10 ± 2.16 and Post-Operatively improved to -0.54 ± 0.20 . ($p < 0.001$). There was significant improvement in postoperative knee ROM. There was statistically significant improvement in the trend of KSS score and WOMAC score over time. 18 participants had no postoperative wound Complications. **Conclusion:** Valgus knee deformity is a challenge in Total knee arthroplasty. Excessive preoperative malalignment predisposes to greater risk of failure. Proper preoperative preparation and perioperative management results in successful outcomes. The improvement in the clinical and functional scores demonstrate the patients' ability to return to the pre-disease state of having stable pain free mobile joint. Our study concluded that Total knee arthroplasty in valgus knees showed excellent clinical outcomes at 6 weeks, 3 months and 12 months and allowing the patients to return to their pre-morbid state.

KEYWORDS

Valgus deformity of knee, Osteoarthritis, Total knee arthroplasty , functional outcome, complications.

INTRODUCTION

Total knee arthroplasty (TKA) is among the most performed Orthopaedic surgeries to treat severe arthritis of the knee joint either due to osteoarthritis or inflammatory arthritis. Majority of total knee replacements are performed for osteoarthritis.

Osteoarthritis is the most prevalent chronic joint disease, the incidence of which is increasing. Severe Pain and impairment of function are the most common symptoms that warrants the need for non-pharmacological, pharmacological, or surgical treatments. (1)

The success of total knee arthroplasty depends on patient selection, perioperative management, implant design and surgical technique. (2,3)

The benefits of this procedure are of pain relief, improved functional results, patient satisfaction and implant longevity. These factors depend on implant sizing, joint line reconstruction, balancing of soft tissue and limb axes alignment. (4)

Femorotibial angles more than 10° were considered to be valgus deformities. Severe valgus deformity is described as an angle more than 20 degrees. This deformity is seen in almost 10% of patients undergoing TKA. (2).

The valgus arthritic knee is frequently a complex deformity with a hypoplastic lateral condyle, lateral tibial plateau bone loss, external rotation of the tibia, remodelling of the femoral and tibial metaphyseal valgus, and misalignment of the patella. (4) It is comprised of two components: bone tissue changes and soft tissue contraction changes. Alterations in bone tissue include metaphyseal femur and tibial plateau remodelling, lateral cartilage degradation, and lateral condylar

hypoplasia. Tightening of the lateral tissues, including the lateral head of the gastrocnemius (LHG), iliotibial band, popliteus tendon, posterolateral capsule, and hamstring tendons, represents soft tissue changes (ITB).

The aforementioned abnormalities may cause tibial external rotation and a propensity for patellar lateral subluxation (5).

Combining the aforementioned deformities would result in improper patellar tracking, abnormal rotational alignment of the distal femur, and femoral malformations, all of which make it extremely challenging to achieve soft-tissue balance when the knee is brought back into physiologic alignment.

In comparison to well-aligned knees or even varus knees, valgus knees may produce inferior clinical results (6). Valgus deformity in adults is most seen in patients with inflammatory arthritis, tibial malunion, physeal arrest or tibial plateau fracture. But in patients who undergo surgery, osteoarthritis remains the most common cause.

MATERIALS AND METHODS

Patient Characteristics

After obtaining the institutional ethics committee clearance and written informed consent, the inpatients in the department of Orthopedics fulfilling the inclusion criteria were enrolled in the study. Each patient was given a unique identity number. Demographic data, medical history, concomitant medications, physical examination, clinical examination including recording the vitals, details of surgery and details of the implant are recorded in the study proforma and relevant radiological investigations as mentioned in the assessment tools were done at baseline visit. Selected patients underwent Total knee replacement arthroplasty.

Follow up visits were at 6 weeks (visit 1), 12 weeks(visit 2),and 24 weeks(visit 3) from the date of surgery. At follow up visits, patients were evaluated clinically (wound and soft tissue status) , Radiologically (alignment, residual deformity) and complications. Based on these data, the final outcome was assessed according to the knee society score.

Inclusion Criteria Were

1. Patients of both genders diagnosed with Osteoarthritis of knee and valgus deformity,
2. Patients of both genders diagnosed with Rheumatoid arthritis with valgus deformity
3. Age: 45-80 years
4. Indication of Total knee Arthroplasty due to failure of conservative management
5. No previous surgeries on the knee
6. Ability to understand the content of the subject information / informed consent form and to be willing to participate in the clinical investigation

Exclusion Criteria:

1. Arthroplasty revision surgery
2. Extra articular deformities not related to osteoarthritis.
3. Previous infection in the knee
4. Severe comorbidities with anaesthetic contraindications

Surgical Technique

Pre-operatively, each patient was evaluated clinically and radiologically. Detailed history, clinical examination and radiological examination was done.

Preoperative roentgenograms included a standing anteroposterior view, a lateral view, and a skyline view of the patella. Radiological grading as advocated by Kellgren and Lawrence was used to evaluate the severity of the arthritis and graded from I to IV . Radiographic evaluation of post-op x-ray was done by knee society roentgenographic scoring system. CT scanogram were used to evaluate the preoperative valgus deformity.

Post operatively, at 2nd and 3rd month, followup CT scanograms were obtained And walking without walker support was used to assess the correction.

Under anesthesia, Patient is positioned in supine position with preparations made for intra operative knee flexion. These surgeries were performed under tourniquet control. The knee joint is exposed by a medial para patellar approach. A standard medial arthrotomy is made. The proximal portion of the tibia should be resected at 90° to its long axis.

In type-II valgus deformities, resect less bone than normal from the medial side. With a valgus knee, the femoral jig is set to cut in 3° of valgus to compensate for metaphyseal-diaphyseal valgus remodeling that has usually taken place and to avoid undercorrection of the underlying deformity .The cutting block is then rotated until it is roughly parallel to the cut surface of the tibia with the knee in 90° of flexion.

The anterior rough cut is made, and then the distal femoral cut is made, resecting no more than 10 mm of bone from the medial side while only removing 1 to 2 mm from the lateral side. During evaluation of extension gap, the application of stress should demonstrate lateral side soft-tissue tightness in an unbalanced valgus knee. If the knee is unbalanced, this should manifest as a trapezoidal gap. Achieving a rectangular extension gap should be the goal.

When the gap is trapezoidal, soft-tissue balancing with use of the “inside-out” technique is necessary to fractionally lengthen the lateral side. The Steps of the “Inside-Out” Technique are Removal of peripheral osteophytes, remnant of the posterior cruciate ligament and posterolateral capsule is released, popliteus is preserved , The iliotibial band is lengthened as necessary with use of the pie-crusting technique. The size of the flexion gap should be the same as the extension gap or even 2 mm less. Cemented Femoral & tibial implants are fixed after trial implantation. Suction drain placed & wound closed in layers. skin . Sterile dressing was done. Postoperative thrombo-embolic prophylaxis with parental S.C injection of enoxaparin sodium (LMWH) 40mcg was given for each patient.

Assessment Of Results

Demographic data of age, sex, degree of preoperative deformity, range of motion were collected. HKA angle, KSS clinical and functional scores, deformity, improvement in range of motion were assessed pre and postoperatively. Patients were asked to follow up at 4weeks, 3 months, 6 months and 12 months. Functional outcomes were measured using KSS clinical and functional score and WOMAC score.

Statistical Analysis

Non-parametric tests were used to make statistical inference . Paired Wilcoxon test was used to explore the difference in HKA Angle at the two time points. Friedman test was used to explore whether the ROM changed significantly over time. Repeated Measures ANOVA was used to explore whether the KSS changed significantly over time. Post-hoc pairwise analysis was performed to explore at which timepoints the ROM differed significantly from the Pre-Operative timepoint. Friedman test was used to explore whether the Functional KSS changed significantly over time. Paired sample t-test was used to explore the difference in WOMAC Score at the two time points.

RESULTS

Basic Details	Mean ± SD Median (IQR) Min-Max Frequency (%)
Age (Years)	61.70 ± 5.77 61.50 (57.00-66.00) 52.00 - 71.00
Age	
51-60 Years	10 (50.0%)
61-70 Years	9 (45.0%)
71-80 Years	1 (5.0%)
Gender	
Male	10 (50.0%)
Female	10 (50.0%)
Duration of Symptoms (Years)	6.60 ± 1.93 6.00 (5.00-8.00) 4.00 - 10.00
Affected Side	
Right	10 (50.0%)
Left	10 (50.0%)
Indication	
OA	19 (95.0%)
RA	1 (5.0%)
Grade of OA	
Grade 1	0 (0.0%)
Grade 2	0 (0.0%)
Grade 3	3 (15.0%)
Grade 4	17 (85.0%)
Duration of Surgery (Minutes)	94.50 ± 9.99 90.00 (90.00-100.00) 80.00 - 120.00
Complications	
Nil	18 (90.0%)
Superficial Infection	2 (10.0%)

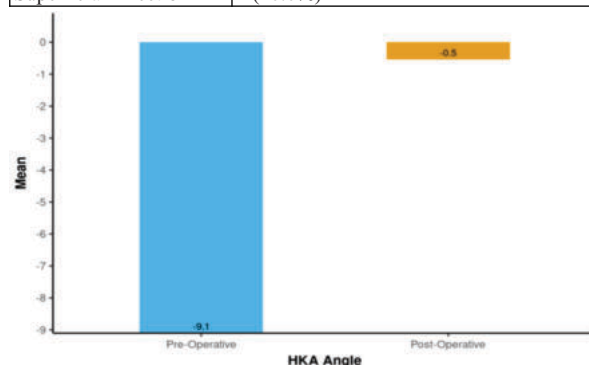


Fig 1: Summary of HKA Angle

- The mean HKA Angle (Pre-Operative) was -9.10 ± 2.16.
- The mean HKA Angle (Post-Operative) was -0.54 ± 0.20.

TABLE 1 : Summary of ROM

ROM	Mean ± SD	Median (IQR)	Min – Max
Pre-Operative	98.00 ± 8.49	100.00 (90.00-105.00)	85.0 - 115.0
4 Weeks	104.25 ± 4.67	105.00 (100.00-110.00)	95.0 - 110.0
3 Months	111.75 ± 4.06	110.00 (110.00-115.00)	105.0 - 120.0

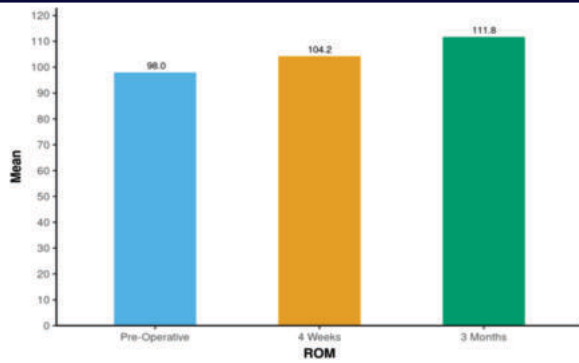


Fig 2: SUMMARY OF ROM

- The mean ROM (Pre-Operative) was 98.00 ± 8.49.
- The mean ROM (4 Weeks) was 104.25 ± 4.67.
- The mean ROM (3 Months) was 111.75 ± 4.06.

Summary of KSS

KSS	Mean ± SD	Median (IQR)	Min – Max
Pre-Operative	36.85 ± 10.51	37.00 (30.00-43.25)	15.0 - 56.0
3 Months	67.40 ± 6.78	64.00 (63.00-73.25)	57.0 - 79.0
6 Months	80.75 ± 6.35	80.50 (78.25-85.25)	65.0 - 90.0
12 Months	86.90 ± 4.48	86.50 (84.50-90.00)	80.0 - 100.0

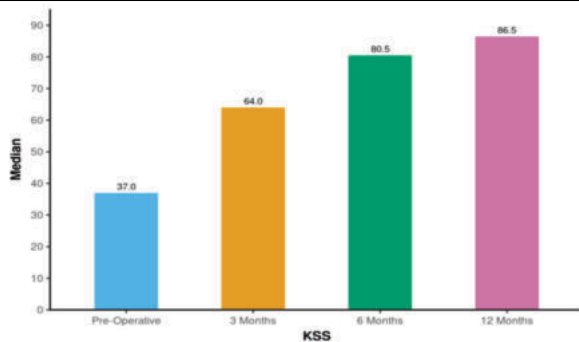


Fig 3: Summary Of KSS

- The mean KSS (Pre-Operative) was 36.85 ± 10.51.
- The mean KSS (3 Months) was 67.40 ± 6.78.
- The mean KSS (6 Months) was 80.75 ± 6.35.
- The mean KSS (12 Months) was 86.90 ± 4.48.

TABLE 2: Summary of Functional KSS

Functional KSS	Mean ± SD	Median (IQR)	Min – Max
3 Months	53.75 ± 11.50	55.00 (48.75-60.00)	30.0 - 80.0
6 Months	78.75 ± 9.30	80.00 (73.75-86.25)	60.0 - 95.0
12 Months	91.00 ± 4.47	90.00 (90.00-90.00)	85.0 - 100.0

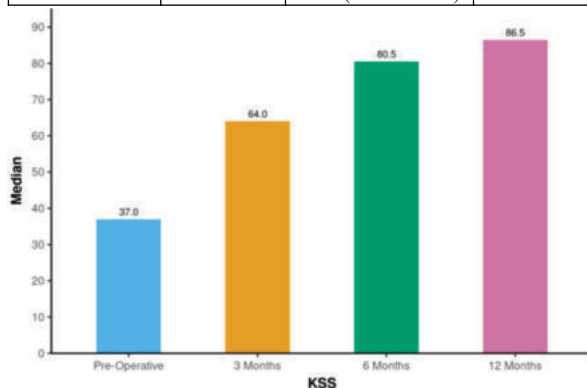


Fig 4: Summary Of Functional KSS

- The mean Functional KSS (3 Months) was 53.75 ± 11.50.
- The mean Functional KSS (6 Months) was 78.75 ± 9.30.
- The mean Functional KSS (12 Months) was 91.00 ± 4.47.

TABLE 3: Summary of Change in Parameters

Change in Parameters	Mean ± SD	Median (IQR)	Min – Max
Change in HKA Angle (Post-Operative)	8.56 ± 2.02	7.95 (7.32-8.93)	6.4 - 14.2
Change in ROM (4 Weeks)	6.25 ± 9.30	7.50 (0.00-11.25)	-15.0 - 25.0
Change in ROM (3 Months)	13.75 ± 9.30	15.00 (5.00-20.00)	0.0 - 30.0
Change in KSS (3 Months)	30.55 ± 11.51	29.50 (24.00-36.75)	8.0 - 51.0
Change in KSS (6 Months)	43.90 ± 13.70	45.00 (37.75-50.25)	17.0 - 67.0
Change in KSS (12 Months)	50.05 ± 11.86	51.50 (43.25-60.00)	24.0 - 70.0
Change in Functional KSS (6 Months)	25.00 ± 15.62	26.50 (15.00-32.00)	-20.0 - 50.0
Change in Functional KSS (12 Months)	37.25 ± 11.97	36.00 (31.50-43.25)	10.0 - 60.0
Change in WOMAC Score (12 Months)	-48.63 ± 2.58	-48.55 (-51.00--46.15)	-52.7 - -45.2

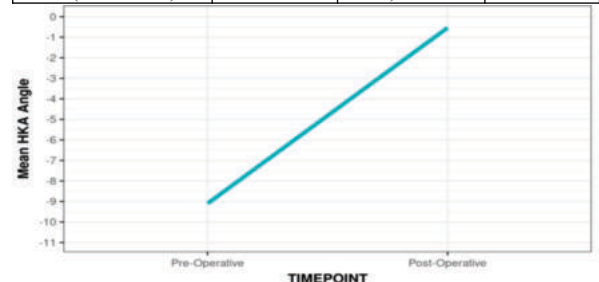


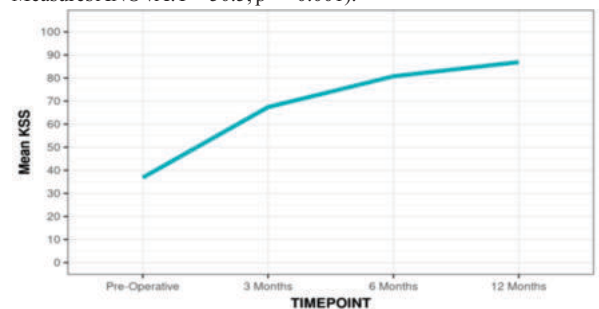
Figure 5: Change in HKA Angle Over Time

The mean HKA Angle increased from a minimum of -9.10 at the Pre-Operative timepoint to a maximum of -0.54 at the Post-Operative timepoint. This change was statistically significant (Wilcoxon Test: V = 0.0, p = <0.001).

TABLE 4: Assessment of change in KSS over time

Timepoint	KSS			Repeated Measures ANOVA	
	Mean (SD)	Median(IQR)	Range	F	P Value
Pre-Operative	36.85(10.51)	37.00 (13.25)	15.00-56.00	50.5	<0.001
3 Months	67.40 (6.78)	64.00 (10.25)	57.00-79.00		
6 Months	80.75 (6.35)	80.50 (7.00)	65.00-90.00		
12 Months	86.90 (4.48)	86.50 (5.50)	80.00-100.00		

The mean KSS increased from a minimum of 36.85 at the Pre-Operative timepoint to a maximum of 86.90 at the 12 Months timepoint. This change was statistically significant (Repeated Measures ANOVA: F = 50.5, p = <0.001).



Clinical Images



Fig 6 (a)

Fig 6 (b)

Fig 6 (c)

Fig 6 (a)- Preoperative Xray
Fig 6 (b)- Postoperative Xray
Fig 6 (c)- Postoperative Ct Scanogram

Followup Clinical Images Showing Good Outcome



DISCUSSION

Knee osteoarthritis is a fairly common condition that can worsen to the point of being incapacitating. The patient's quality of life is negatively impacted because of the discomfort and diminished function. Despite the fact that there are numerous treatment options, such as conservative and surgical care, joint replacement is the most effective one.(11)

Total knee arthroplasty is now a common procedure for treating arthritic knees since it provides pain relief, stabilises the knee with a proper range of motion, and enhances function significantly. (7) This prospective study was carried out to determine the surgical and clinical outcomes after total knee arthroplasty in valgus deformity.

Demographics

The mean age of the participants in the present study was 61.70 ± 5.77 . Majority (50%) of the participants belonged to the age group of 51-60 years. Equal predilection was noticed in both the genders. This was in contrast to a study by **Kadam et al**(7) who noticed a male predominance with majority (57.5%) subjects belonging to the age group of 56-65 years. A higher predilection was observed in the study by **Rajgopal et al.** (9) The results of our study agree with those of **Giesenger et al.**'s (12) study, which included 98 cases of TKAs and reported a similar mean age and female predominance.

19 patients were indicated for TKA as a result of osteoarthritis while 1 patient presented with rheumatoid arthritis. 85% subjects presented with grade 4 osteoarthritis while the rest 15% had grade 3. No cases of grade 1 or 2 osteoarthritis were seen.

Aging is a major risk factor for osteoarthritis. Aging is responsible for an imbalance between the catabolic and anabolic activities in the joint that characterises osteoarthritis.(14) In elderly individuals, due of the comorbidities and underlying strength deficiency, the rehabilitation period may be extended. In end-stage osteoarthritis of the knee, a quadriceps strength deficit of up to 38% has been shown, and this deficit is anticipated to be substantially worse in older individuals with severe osteoarthritis. Overall, it has been demonstrated that patients over 80 years old had worse general results after arthroplasty. (15)

Left and right sides were noted to be equally affected in the present study. In contrast, **Gopinath et al** (10) in their study observed the right side (55%) to be affected more. The mean duration of surgery in the current study was 94.50 ± 9.99 minutes which was highly significant. Several studies have shown that longer procedures come with a higher risk of infection (16,17). To identify knee replacements at a higher risk of infection, the Centers for Disease Control (CDC) set a cut-off of 122 minutes (the 75th percentile). The surgery duration in our study was well within the limits set by CDC.

Complications

No complications were noted in the majority (90%) of the participants. Superficial infection was observed in only 2 subjects (10%).

HKA Angle

The mean preoperative HKA angle was -9.10 ± 2.16 while postoperatively it was -0.54 ± 0.20 . The mean Change in HKA Angle was 8.56 ± 2.02 which has statistically significant. Similar results were obtained in a study by **Chalidis et al**(8), wherein an improvement in the tibiofemoral angle from preoperative value of 11 degrees to a postoperative value of 3.75 degrees was observed.

ROM

The patient's level of physical activity has a direct correlation with range of motion, one of the most crucial factors in determining whether the patient will be satisfied with the surgery. In the present study, the mean preoperative ROM 98.00 ± 8.49 while at 4 weeks and 3 months it showed significant improvement to 104.25 ± 4.67 and 111.75 ± 4.06 respectively. The mean change in ROM at 4 Weeks was 6.25 ± 9.30 while that at 3 Months was 13.75 ± 9.30 . Similar results were obtained by **Rajgopal et al**(9) where preoperatively ROM was 71.9 ± 9.5 while postoperatively it was 112.2 ± 8.9 . In contrast to the present study, **Elkus et al**(3) noticed a mean ROM of 110 both preoperatively as well as postoperatively.

KSS

The effectiveness of a total knee arthroplasty is evaluated using the knee society score.

The mean KSS pre-Operatively was 36.85 ± 10.51 , while at 3 months, 6 months and 12 months of follow up, an increased trend was noted with the mean KSS being 67.40 ± 6.78 , 80.75 ± 6.35 and 86.90 ± 4.48 respectively. **Elkus et al**(3) observed an improvement from 30 preoperatively to 93 postoperatively in their study. **Chalidis et al** (8) in their study noted an improvement from 40 preoperatively to 80.4 postoperatively. Similar to this, a significant improvement in knee social score was seen in the study by **Farahini et al.** (19). Our findings are in line with a research by **Yaratapalli et al.**(20) that showed an improvement in knee society score following TKA.

The mean change in KSS at 3 Months, 6 months and 12 months was 30.55 ± 11.51 , 43.90 ± 13.70 and 50.05 ± 11.86 respectively. Similar results were obtained by **Kadam RV et al.** (7), wherein preoperatively the KSS was 49.4 ± 13.79 ; however the mean change at 1 months, 3 months and 6 months was 65.95 ± 11.16 , 78.40 ± 8.67 , 86.08 ± 5.64 respectively.

Function AL KSS

In the present study, the mean of preoperative Functional KSS (Pre-Operative) was 1.00 ± 13.73 which significantly improved to 91.00 ± 4.47 at 12 months postoperative. **Elkus et al.**(3) noticed a change of 34 to 81 in their study. **Chalidis et al** (8) in their study noted a significant improvement in functional KSS from 35 preoperatively to 65 postoperatively.

The mean change in functional KSS at 6 Months, and 12 months was 25.00 ± 15.62 and 37.25 ± 11.97 respectively. Similar results were obtained by **Kadam RV et al.** (7), wherein preoperatively the KSS was 32.75 ± 11.79 ; however the mean change at 1 months, 3 months and 6 months was 56.65 ± 10.98 , 74.58 ± 9.23 , 84.43 ± 9.59 respectively.

WOMAC

The most often utilised clinical instrument for assessing patients with knee osteoarthritis is the self-administered Western Ontario and McMaster Universities (WOMAC) index. The mean preoperative WOMAC score was 59.20 ± 3.35 while postoperatively it decreased. The mean change in WOMAC score at 12 Months was 10.57 ± 1.15 . This was significant. Lesser the WOMAC score, better is the outcome.(12,13).

According to **Chalidis et al**(8), the WOMAC score showed a significant improvement from 43.54 prior to surgery to 17.52 post surgery. **Ho KW et al.** (17) in their study demonstrated a statistically significant change in their total and percentage score in their first-year and second-year follow-ups.

CONCLUSION

TKR is among the most performed surgeries for the treatment of knee arthritis due to various aetiologies. Successful outcomes in TKR depend on thorough preoperative planning, efficient peri-operative management and surgical technique. Peri-operatively, reduction in distal femoral cut angulation, preventing excessive external rotation to prevent postoperative patella maltracking and prevention of excessive internal rotation which leads to increased risk of patella dislocation must be paid attention to.

Adequate balancing of flexion and extension gaps are the keys to successful surgical outcomes.

In the hands of skilled surgeons, total knee arthroplasty is a safe and

reliable treatment. After six months of treatment, total knee arthroplasty produced higher pain alleviation and functional improvement. The improvement in the postoperative knee clinical score and knee functional score demonstrate how it enhances the patient's functional capacity and ability to return to their pre-disease state, which is to have a pain-free mobile joint. It provides older patients with better pain relief than conservative treatment by reducing joint discomfort, increased range of motion, correction of deformities, and by enhancing the quality of life while doing daily activities. (21)

The limitations of our study was that our sample size was small, with limited period of follow-up and that it was a single center study.

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