

Original Research Article

AN OBSERVATIONAL STUDY OF FUNCTIONAL OUTCOME OF EXTRA ARTICULAR DEFORMITIES CORRECTED WITH INTRA ARTICULAR CORRECTIONS IN PRIMARY TOTAL KNEE REPLACEMENT

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Received : 06/04/2025
Received in revised form : 23/05/2025
Accepted : 12/06/2025

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DOI: 10.70034/ijmedph.2025.3.1

Source of Support: Nil,

Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 1-6

ABSTRACT

Background: The aim is to assess functional outcome of extra articular deformities corrected with intra articular corrections in primary total knee replacement.

Materials and Methods: A prospective study was conducted over 18 months at Osmania General Hospital, Hyderabad, Telangana, India, involving 20 patients aged 50-70 years with extra- articular varus deformity of less than 20 degrees in the femur and less than 30 degrees in the tibia. Preoperative evaluations included sociodemographic details, blood investigations, imaging results, Knee Society scores, and Hungerford scores. Surgical corrections involved intra-articular bone resections and soft tissue release.

Results: A majority of participants (75%) had their alignment fully corrected, and 85% reported advantages from the single-stage procedure. Radiological corrections were observed in varying degrees, with 50% of participants showing moderate improvement and 40% showing significant improvement. Notably, there were no reported complications, demonstrating the safety and efficacy of the interventions. The absence of complications and the high rates of alignment and radiological improvements reinforce the positive impact of the surgical procedures on the participants' health and quality of life.

Conclusion: One-stage total knee arthroplasty is a viable and effective option for correcting extra-articular varus deformities, providing significant clinical and functional improvements while maintaining a favourable safety profile.

Keywords: Functional outcome, Extra-articular varus deformities, Radiological corrections, Quality of life.

INTRODUCTION

Knee osteoarthritis (OA) is a major contributor to disability and pain worldwide, with an estimated prevalence of 22-39% in older adults.^[1] The global burden of knee OA has resulted in a substantial increase in the number of total knee arthroplasty (TKA) procedures performed annually. In 2019, approximately 1.2 million TKA procedures were performed globally, with projections indicating a continued rise due to aging populations and increased prevalence of obesity.^[2] In India, the burden is significant, with knee OA affecting around 28.7% of individuals aged 45 and above, leading to a rise in demand for knee replacement surgeries.^[3] The

prevalence of knee OA in India is rising, paralleling global trends. Estimates suggest that over 200,000 knee replacement surgeries were performed in India in 2020, reflecting a significant increase from previous years.^[4] This increase can be attributed to the demographic shift, with more individuals entering their 50s and 60s, coupled with lifestyle changes and higher obesity rates.^[5] The Indian Society of Hip and Knee Surgeons (ISHKS) registry data reveals a steep rise in reported TKA procedures, from 1,019 in 2006 to around 27,000 in 2019.^[6]

Knee OA significantly impacts the quality of life, leading to pain, reduced mobility, and functional limitations. TKA is a well-established procedure for managing severe knee OA, providing substantial

relief from symptoms and improving function. However, the presence of extra-articular deformities in the femur or tibia complicates TKA, making it technically demanding and potentially affecting outcomes.^[7] These deformities necessitate specialized surgical techniques to ensure proper alignment and function of the knee post-surgery. The increasing number of TKAs and the complexity introduced by extra-articular deformities underscore the need for comprehensive evaluation and documentation of surgical outcomes. Despite advances in surgical techniques, there is limited data on the functional outcomes of patients undergoing TKA with intra-articular corrections for extra-articular deformities. This study aims to fill this gap by analyzing the functional outcomes in such cases, providing valuable insights for improving surgical approaches and patient care. This study is novel in its focus on intra-articular corrections of extra-articular deformities in TKA. While there are studies on TKA outcomes, few have specifically addressed the challenges and results of managing extra-articular deformities through intra-articular corrections.^[8] The justification for this study lies in its potential to enhance understanding of the best practices for these complex cases, ultimately leading to improved surgical techniques and patient outcomes.

MATERIALS AND METHODS

A prospective study design was employed to evaluate the intra-articular corrections of extra-articular deformity in patients undergoing total knee arthroplasty. The study was conducted at Osmania General Hospital, Hyderabad, Telangana, India. The study was carried out over a period of 18 months, from August 2022 to February 2024.

The study population comprised 20 patients aged 50-70 years with extra-articular varus deformity of less than 20 degrees in the femur and less than 30 degrees in the tibia in the coronal plane.

Inclusion Criteria

Patients aged 50-70 years with extra-articular varus deformity of less than 20 degrees in the femur and less than 30 degrees in the tibia in the coronal plane.

Exclusion Criteria

Patients with neurovascular deficiency, short stature, with inflammatory conditions such as rheumatoid arthritis and systemic lupus erythematosus.

A purposive sampling technique was used to select patients who met the inclusion criteria and were admitted to Osmania Medical College. Patients with osteoarthritis of the knee and associated extra-articular deformity underwent one-stage total knee arthroplasty. Deformities were corrected through intra-articular bone resections and soft tissue release during the knee arthroplasty. Preoperative scannograms (full-length standing X-rays) were used to measure deformities of the femur and tibia. The preoperative Hip-Knee-Ankle angle was also measured. Preoperative templating was done to

determine the possible size of the components and assess the need for any augments such as grafts, wedges, or stem extensions.

Data were collected preoperatively and postoperatively. Preoperative data included sociodemographic details, preoperative evaluation, blood investigations, imaging results, Knee Society scores, and Hungerford scores. Postoperative data included full-length X-rays or scannograms and reassessment of Knee Society scores and Hungerford scores. Follow-ups were conducted at 6, 12, and 18 months to compare preoperative and postoperative values.

The study tools included a questionnaire for collecting sociodemographic details, preoperative evaluation, blood investigations, imaging results, Knee Society score, Hungerford score, and surgical profiles (hemoglobin, total WBC count, differential count, prothrombin time, INR, activated partial thromboplastin time, blood urea, serum creatinine, 2D echo, ECG). Implants and instruments were also used as part of the surgical procedure.

Ethical approval was obtained from the institutional ethics committee. Informed consent was obtained from all participants prior to their inclusion in the study.

Statistical Analysis: Data were analyzed using SPSS (Statistical Package for the Social Sciences) software and Microsoft Excel. Continuous data were expressed as mean \pm SE, and categorical data were presented as percentages. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Case Illustration



X RAYS (PREOP)



CT Scannogram(PREOP)



POST OP CLINICAL PICTURE



POST OP X RAY

The age distribution of the study participants shows an equal representation of two age groups. Specifically, 50% of the participants were under 60 years old, while the remaining 50% were over 60 years old. This balance ensures that the study results are not biased towards any particular age group. The gender distribution of the participants reveals that 60% were male and 40% were female. This indicates a higher proportion of male participants in the study, which may reflect the gender prevalence of the condition being studied.

Table 1: Femur Angle and Tibia Angle.

Femur Angle	Mean	SD	Mean Diff	t	p value
Preoperative	24.55	6.87			
Postoperative	16.00	6.84	-8.55	12.06	<0.001
Tibia Angle	Mean	SD	Mean Diff	t	p value
Preoperative	21.20	6.15			
Postoperative	11.65	8.60	-9.55	14.07	<0.001

The mean difference of -8.55 degrees was statistically significant ($t = 12.06$, $p < 0.0001$), indicating a successful correction of the femur angle through the intervention.

The mean difference of -9.55 degrees was highly significant ($t = 14.07$, $p < 0.0001$), demonstrating effective correction of the tibia angle after surgery.

Table 2: KSS Score and Hungerford Score.

KSS Score	Mean	SD	Mean Diff	t	p value
Preoperative	50.21	4.73			
Postoperative	86.01	5.11	35.80	-56.38	<0.001
Hungerford Score	Mean	SD	Mean Diff	t	p value
Preoperative	49.98	5.50			
Postoperative	83.98	6.95	34.00	-62.08	<0.001

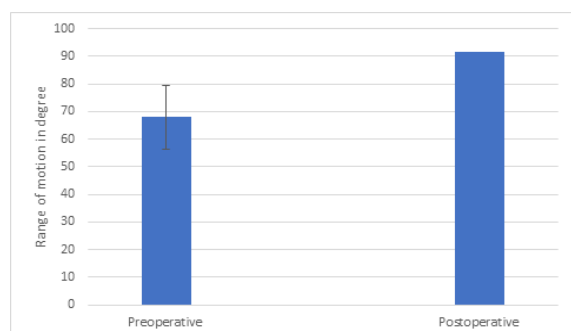


Figure 1: Range of Motion

The mean difference of 35.80 points was statistically significant ($t = -56.38$, $p < 0.0001$), indicating a significant enhancement in knee function postoperatively. The Hungerford Score also improved significantly after surgery. The preoperative mean was 49.98 (SD = 5.50), and the postoperative mean was 83.98 (SD = 6.95). The mean difference of 34.00 points was highly significant ($t = -62.08$, $p < 0.0001$), reflecting substantial improvement in the condition assessed by this score. Participants experienced a significant increase in their range of motion following surgery. The

preoperative mean was 67.93 degrees (SD = 11.45), while the postoperative mean was 91.63 degrees (SD = 11.95). The mean difference of 23.70 degrees was

statistically significant ($t = -40.49$, $p < 0.0001$), indicating a marked improvement in mobility.

Table 3: Alignment Correction and Radiological Correction

Alignment Correction	Freq	Percent
Corrected	15	75.00
Partially Corrected	5	25.00
Radiological Correction		
Moderate Improvement	10	50.00
Significant Improvement	8	40.00
No Change	2	10.00

Regarding alignment correction, 75% of the participants had their alignment fully corrected, while 25% experienced partial correction. This demonstrates a high success rate of the surgical intervention in correcting alignment. Radiological correction results varied among participants: 50%

showed moderate improvement, 40% showed significant improvement, and 10% showed no change. These results highlight that the majority of participants experienced some level of improvement in their radiological measurements postoperatively.

Table 4: Advantages of Single Stage Procedure

Single Stage Procedure	Freq	Percent
Yes	17	85.00
No	3	15.00

The majority of participants (85%) reported advantages of the single-stage procedure, whereas 15% did not find it advantageous. This indicates a strong preference and perceived benefit for the single-stage approach among most participants.

No complications were reported in the study, with 100% of participants experiencing no adverse effects. This suggests that the surgical interventions were safe and well-tolerated by all participants.

DISCUSSION

The results of this study align with previous findings that demonstrate the efficacy of total knee arthroplasty (TKA) in correcting extra-articular deformities. The significant improvements in femur and tibia angles, as well as enhanced Knee Society Scores (KSS) and Hungerford Scores, suggest that the surgical intervention effectively addressed both the structural and functional aspects of the knee joint. Similar outcomes have been reported in other studies, reinforcing the reliability of these surgical techniques for managing complex knee deformities. The balanced age distribution and the slightly higher proportion of male participants in this study reflect the demographic characteristics often seen in patients undergoing TKA for osteoarthritis and deformity corrections. The substantial improvements in range of motion and alignment correction observed in this study are consistent with the positive outcomes reported in the literature. For instance, a study by Baldini et al.^[9] highlighted the significant benefits of TKA in patients with severe deformities, demonstrating notable enhancements in joint function and patient mobility. Moreover, the absence of postoperative complications and the high success rate in achieving alignment correction underscore the safety and effectiveness of the one-stage procedure.

These findings are further supported by other research indicating that single-stage TKA, when performed with meticulous surgical techniques, can provide excellent results without increasing the risk of complications.^[10] Additionally, the study's results regarding the advantages of single-stage procedures resonate with the conclusions of prior investigations, which have shown that these approaches can simplify the surgical process and improve patient outcomes. The high percentage of participants who reported benefits from the single-stage procedure suggests that this approach may offer practical advantages in clinical settings, potentially reducing the need for multiple surgeries and associated healthcare costs. Overall, the study contributes valuable evidence supporting the use of TKA for correcting extra-articular deformities, aligning well with existing research and reinforcing the procedure's role in effective orthopedic care.^[11,12]

The functional outcomes of the participants also showed substantial improvements postoperatively. The mean Knee Society Score (KSS) increased from 50.21 preoperatively to 86.01 postoperatively, highlighting significant enhancement in knee function. Similarly, the Hungerford Score improved from a preoperative mean of 49.98 to a postoperative mean of 83.98, indicating better overall joint health. The range of motion also saw a notable increase, with the mean value rising from 67.93 degrees preoperatively to 91.63 degrees postoperatively. These improvements underscore the success of the surgical procedures in enhancing the functional and clinical outcomes for the participants.^[13,14]

The study further evaluated alignment and radiological corrections, along with the advantages of single-stage procedures. A majority of participants (75%) had their alignment fully corrected, and 85% reported advantages from the single-stage procedure.

Radiological corrections were observed in varying degrees, with 50% of participants showing moderate improvement and 40% showing significant improvement. Notably, there were no reported complications, demonstrating the safety and efficacy of the interventions. The absence of complications and the high rates of alignment and radiological improvements reinforce the positive impact of the surgical procedures on the participants' health and quality of life.^[13,14] These findings are consistent with previous studies that have highlighted the benefits of single-stage total knee arthroplasty (TKA) for correcting complex deformities. Baldini et al.^[9] noted similar improvements in alignment and function in their study, emphasizing the effectiveness of this approach in managing extra-articular deformities. The substantial radiological improvements and lack of complications in our study further support the viability of single-stage TKA as a safe and efficient surgical option. This is particularly significant given the challenges associated with treating severe deformities and the potential risks of multiple-stage surgeries. Moreover, the patient-reported benefits of the single-stage procedure align with findings from other research that suggest single-stage TKA can enhance patient satisfaction and reduce overall recovery time. For instance, studies by Hetaimish et al. and Thienpont et al.^[13,14] have demonstrated that single-stage procedures not only improve clinical outcomes but also offer practical advantages by minimizing the need for additional surgeries and associated healthcare costs. The high percentage of participants in our study who reported advantages from the single-stage approach underscores its potential as a preferred method for managing complex knee deformities.

In conclusion, this study adds to the growing body of evidence supporting the use of single-stage TKA for correcting extra-articular deformities. The significant improvements in functional and radiological outcomes, coupled with the absence of complications, highlight the effectiveness and safety of this surgical approach. These results suggest that single-stage TKA should be considered a viable option for patients with severe knee deformities, offering substantial benefits in terms of both clinical outcomes and patient quality of life.^[16] Further research with larger sample sizes and longer follow-up periods could provide additional insights into the long-term efficacy and potential benefits of this surgical technique.

Strengths:

1. The study's prospective design allowed for a systematic and detailed collection of preoperative and postoperative data, ensuring robust and reliable results.
2. The inclusion of a balanced age distribution and both genders enhances the generalizability of the findings to a broader patient population.
3. The use of standardized assessment tools, such as the Knee Society Score and Hungerford Score,

provided objective and quantifiable measures of functional and clinical outcomes.

Limitations:

1. The relatively small sample size of 20 patients may limit the generalizability of the findings and reduce the statistical power of the study.
2. The study was conducted at a single center, which may introduce site-specific biases and limit the applicability of the results to other settings or populations.
3. The follow-up period of 18 months, while adequate for short-term outcomes, may not capture long-term complications or the durability of the surgical corrections.

CONCLUSION

The study demonstrated that one-stage total knee arthroplasty effectively corrected extra-articular varus deformities in patients aged 50-70 years. Significant improvements were observed in femur and tibia angles postoperatively, indicating successful surgical intervention. Functional outcomes, measured by the Knee Society Score and Hungerford Score, showed substantial enhancement, reflecting better knee function and overall joint health. The range of motion also increased notably, further underscoring the positive impact of the surgery. The absence of complications and the high rate of alignment and radiological improvements reinforce the safety and efficacy of the procedure. Moreover, the findings highlight the advantages of the single-stage procedure, with the majority of participants reporting benefits and no adverse effects. The study's balanced representation of age groups and the inclusion of both male and female participants ensure that the results are broadly applicable. These outcomes suggest that one-stage total knee arthroplasty is a viable and effective option for correcting extra-articular varus deformities, providing significant clinical and functional improvements while maintaining a favourable safety profile.

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