

EFFECTIVENESS OF TOTAL KNEE REPLACEMENT WITH POSTERIOR STABILISED KNEE PROSTHESIS –A PROSPECTIVE STUDY

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Abstract

Background: The objective of this study was to assess the efficacy of total knee replacement with posterior stabilized knee prosthesis performed in a tertiary care centre. **Materials and Methods:** Thirty individuals participated in this prospective observational study. Total knee arthroplasty (TKA) was performed on all study participants at the Department of Orthopaedics, Government Medical College, and Thiruvananthapuram. 17 patients underwent total knee replacement on the right using a posteriorly stabilized knee prosthesis, while 13 patients underwent total knee replacement on the left using a posterior stabilized knee prosthesis. All participants in the study who underwent TKA with a posteriorly stabilized knee prosthesis were evaluated prior to surgery. This research was conducted between 2021 and 2022. In this study, data were collected using a structured questionnaire and proforma, and the Knee Society score was applied to calculate the functional outcome. **Results:** Out of 30 patients, 23 had excellent outcomes, 5 had good outcomes, 2 had fair outcomes, and no patient had a poor outcome. The p value was found to be 0.0001 by comparing the preoperative Knee Society functional score mean value of 49.4 to the postoperative Knee Society functional score mean value of 86.3, as well as the preoperative Knee Society clinical score mean value of 49.6 to the postoperative Knee Society clinical score mean value of 85.3. The study demonstrated statistical significance. **Conclusion:** This study showed that total knee arthroplasty using a posteriorly stabilized knee prosthesis is an effective form of treatment that can ease pain, support the knee joint, facilitate a wide range of motion, and correction of deformities.

INTRODUCTION

Total knee arthroplasty (TKA) is one of the most cost-effective and successful surgeries in orthopaedics. People with severe degenerative knee osteoarthritis may achieve advantageous outcomes from it. It may alleviate pain, bring back function, and improve the quality of life.^[1] Symptomatic knee degenerative osteoarthritis affects 240 out of every 100,000 patients each year, and about 400,000 patients in the US endure their first TKA surgery each year.^[2] Total knee replacement (TKR) is one of the most popular orthopedic surgeries. It is used to treat serious knee pain caused by osteoarthritis or inflammatory arthropathy. Most of the time, a total knee arthroplasty is done because of osteoarthritis. A total joint replacement is needed when damage to the cartilage in the medial, lateral, or patellofemoral joint causes severe pain and an inability to move.

When anti-inflammatory drugs, lifestyle changes, and exercise are unable to ease symptoms and improve functional ability, joint replacement is the last choice.^[2,3]

In the 1970s, posterior-stabilized (PS) TKA emerged as an option to cruciate-retaining (CR) TKA. Since then, it has become a common TKA form that has the same results as CR-TKA. Several substitutes have been made to make the results of these surgeries last longer and work more effectively. But there has been conflict about whether or not the posterior cruciate ligament (PCL) should be kept or taken out during the surgery. Some potential advantages of cruciate-retaining prosthetic designs include keeping the bone in place, restoring normal knee kinematics, increasing proprioception, cruciate retaining prosthesis promotes femoral roll back during flexion as retained PCL prevents anterior translation of femur

on the tibia.^[3] Posterior-stabilized implants strive to replace the role of the PCL with a polyethylene post and femoral cam. These features prevent the femur from moving forward on the tibia and let the femur roll back when the knee bends. There may be benefits to these designs, such as a simpler process, a more stable component interface, and an increased range of motion.^[4,5]

The post-cam device is unique to PS-TKA because it replaces the degenerative posterior cruciate ligament (PCL). This stops the posterior tibial instability, makes it easier for the femur to roll back, and increases the range of motion (ROM). The post-cam device is said to have different designs. The design is based on a post on the polyethylene (PE) insert and a cam on the femoral component. Whenever the knee bends, the post and cam work together to help the femoral rollover.^[6]

The objective of this study was to assess the efficacy of total knee replacement with posterior stabilized knee prosthesis performed in a tertiary care hospital.

MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Orthopaedics, Govt. Medical College, and Thiruvananthapuram. This study was carried out between 2021 and 2022. There were a total of 30 participants in this study, out of which 17 patients underwent right total knee replacement using a posterior stabilized knee prosthesis and 13 patients underwent left total knee replacement using a posterior stabilized knee prosthesis. Research was conducted after obtaining approval from the Institutional Ethics Committee (IEC) at Medical College Hospital. All the study participants who met inclusion criteria have undergone total knee replacement using a posterior stabilized knee prosthesis.

Inclusion Criteria

1. Patients older than 40 years of either sex
2. Patients with moderate to severe knee pain with angular knee deformity, knee stiffness with decreased range of motion, and unilateral or bilateral knee involvement

Exclusion Criteria

1. Patients with any local or systemic infectious condition,
2. Patients with other joint abnormalities deterring mobilization
3. Patients with neuropathic arthritis or other comorbid conditions rendering them unfit for surgery
4. Patients who refused to give assent

Sampling method

This study included a total of thirty participants. All consecutive cases meeting eligibility criteria attending the institute who were above the age of 40 years and required TKR as a treatment modality for degenerative, inflammatory, or post-traumatic

arthritis of unilateral or bilateral knee joints. All participants were selected after providing written, informed, and voluntary permission. The Knee Society score is used to measure the patient's outcome.

Sampling technique: All patients meeting the inclusion criteria consecutively added till the required sample size was met.

Data Collection Tools

The data was gathered via semi-structured questionnaire, written informed content, and knee society score.

Variables

The following study characteristics were used age, sex, socioeconomic level, diagnosis, side affected, knee deformity before surgery, Preoperative and postoperative Knee Society scores, knee's range of motion and complications.

Data Collection Procedure

In the present study, 30 patients having complete knee replacements with posterior stabilized knee prostheses were prospectively included. The research was carried out at the Department of Orthopaedics, Government Medical College, and Thiruvananthapuram. After IEC permission, the study time was limited to one year. Preoperative data and the three-month follow-up were acquired from the study participants using the knee society functional score. The knee society clinical score is used to clinically evaluate the functional range of motion and the stability of the knee in both the anteroposterior and mediolateral directions. Pre- and post-operatively, the pain score was determined using a visual analog scale. Before surgery, patients provided written, fully informed consent. For 8 hours, all patients were maintained on zero oral intake. Cefoperazone+sulbatam was used as a preoperative parenteral antibiotic. Every patient had a catheter placed during the procedure, which were performed under epidural anesthesia.

Preoperative evaluation. Before surgery, a standing AP view, lateral view, and skyline view of the patella are all part of the radiological evaluation. A complete blood count, electrolytes, renal function tests, viral markers, liver function tests, and ECG are part of the routine preoperative laboratory examination that comes after a thorough clinical assessment. Then, a comprehensive pre anaesthetic evaluation was performed on all patients.

Surgical Techniques

The patient was positioned supine with the knee in 90-degree flexion. A midline vertical skin incision is made. Medial parapatellar retinacular incision. Continue the incision along the medial side of the patella, all the way to the anteromedial surface of the tibia, along the medial border of the patellar tendon. To release the lateral patellofemoral plica, extend the knee and evert the patella. Flex the knee and remove the anterior cruciate ligament, as well as the anterior horns of the medial and lateral menisci and any osteophytes that may be present. Externally

rotate and sublux the tibia, excise the infrapatellar fat pad, and expose the lateral tibial plateau.

1. **Soft Tissue Releases:** The medial tissues of the knee are released in varus. This is accomplished by removing medial osteophytes, releasing the deep MCL, and releasing the pes anserinus and semimembranosus. In valgus knee lateral release, the lateral patellofemoral ligament, the iliotibial band from the Gerdy's tubercle, the popliteus, the capsule attachments to the lateral tibia, and the lateral collateral ligament from the femur are all released.
2. **Proximal Tibial Resection:** The distal end of the guide's shaft is positioned next to the tibialis anterior tendon, about at the ankle joint. At the level of tibial resection, two fixation pins are employed, and following resection, the guide but not the pins are withdrawn.
3. **Anterior and posterior femoral resection:** Using the femoral template, the suitable femoral component is chosen after the removal of all osteophytes. The proper femoral reconstruction guide is chosen. The femoral guide yolk has been put together and locked to the guide. With two or more fixation pins, the yoke is centered with regard to the shaft, and the guide is centered between the femoral epicondyles. In order to implant the PCL, a lengthy hole is bored up to the shaft, with the entrance point set a few millimeters medial to the midline. Up to the shaft, insert the intramedullary rod. Place the femoral guide positioner on the resected tibial surface and into the slot of the femoral guide. The positioner's roles include recreating the flexion gap and balancing the tension in the lateral and medial ligaments. If it is excessively tight, the tibial excision was performed excessively and should be repeated. Insert a thickness adapter that will best approximate the typical flexion tension of the ligaments if the joint is excessively loose in flexion. The anterior femoral resection is carried out first, and the anteroposterior femoral resection guide is fastened with two pins. Resection of the posterior femoral condyle is performed more medially.
4. **Gap Balancing:** Using spacer blocks, the flexion and extension gaps were evaluated. The flexion and extension gaps have to be equal and rectangular. The posterior capsule must be released in order to remove the tight extension gap, which may be fixed by removing extra bone from the distal femoral incision. By removing extra bone from the posterior condyle of the femur, a tight flexion gap may be addressed, which will increase postoperative flexion. Since tibial cuts impact flexion and extension gaps equally, more bone is taken from the tibia in situations where there is an equal flexion and extension gap but insufficient room for the prosthesis.
5. **Distal Femoral Resection:** The distal femoral resection guide was properly angled when it was put into the guide. a T-handled intramedullary rod put into the femur and the positioner. The distal femur is flattened with the anterior femoral resection towards the resection guide. The mechanical and anatomical axes of the femur are different, and the distal femoral resection is performed in accordance with the femoral resection angle. The guide is positioned, and the intramedullary rod is removed, leaving two pins in the guide that are inserted into the anterior femoral resection surface. Applying traction while fully extending the tibia simulates typical ligamentous tension. With the aid of the femoral resection guide, insert the guide positioner into the joint space and into the guide's slot to complete the distal femoral resection.
6. **Other Femoral Cuts:** The finishing guide is centered between the epicondyles, and two holes are drilled through the resection guide's guidance holes. First, the anterior chamfer is resected. Without notching the posterior femoral shaft, a posterior chamfer cut is performed.
7. **Final Tibial Preparation:** The correct-sized tibial reamer guide template is aligned for optimal bone coverage, and the guide is secured with pins. The opening for the stem of the plateau is reamed with a conical tibial reamer.
8. **Trial Reduction:** Using the impactor, a trial tibial component of the appropriate size is inserted and impacted. Keeping the knee in full flexion, the femoral trial is affixed to the femoral inserter and positioned on the femoral surface that has been prepared. The knee is completely extended with all trial prosthetics in position. Observe the medial and lateral alignment and stability in the AP and mediolateral planes. If instability is observed, the next size tibial insert is chosen. To implant the cemented tray, assemble the cemented keel stem punch onto the slap hammer, insert the punch through the guide, and strike until the punch's shoulder contacts the guide.
9. **Implanting the Components:** Utilizing pulse lavage, thoroughly sanitize all surfaces. Cement is applied to the anterior, anterior chamfer, and distal surfaces of the bone, as well as the posterior chamfer and posterior condylar recesses of the component. After attaching the implant to the inserter, thoroughly seat the impact using the femoral impactor and mallet. Following the application of bone cement, the tibial tray is inserted without malrotation. A permanent tibial insert is inserted into the tibial tray and seated posteriorly with the anterior margins resting on the lip. Osteophytes under the patella are removed, and patelloplasty is performed. Electrocautery is used to perform circumferential patellar denervation.
10. **Closure:** The tourniquet is released, and saline irrigation is performed. A suction drain is used.

Deep retinal tissues are closed with absorbable sutures, and subcutaneous layers are closed with staples. A Jones compression dressing and knee immobilizer are administered.

Post-op-protocol

The patient received epidural analgesia and intravenous antibiotics for three to five days. The suction drain was withdrawn on the second postoperative day. The patients were instructed to walk with full weight bearing on the first postoperative day using a walker. Exercises to strengthen the quadriceps began on the first postoperative day. Systemic DVT prophylaxis begins on the first postoperative day and is administered for five days. After fifteen days, the skin staples were withdrawn.

Follow up

The patient is evaluated clinically, functionally, and with X-rays six weeks postoperatively and then every four weeks until three months. The knee society score is computed after three months.

Data Analysis

Subjects are evaluated using the knee society score, and the resulting data will be input into a Microsoft Excel data sheet and analyzed using SPSS 26

(Statistical Program for the Social Sciences) software. The categorical data will be represented as frequencies and percentages. The average and standard deviation are used to represent continuous data. The Paired t test is the significance test for paired data, such as pre- and post-surgery measurements. A p-value less than or equal to 0.05 is considered statistically significant.

RESULTS

Baseline characteristics

The study included a total of 30 participants. 10 patients were between the ages of 56 and 60, 9 were between 61 and 65, and 10 were between 66 and 70 years of age. The meanSD age of study participants was 62.64.9 years. The youngest subject was 55 years old, while the eldest was 70 years old. 12 men (40%) and 18 women (60%) were present. The mean±SD BMI of study subjects was 25.3±3.9 kg/m². As per the Asian grading 30% (n=9) were having normal BMI. The highest BMI in the study population was 34.5kg/m².(Table 1).

Table 1:

Variable	Characteristic's	n	%
Age in years	51-55	1	3.3
	56-60	10	33.3
	61-65	9	30
	66-70	10	33.4
	Mean±SD age=62.6(SD=4.9) years		
Gender	Male	12	40
	Female	18	60
BMI grading(kg/m ²)	Normal(18.5-22.9)	9	30
	Overweight(23-24.9)	12	40
	Pre obese(25-29.9)	4	13.3
	Obese(30 and above)	5	16.7
	Mean±SD BMI= 25.3(SD=3.9) kg/m ²		
Total		30	100

Preoperative assessment

In this study, 17 patients ((56.7%) underwent TKR on right knee during the study. Rest 13 (43.3%) persons underwent surgery on left side. None were done on both sides during the study period. Out of 30 cases 24 (80%) subjects had osteoarthritis as the primary diagnosis. 4 persons had rheumatoid arthritis (13.3%). The remaining 2 cases (96.7%) were OA secondary to septic arthritis. Majority (n=13, 43.3%) had no deformity at the time of surgery. The commonest deformity was fixed flexion deformity identified in 9 subjects (30%). Varus deformity was present in 5(16.7%). Valgus deformity was the least common (n=3, 10%).(Table-2).

Table 2:

Variable	Characteristic's	n	%
Side affected	Right knee	17	56.7
	Left knee	13	43.3
Diagnosis	Primary osteoarthritis	24	80
	Rheumatoid arthritis	4	13.3
	OA knee secondary to Septic arthritis	2	6.7
Deformity	None	13	43.3
	Fixed flexion deformity	9	30
	Varus deformity	5	16.7
	Valgus deformity	3	10

Post-operative assessment

Grading of the post-operative knee society score revealed that 23 subjects (78.7%) had an exceptional post-operative knee society score (Clinical score), 5 cases (16.7%) had a good post-operative knee society score

(Clinical score), and 2 cases (6.6%) had a fair post-operative knee society score (Clinical score). 24 of the 30 trial participants (80%) had an outstanding post-operative knee society score (Functional score). 5 (16.7%) of the patients obtained an excellent post-operative knee society score (Functional score). 1 (3.3%) got a good post-operative knee society score (Functional score). (Table 4).

Table 3: Post-operative knee society score grading

Post-operative knee Society score grading	Clinical score		Functional score	
	N	Percent	N	Percent
Excellent	24	80	23	77.7
Good	5	16.7	5	16.7
Fair	1	3.3	2	6.6

Comparison of preoperative and postoperative values

Pre-operative: All subjects had moderate or severe pain pre operatively. By Visual analogue scale they had pain score of 4-7 (Median 6) and mean pain score 5.9. The Mean±SD pre-operative range of motion was 77.60±17.9. The minimum ROM was 51 and the maximum was 117 pre-operatively. All subjects had pre-operative Knee Society Score less than 60. The mean±SD score was 49.5± 4.6. The minimum score was 40 and the maximum score was 58 pre-operatively. All subjects had pre-operative functional Knee Society Score less than 60. The mean±SD score was 49.4± 5.6. The minimum score was 30 and the maximum score was 55 pre-operatively.

Post-operative: After 3 months of follow up none of the subjects had moderate or severe pain. 1 had VAS 3 score. 2 had (6.7%) VAS 2 and 3(10%) had VAS 1 score. 24(80%) subjects were pain free. The mean ±SD post-operative range of motion was 115.50±13.3. The minimum ROM was 940 and the maximum was 1340 post-operatively. All subjects had post-operative Knee Society Score more than 60. The mean±SD score was 85.3± 8.8. The minimum score was 68 and the maximum score was 95 post-operatively. The mean±SD postoperative functional score was 86.3± 8.1. The minimum score was 67 and the maximum score was 95 post-operatively.

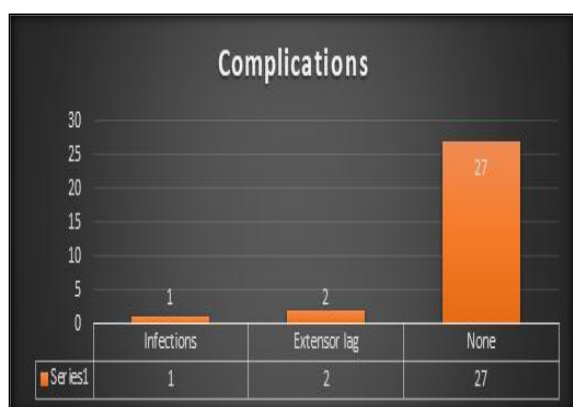
Pain by visual analogue scale score showed reductions in the follow up which was statistically significant. The post-operative ROM, clinical and functional knee society scores showed statistically significant improvement after analysis using paired t-test.(table3).

Table 4:

Paired t-test	Mean		T-value	p-value
	Pre-operative	Post-operative		
Pain(visual analogue scale)	5.9	0.5	36.3	<0.001
ROM	77.6	115.4	21.3	<0.001
Clinical score	49.5	85.3	47.1	<0.001
Functional score	49.4	86.3	38.4	<0.001

Complications

In a three-month follow-up, 27 of the 30 individuals included in the trial experienced no problems. One patient had a superficial skin infection after surgery. There were two patients who had post-operative extensor lag. The total complication rate (n=3) was 10%.



DISCUSSION

The objective of this study was to assess the efficacy of total knee replacement with posterior stabilized

knee prosthesis performed in a tertiary care center. 17 patients underwent right total knee replacement with posteriorly stabilized knee prosthesis and 13 patients underwent left total knee replacement with posteriorly stabilized knee prosthesis, for a total of 30 participants.

The average age of the research participants was 62 years, with the youngest patient being 55 and the eldest patient being 70. Ten patients were between the ages of 56 and 60, nine were between 61 and 65, and ten were between 66 and 70. 60% of the subjects in the current study were female, while 40% were male. In this study, the average BMI was 25.3 kg/m². 30% of the patients possessed a healthy BMI. 40 percent of the patients were overweight, and 16.7 percent were obese. The number of patients with osteoarthritis was 80% (24 knees), which was greater than the number of patients with rheumatoid arthritis, which was 13% (four knees). The results are consistent with those of Back et al., who discovered that 83% (354 of the knees) had osteoarthritis and 14% (59) had rheumatoid arthritis.

In this study, 80% of clinical knee score outcomes were rated as excellent, 16.7% as good, and 3.3% as fair, while 77% of functional knee score outcomes were rated as excellent, 16.7% as good, and 6.6% as

fair. In a study by Suhail et al.^[11], the clinical knee score outcomes were 77.3% exceptional, 21.3% acceptable, and 1.3% inadequate. According to the functional knee score, 64% of knees were exceptional, 29.3% were acceptable, and 6.4% were poor. In another investigation by Williams et al.^[12], the clinical knee score rated 92% of knees as outstanding, 1.6% as good, and 6.5% as poor. Clinical knee score rated 60% of knees as excellent, 13.3% as good, and 13.3% as poor, while functional knee score rated 34.6% of knees as excellent, 46.1% as good, and 46.1% as poor. In a study by Reddy et al.^[14], the functional knee score indicated that the outcome was outstanding in 79.4% of knees, acceptable in 5.8%, and subpar in 5.8%.

In this study, it was determined that the average knee society scores were comparable to the averages from other studies.^[14,15] In this study, the mean clinical knee score was 49.6 before surgery and 85.3 after surgery. In addition, the mean functional score was 49.4 prior to surgery and 86.3 after surgery. The mean clinical knee score was 30.0 preoperatively and 90.0 postoperatively, according to a study by Smith et al.^[15]; the mean functional knee score was 51.07 preoperatively and 70.0 postoperatively. In another study conducted by Kim T. H. et al., the mean clinical knee score increased from 30.9 preoperatively to 94.2 postoperatively, while the mean functional knee score improved from 44.9 preoperatively to 84.7 postoperatively.^[15] In a series of cases examined by Kim Y. H. et al.^[16], the mean clinical knee score increased from 35.3 to 94 postoperatively, while the mean functional knee score decreased from 44.2 to 83 postoperatively.

In this study, the average preoperative ROM was 77.6 degrees, while the average postoperative ROM was 115.4 degrees. It is noted that the range of motion obtained in this research after total knee replacement is comparable to the findings of other studies.^[14,15] Li et al.^[18] found that the mean preoperative ROM was 88 degrees, and the mean postoperative ROM was 100 degrees. In a separate study, Nutton et al.^[19] found that the mean ROM increased from 126 degrees preoperatively to 136 degrees postoperatively. Kim et al.^[20] found that the average preoperative ROM was 117.3 degrees and the average postoperative ROM was 134.7 degrees. Williams et al.^[12] demonstrated in 2010 that the mean preoperative ROM was 99 degrees and the mean postoperative ROM increased to 115.5 degrees. All patients had moderate or severe knee pain prior to surgery, as measured by the visual analog scale, and all patients experienced a reduction in knee pain, as none of the subjects had moderate or severe knee pain. Eighty percent of patients were pain-free. Burnett et al.^[19] stated that anterior knee pain after Total Knee Arthroplasty is dependent on component rotation or component design rather than patella resurfacing.

One patient (3.33%) developed a postoperative superficial surgical site infection, which responded favorably to knee debridement and intravenous

antibiotics. After surgery, 6.66% (n = 2) of patients experienced extensor lag. Other complications, such as deep vein thrombosis due to clexane thromboprophylaxis or knee rigidity, did not arise in any of the patients. For 90% of the participants, there were no complications following surgery. Due to the brief duration of the trial, long-term complications such as implant failure, retraction, and polyethylene degradation were not observed. In this study, no patients demonstrated postoperative knee instability. The findings of Hooper et al. and the present study concur that total knee replacement is an effective implant.^[10]

CONCLUSION

Total knee arthroplasty has revolutionized the treatment of knee osteoarthritis and rheumatoid arthritis. With a postoperative mean clinical score of 85 and a mean functional knee score of 86, this study's results are comparable to those of previous global investigations. The rate of complications is also lower than in prior studies, with only one patient suffering from a superficial infection and two from extensor lag. 90% of patients who underwent surgery reported a significant reduction in unpleasantness.

This study demonstrated that total knee arthroplasty with posterior stabilized knee prosthesis is highly effective and provides overall pain relief, satisfactory joint stability, and increased range of motion in the knees when performed with preoperative patient selection, intraoperative soft tissue balancing, correct overall alignment of the prosthesis, and postoperatively appropriate rehabilitation.

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