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A Prospective Study to Analyze the Functional Outcome of Total Knee Arthroplasty in Degenerative Osteoarthritis

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ABSTRACT

Osteoarthritis is thought to be the most prevalent chronic joint condition. The obesity pandemic and the aging population are both factors in the rise in osteoarthritis cases. Pain and loss of function are the main clinical criteria that trigger treatment, encompassing non-pharmacological, pharmaceutical, and surgical approaches. Total knee arthroplasty (TKA) is increasingly being used as a viable treatment option for severe arthritis. The component shape, the degree of conformity of the articulating surface and the anchoring technique are different for each of the systems. Research was needed to determine the efficacy of different prostheses after the emergence of these different types of prosthetics. Numerous grading systems were created as a result to assess the outcomes of total knee replacement. The Knee Society Score System is further classified into a functional score, which evaluates the patient's ability to walk and climb stairs and a knee score, which simply measures the knee joint itself. The issue of decreasing knee scores linked to patient infirmity is resolved by the dual rating method. Objective of the study is to look into the functional outcomes of a cemented complete knee replacement after primary osteoarthritis and to investigate the disadvantages of a cemented total knee replacement for osteoarthritic patient. Follow up is by Six weeks after surgery or one month after discharge, the patient was assessed for any signs of a post-operative infection. After post-operative infection was ruled out, the patient completed clinical and functional evaluations using the Knee Society Score at three-and six-month intervals following surgery. The average knee clinical score before surgery increased to 94.1 using the cemented posterior cruciate sacrificing design and the average knee functional score before surgery increased to 39.35 from an average post-operative knee functional score of 84.75 at the one-year follow-up.

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Key Words

Total knee arthroplasty, degenerative osteoarthritis, total condylar prosthesis, knee clinical score, knee functional score, periprosthetic fracture

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INTRODUCTION

The majority of knees with arthritis show some degree of instability, deformity, or contracture, or a combination of these. The most prevalent causes of arthritis in the knee include rheumatoid arthritis (RA), osteoarthritis (OA), juvenile RA, post-traumatic arthritis, secondary osteoarthritis and various kinds of inflammatory arthritis. Osteoarthritis is thought to be the most prevalent chronic joint condition. The obesity pandemic and the aging population are both factors in the rise in osteoarthritis cases. Pain and loss of function are the main clinical criteria that trigger treatment, encompassing non-pharmacological, pharmaceutical and surgical approaches. Researchers have concentrated on the concept of modifying the articular surfaces to enhance knee joint performance since the 19th century. To manage the knee kinematics in surface replacement arthroplasty, multiple prosthesis types were developed. Total knee arthroplasty (TKA) is increasingly being used as a viable treatment option for severe arthritis. The component shape, the degree of conformity of the articulating surface, and the anchoring technique are different for each of the systems. Research was needed to determine the efficacy of different prostheses after the emergence of these different types of prosthetics. Numerous grading systems were created as a result to assess the outcomes of total knee replacement. The Knee Society Score System is further classified into a functional score, which evaluates the patient's ability to walk and climb stairs and a knee score, which simply measures the knee joint itself. The issue of decreasing knee scores linked to patient infirmity is resolved by the dual rating method.

Objectives of the Study:

- To look into the functional outcomes of a cemented complete knee replacement after primary osteoarthritis.
- To investigate the disadvantages of a cemented total knee replacement for osteoarthritic patients.

MATERIALS AND METHODS

This prospective observational study, conducted in a hospital, aimed to evaluate the functional result of cemented total knee arthroplasty in patients with primary osteoarthritis. The time frame for this investigation was December 2021-December 2023. Knee Society scores were used to evaluate the clinical and functional status of thirty patients who successively gave their assent and underwent Posterior Cruciate Sacrificing Cemented Total Knee Arthroplasty. There were two follow-up periods: three and six months. The study was carried out at the Narayana Medical College's Department of Orthopaedics in Nellore, Andhra Pradesh. The Knee Clinical Score and Knee Functional Scores before and after surgery.

Inclusion Criteria: All patients above the age of 45 years warranting TKR as a therapeutic option for unilateral or bilateral knee joints for osteoarthritis of the knee.

Exclusion Criteria:

- Acute infectious diseases, either systemic or local.
- Individuals who cannot have surgery due to comorbidities.
- Individuals whose joint problems prevent them from being mobilized.
- Arthritis nervosa.

Pre Operative Evaluation:

Clinical Assessment:

- Every patient's complete medical history was obtained.
- The Knee Society Score 5 was used to evaluate each patient's functional and clinical status. All patients had preoperative medical examinations performed in order to guard against potentially fatal or severely disfiguring consequences.
- Any variations in limb length were observed. All hip and foot abnormalities were evaluated for their presence. The extensor mechanism was examined for any possible contractors of the quadriceps.
- Any fixed flexion contractors or varus or valgus deformities in the knee abnormalities were investigated.

Radiographic Assessment:

- To acquire knee radiographs, standard protocols were followed: a standing anteroposterior view, a lateral view and a skyline view of the patella.

In addition to sizing the femoral and tibial components, assessments were made for any laxity in the collateral ligaments, tibia subluxation, osteophytes and bone abnormalities in the tibia and femur.

Post-Operative Protocol: Intravenous antibiotics and subcutaneous low molecular weight heparin were administered to the patients as part of their DVT prophylactic treatment. The patient's knee was immobilized post-surgery with a knee immobilizer and a Jones compressive bandage.

- Static quadriceps exercises were taught to the patient on the first post-operative day
- After two postoperative days, the wound was examined and the dressing debulked.

The patient was instructed to continue performing static quadriceps workouts and was forced to walk fully weight bearing while wearing a knee immobilizer. The patient was taught dynamic quadriceps exercises on the fourth post-operative day and knee flexion was initiated.

- After surgery, IV antibiotics were administered for the first 48 hours before switching to oral antibiotics for the following five days. The first five days following surgery were spent administering DVT prevention.
- On the twelfth postoperative day, the sutures were taken out and the patient was instructed to resume her normal physical therapy.

Follow Up: Six weeks after surgery or one month after discharge, the patient was assessed for any signs of a post-operative infection. After post-operative infection was ruled out, the patient completed clinical and functional evaluations using the Knee Society Score at three-and six-month intervals following surgery.

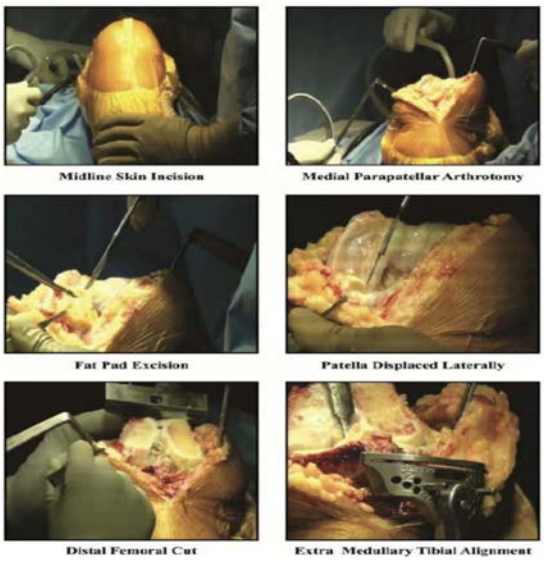

Fig. 1: Six Weeks After Surgery or One Month

RESULTS AND DISCUSSIONS

Table 1: Age Distribution

Age Group	Frequency	Percent
51-55	5	17%
56-60	7	23%
61-65	7	23%
66-70	6	20%
71-75	5	17%
Total	30	100%

The bulk of the patient group was between the ages of 61 and 65, which accounts for 35% of the patients in our study. Within the patient population, the youngest patient's age ranged from 51-74. It was 63.45 years old on average.

Table 2: Gender Distribution

Gender	Frequency	Percent
Female	16	53%
Male	14	47%
Total	30	100%

There were more women than men in the 3:1 ratio, or 50% of the patient.

Table 3: Side Distribution

	Frequency	Percent
Left	16	53%
Right	14	47%
Total	30	100%

There was a predominance of right side accounting for 60% of the patients.

Table 4: Indication

Indication	Frequency	100%
Osteoarthritis	30	100%
Total	30	100%

Every case that was operated on had primary osteoarthritis in the knee. Accounting for all patients in this trial, 100%.

Table 5: Knee Clinical Score

	N	Mean	Median	Mode	St. Deviation	Minimum	Maximum
Pre-Op	30	26.75	27.50	15	8.43	14	81
Post-Op	30	94.40	96.60	97	5.11	40	90

In this study, the average Knee Clinical Score prior to surgery was 26.75 and it increased to an average Post-Op Score of 94.1.

Table 6: Grading of Knee Clinical Score

	Frequency	Percentage
Excellent	24	80%
Good	06	200%
Poor	00	00%
Total	30	100%

According to the Knee Society Clinical Scoring System, of the 30 patients analyzed in this study, 24(80%) had excellent results, 06(20%) had good results and none had terrible results.

Table 7: Knee Functional Score

	N	Mean	Median	Mode	St. Deviation	Minimum	Maximum
Pre-Op	30	38.73	40	45	10	16	50
Post-Op	30	85.33	90	90	7.89	65	95

In this study, the mean Knee Functional Score before surgery was 39.35 and it increased to a mean score of 84.75 after surgery.

Table 8: Grading of Knee Functional Score

	Frequency	Percentage
Excellent	21	70%
Good	06	20%
Fair	03	10%
Poor	00	00%
Total	30	100%

Based on the Knee Society Functional Scoring System, of the 30 patients analyzed in this study, 21 patients (70%) had outstanding outcomes, 06 patients (20%) had good results and 03 patients (10%) had fair results. The KCS averages before and after surgery varied by 67.35(95% CI: 64.56-70.14). When comparing the Knee Clinical Scores before and after surgery, the P-values was significant (<0.001). The KFS averages before and

Table 9: Comparing Between Pre-Op and Post-Op Knee Clinical and Functional Score

	Paired Difference		
	Mean	Standard Deviation	P-value
Pre-Op KCS-Post-Op KCS	67.9	3.32	<0.001
Pre-Op KFS-Post-Op KFS	46.6	2.02	<0.001

after surgery varied by 45.40 (95% CI), ranging from 41.24-49.56. The p-value was significant (<0.001) when comparing the Knee Functional Scores before and after surgery. A major improvement in functional capacity is frequently achieved with total knee arthroplasty, an effective treatment. Elderly patients with degenerative arthritis who were experiencing substantial mobility problems experienced great relief following total knee replacement surgery. The quality of life, mobility, deformity correction and joint discomfort were all significantly improved in patients who underwent posterior cruciate sacrifice cemented total knee arthroplasty. The posterior cruciate replacement implant design was found to be the most successful of the numerous implant designs that were available. Following total knee arthroplasty, C. Buz Swanik[1] noted that patients mobility had improved and they were able to duplicate joint position. Improvements in pain and inflammation might be attributed to retensioned capsule-ligaments structures and decreased discomfort. In the group treated with the posterior stabilized prosthesis, joint position was more nearly replicated when the knee was stretched from a flexed position. The ability to proprioce and balance in individuals following a posterior stabilized total knee replacement appears to be unaffected by maintaining the posterior cruciate ligament. Studies on gait analysis by Andriacchi and Galante[2], Kelman *et al.* and others have shown that individuals with PCL-retaining prosthesis had a more symmetrical gait than those with PCL-sacrificing or PCL-substituting designs. This is particularly valid for stair climbing. Patients exhibiting PCL-sacrificing/PCL-substituting designs had less knee flexion when climbing stairs and a tendency to lean forward in a posture that saves quadriceps. These results have been cited as arguments in favor of maintaining the PCL. The results of these earlier studies are contradicted by Wilson *et al.*'s gait study[3], which compares knees that have been sacrificed or replaced for the PCL with those of normal patients. In vivo investigations by Dennis[4], Victor, Banks and Bellemans and Stiehl provide additional evidence that contradicts these prior findings. These findings demonstrated a paradoxical forward translation of the femorotibial contact point during weight bearing flexion in some PCL-retaining knees using fluoroscopy during single-stance deep knee bends., the more uniform femoral rollback was seen in the PCL-substituting/sacrificing knees investigated. Determining whether or not to sacrifice the PCL at TKR has been the subject of much debate. The femorotibial contact zone's flexion-related posterior glide and roll are impacted by the PCL. Isolated PCL removal increases the flexion gap. A dished polyethylene insert with a higher anterior lip or a tibial post and femoral cam may be used to restore stability and femorotibial rollback. The usage of PCL substituting/sacrificing designs has been demonstrated to promote knee flexion after surgery. This could be due to more usual kinematics. Fluoroscopic studies reveal greater femoral rollback when using the cam-post articulation than when using some PCL-retaining devices. It is commonly believed by authors that the PCL suffers from various forms of arthritis and contracture, which makes it difficult for them to balance. Even while proponents of PCL retention like Ritter and Scott have devised intraoperative PCL balance tests, researchers like Maloney[5] have remarked that it is difficult to duplicate near-normal PCL strain and function in a PCL-retaining knee replacement, even in a lab context. In Maruyama[6] randomized experiment, patients with bilateral TKR were evaluated. The results showed that patients with PCL substitution or sacrifice had a greater range of motion than those with PCL retention. Clark[7] found that PCL substitution led to increased flexion two years after surgery. A recent meta-analysis found that, in comparison to PCL retention, PCL-substituted designs exhibited an 8° improvement in flexion. Using PCL replacement or sacrifice has not been found to improve flexion by other researchers. In certain situations, the PCL may not function even when a PCL retaining design is used. Resecting or leaving the PCL intact did not affect the clinical result, according to a Cochrane analysis. A posterior cruciate sacrifice technique was used to operate on all 30 patients who satisfied the study's inclusion requirements. Total knee arthroplasty with patella preservation produced comparable clinical results to total knee arthroplasty with patellar resurfacing, according to Robert L. Barrack[8]. According to Robert L. Barrack *et al.,* postoperative anterior knee pain is associated with the component design or characteristics of the surgical method, such as component rotation, rather than the patella's resurfacing status. Nutton[9] determined that there was no improvement in knee function by comparing patellar resurfacing to a matched group of individuals who did not receive resurfacing. Wood[10] reported that total knee arthroplasty with patellar resurfacing had superior clinical outcomes compared to total knee arthroplasty with patellar retention.

Patients who underwent total knee replacement with patellar resurfacing showed significant limitation in their ability to extend their knee and this condition was significantly connected with the development of anterior knee pain after surgery. The patellofemoral joint may not always be pain-free after patellar resurfacing. The KAT[11] was unable to show that patellar resurfacing would be significantly beneficial. Throughout our inquiry, no patellas were found again. Osteophytes were retrieved after each patella underwent a circumferential cautery enervation. Using the Knee Society Score, the overall outcome of the knee arthroplasty was assessed. The knee Society Score assessment system was the logical progression of the Hospital for Special Surgery (HSS) grading system. The Knee Society Score methodology makes a distinction between outcomes pertaining to the function of the patient and outcomes pertaining to the surgically repaired knee. Two components comprise the system: a knee functional score that assesses the patient's capacity for walking and stair climbing and a knee clinical score that assigns a numerical value to the knee joint itself. Together with the relatively objective clinical score for the knee, which is based on clinical indicators, the patient's subjective assessment of the knee's function during specific activities determines the knee functional score. After posterior cruciate sacrificing cemented total knee arthroplasty, our study found a considerable improvement in the Knee Clinical Score and Knee Functional Score. In this consecutive review of thirty patients who underwent posterior cruciate sacrifice design for cemented total knee arthroplasty, no problems were noted throughout the follow-up period.

Summary:

- This study is a follow-up of thirty patients who had total knee arthroplasty with cement employing a posterior cruciate sacrifice design.
- Of the patients in our study, 35% were between the ages of 61 and 65, making up the bulk of the patient population. The ages of the patients ranged from 54 for the youngest and 74 for the oldest. The average age was sixty-three.45.
- In this study, 60% of the patients had a 3:1 ratio, meaning that women predominated. 60% of the patients were on the right side, which was the predominant side.
- In every case, primary osteoarthritis of the knee was the diagnosis.
- In this study, the mean pre-op Knee Clinical Score was 26.75 and it increased to a mean post-op score of 94.1.
- Of the 30 patients evaluated in this study, 24 patients (80%) had excellent results and 06 patients (20%) had good results based on the Knee Society Clinical Scoring system. In this study, the average pre-op Knee Functional Score was 39.35 and it increased to an average post-op score of 84.75.
- Of the 30 patients evaluated in this study, 21 patients (about 70%) received Excellent, 06 patients (20%) received Good and 03 patients (10%) received Fair scores using the Knee Society Functional Scoring system.
- The mean difference between pre- and post-operative KCS was 67.35 (95% CI:64.56 to 70.14). Comparison of the pre-op and post-op Knee Clinical Scores revealed a significant P value (<0.001).
- The averages of pre-op KFS and post-op KFS differed by 45.40 (41.24-49.56, 95%CI). When comparing the pre-op and post-op Knee Functional Scores, the P value was significant (<0.001).

CONCLUSION

Following cement total knee replacement, improvements are seen in the post-operative Knee Clinical Score and Knee Functional Score, demonstrating the patient's enhanced functional ability and potential to return to the pre-disease state, or a pain-free movable joint. The average knee clinical score before surgery increased to 94.1 using the cemented posterior cruciate sacrificing design and the average knee functional score before surgery increased to 39.35 from an average post-operative knee functional score of 84.75 at the one-year follow-up.

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