



ORIGINAL RESEARCH PAPER

Orthopaedics

A PROSPECTIVE STUDY ON FUNCTIONAL OUTCOME IN POSTERIOR CRUCIATE RETAINING VERSUS POSTERIOR CRUCIATE SACRIFICING TOTAL KNEE ARTHROPLASTY

KEY WORDS: Total knee arthroplasty, posterior cruciate ligament, Knee society knee score, Functional knee score, Womac score.

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ABSTRACT

Background: Total knee arthroplasty has evolved over the past decades into a very much reliable surgical treatment for advanced arthritis of knee. Total knee replacement has been shown to restore patient function and relieve pain and deformity that results from knee arthritis. The success of a total knee replacement is determined by many factors like degree of pain relief and functional outcome. The role of Posterior cruciate ligament in total knee replacement is controversial. The first is to retain the ligament and to preserve as much as possible of the normal anatomy and function of the knee. Preservation of the ligament is thought to enhance stability, femoral rollback, mechanical advantage of the quadriceps muscle and proprioceptive properties. Theoretically it has been suggested that PCL retaining can increase the range of flexion and prevents posterior translation which reduces loosening and excessive polyethylene wear by decreasing the shear stresses at the fixation surfaces. We conducted a prospective study to compare resection with retention of PCL using a standard PCL-retaining cemented total knee replacement and assessed the functional outcome using functional knee scores and WOMAC score.

Aims and Objectives: The aim of the study is to “prospectively compare the functional outcome between posterior cruciate ligament retaining and posterior cruciate ligament sacrificing total knee arthroplasty.

Materials and Methods: The study was done on 20 patients admitted to Hi-Tech Medical College & Hospital, Bhubaneswar. Scoring system formulated by the WOMAC Score, Knee Society Knee Score and Functional Knee Score were used to evaluate the patients before and after surgery. Both knee scores and functional scores are calculated with each amounting to a total of 100 points and WOMAC Score with max of 96 points. All patients were evaluated post-operatively and followed up.

Results: Analyzing the functional outcome it was found that all the patients in both the groups had significant improvement in their knee score and the functional knee score. Analyzing the total Knee Scores, the average Knee Society Score for the PS group was 85.80 and that of CR group was 75.60 and statistical analysis revealed a significant difference in the p-value in favour of Cruciate Sacrificing Prosthesis signifying that Cruciate Sacrificing Prosthesis has better functional outcome. The functional knee society also showed a marked improvement in all patients, for CS group FKS was 99.6 and for CR group it was 91.6. The WOMAC Score also showed a marked improvement. In CS groups it was 24.6 and in CR it was 27.4. Statistical analysis showed a highly significant difference in favor of cruciate sacrificing prosthesis.

Conclusions:Total Knee Arthroplasty in patients in whom posterior cruciate ligament was sacrificed was found to have a better functional outcome as compared to the retaining group, which can be mainly attributed to the persistence of flexion deformity in cruciate retaining group. In Indian scenario where knee replacement is done at a late stage of osteoarthritis, sacrificing the contracted posterior cruciate ligament has better outcomes as compared to retaining it.

I. INTRODUCTION :

Total knee arthroplasty has evolved over the past decades into a very much reliable surgical treatment for advanced arthritis of knee. Total knee replacement has been shown to restore patient function and relieve pain and deformity that results from knee arthritis. The success of a total knee replacement is determined by many factors including pain relief, functional outcome, and range of motion.[1] There have been numerous changes in the total knee arthroplasty, like alterations in component geometry, understanding of the rotational alignment of the components, sizing options and modularity, accurate instrumentation for correcting deformity and improved cementation techniques. The best knee replacement is one, which the kinematics of the normal knee is reproduced. Amongst several factors affecting the kinematics, variations in surface geometry and the retention or sacrificing the posterior cruciate ligament is considered especially important. There are four options available to the surgeon.

The first is to retain the ligament and to preserve as much as possible of the normal anatomy and function of the knee. Preservation of the ligament is thought to enhance stability, femoral rollback, mechanical advantage of the quadriceps muscle and proprioceptive properties.[2,3,4] The second option is to excise the ligament in order to facilitate the correction of any fixed deformities.[5] This allows more

accurate and reliable soft tissue balancing. The third option is to substitute the ligament with a posterior stabilized tibial insert having a central post, which can engage on a femoral cam during flexion, mimic femoral rollback and reproduce near normal kinematic profiles.[6] The central post may also allow some stability in the antero-posterior plane and act as a secondary stabilizer to a varus or valgus stress.[7] The fourth option is to release the ligament; this offers a compromise between preservation and excision.[8]

II. METHODOLOGY: MATERIALS AND METHODS

Place Of Study: Hi-Tech Medical College and Hospital, Bhubaneswar

Period Of Study: November 2019- October 2021

Consent: Written informed consent of the patients was obtained

Inclusion Criteria:

In our hospital total knee arthroplasty is being done for osteoarthritis, post-traumatic arthritis and rheumatoid arthritis.

This includes varus as well as valgus knees.

1. Osteoarthritis & Rheumatoid arthritis
2. Age > 40 yrs
3. Gender- Both

4. Kellgren and Lawrence score Grade 3 and 4

Exclusion Criteria

1. Age < 40 yrs
2. Minimal degenerative changes (KLI & II)
3. Poor skin conditions
4. Varicose veins
5. Medically unfit

STUDY DESIGN: Prospective study.

After obtaining clearance and approval from the institutional ethical committee and patients fulfilling the predetermined inclusion & exclusion criteria, was included in the study after obtaining informed consent. During this study period 26 knees were replaced in 18 patients. All patients were followed at 3 weeks, 6 weeks, 12 weeks, and thereafter every 6 months. Among these patients Osteoarthritis (18), Rheumatoid arthritis (06) Posttraumatic arthritis (02). For SIDE Number Right (05) Left (05) Bilateral (08). For Type of Deformity and Number-Varus (20) Valgus (06).

Preoperatively height and weight of the patients recorded. Scoring system formulated by the American knee society used to evaluate the patients before and after surgery. Both knee scores and functional scores calculated with each mounting to a total of 100 points.[9] Preoperative weight bearing radiograph taken to all patients who underwent knee replacement surgery. Radiological grading system [10] as advocated by Kellgren and Lawrence used to evaluate the severity of arthritis and graded from I to IV as follows.

Grade-I: (Doubtful)-Minute osteophytes, doubtful significance

Grade-II: (Mild)-Definite osteophytes, unimpaired joint space

Grade-III: (Moderate)-Moderate diminution of joint space

Grade-IV: (Severe)- Joint space greatly impaired with sclerosis of subchondral bone

All 18 cases were undergone surgery at various periods of time during the study period. Posterior cruciate retained in 14 knees and sacrificed in 12 knees. In retained cases, congruent poly used as insert and in sacrificed cases, ultra congruent poly used.

Standard post-operative protocol followed as advised by the American knee society. Patients discharged after suture removal on the 12th postoperative day. Regular follow up done at 3 weeks, 6 weeks, 12 weeks and then every 6 months. Post operatively patients functional outcome studied using knee society scores.

Statistical Analysis:

Descriptive and inferential statistical analysis has been carried out in the present study. Significance is assessed at 5 % level of significance. Chi-square/ Fisher Exact test has been used to find the significance of study.

III. RESULTS:

A] Age Distribution: The age of the patients who underwent total knee arthroplasty in our series ranged from 47 to 77 years; average was 60.11 years. More than 50% of the patients belong to sixth decade.

B] Height: The range in our series was from 150cms to 174cms. The mean was 158.11cms.

C] Weight: The weight of the patients ranges from 48kgs to 80kgs. The average Weight was 60.03kgs.

D] KNEE SOCIETY SCORE: All patients evaluated by scoring system proposed by The American Knee society. The average preoperative knee society score was 46.73. The average preoperative functional score was 48.46.

		KNEE SCORE	FUNCTIONAL SCORE
	Preoperative	46.73	48.46
Postoperative	Cruciate retained	93.71	85.28
	Cruciate sacrificed	90.83	71.66

Of the 20 patients entered into the study, 18 (26 total knee replacements) patients were available for review. Their mean age was 60 years. Total knee arthroplasty was performed on 18 knees for osteoarthritis and 4 for rheumatoid arthritis and 2 for posttraumatic arthritis. 20 varus and 6 valgus knees .Two patients lost follow-up.

The mean pain score , range of movement , knee score , function score between the cruciate retained and the sacrificed groups shows that mean pain score for the retained group was 48.92 and 47.08 for the sacrificed group.

Group	Mean pain score
Cruciate retained	48.92
Cruciate sacrificed	47.08

The range of movement for the retained group was 105 degrees and 100 degrees in sacrificed group.

Group	Mean of movement
Retained	105 degrees
Sacrificed	100 degrees

Mean knee society score for retained group is 94.07 and 92.08 for Sacrificed group.

Group	Mean knee society score
Retained	94.07
Sacrificed	92.08

Stability assessed in both the antero-posterior and medio-lateral planes. The cruciate retained knees were more stable with 83% (16 cases) having less than 5mm of antero-posterior tibial translation and 100% having less than 5 degree of tibial tilt in medio-lateral plane. 75% (14 cases) of excised group had less than 5mm of tibial translation. This laxity not reflected in medio-lateral planes.

Knee	Normal Antero-posterior stability	Normal Medio-lateral stability
Retained	83%	100%
Sacrificed	75%	100%

IV. DISCUSSION:

Total knee arthroplasty for arthritic patients in whom all the conservative measures are exhausted, is an excellent procedure if proper attention paid to the patient selection. As total knee arthroplasty is a surface replacement within the existing soft tissue sleeve, it functions within normal anatomic and physiologic boundaries. Recent information on the outcome of minimally invasive procedures suggests the reduction of the surgical trauma offers early improvement and faster rehabilitation. This effect levels off after 3 months to a result similar to that in patients who had a standard exposure. This means factors other than the exposure and extensor mechanism violation are involved in the reduced functionality after total knee arthroplasty.

Various factors are associated with the onset and progression of osteoarthritis.[11-17]. These include genetic factors, age, sex, obesity, occupation, abnormal loading of the joint in kneeling, squatting and cross-legged sitting. The mean age of our patients who had osteoarthritis is lesser than the data available from the western population. The earlier onset of osteoarthritis in individuals with normal range of body mass index explained by the habit of kneeling, squatting, cross-

legged sitting practiced by the population in this part of the world.

Out of 18 patients 11 had complete obliteration of joint space at the time of presentation, due to lack of awareness about nature of the disease and about the availability of the various treatment modalities including surgery. Low socioeconomic status and illiteracy may be contributing factors for this.

Retention of posterior cruciate ligament in total knee arthroplasty, advocated as a way to transmit load through the ligament to the tibia, to encourage femoral component rollback to increase flexion, and maintaining the joint line. Retention of posterior cruciate ligament results in a central contact area of the femur on the tibia that helps to distribute load evenly on the tibial component.

In our study flexion and standing view radiographs taken postoperatively for all patients. PCL retained cases exhibits femoral rollback when compared to the PCL sacrificed knees. In 99% of the virgin arthritic knees requiring arthroplasty including rheumatoids posterior cruciate ligament was found to be intact. The intact PCL may have to sacrificed in rare instances. In the knee with severe angular deformity requiring an extensive release on the concave side of the deformity, the intact posterior cruciate ligament can act as a tether and hinder proper balancing of medial and lateral structures. In our experience, this has occurred twice in the last 12 knees. Each knee has presented with angular deformity of 30 degrees and required extensive medial and lateral release.

We have used the scoring system as advocated by the American knee society. According to this system only three main parameters pain, stability, range of motion judged. Flexion contracture, extension lag and misalignment dealt with as deductions. Thus, 100 points given to knee with no pain, 125 degrees of motion and less than 5mm of anteroposterior and 5 degrees of mediolateral instability.

Functional score considers walking distance and stair climbing with deductions for walking aids. The maximum functional score 100 is given to patients who can walk unlimited distance and go up and down stairs normally. Although some advocate retaining the posterior cruciate ligament in all patients and others argue for posterior cruciate ligament sacrifice and substitution in all patients Laksin et al suggest a more appropriate approach in which implant design selection based on an individual's pathologic criteria.

In our study, posterior cruciate ligament sacrifice was done in patients who had severe end stage degenerative arthritis, valgus and varus deformities of more than 25 degrees, where surgical exposure is challenging and balancing soft tissue is difficult.

All 18 patients evaluated preoperatively and postoperatively using knee society score. Statistically no significant differences in the follow-up mean pain score and mean knee society score observed in both the cruciate retained and sacrificed groups. Anteroposterior and mediolateral instability does not show any significant differences in both the groups. Translation of the proximal tibia posteriorly in flexed knee is very well obvious radiologically in sacrificed group indicating posterior cruciate ligament's function as a restraint to translational displacement. Significantly, greater improvement in flexion from preoperative to most recent follow-up assessment seen in patients in the posterior cruciate retaining group compared to the sacrificed group. This is due to femoral roll back defined as the posterior shift of the tibiofemoral contact areas well exhibited radiologically after flexing the knee. In addition, a significantly greater improvement in stair climbing and the mean functional score in cruciate retained arthroplasty groups.

Charles Engh has observed that before any technique is to be adopted or recommended there must be a minimum follow up

of ten years. Ours is a small series with maximum follow up of only two years, we can't draw any conclusion from our findings. But the average age of our total knee arthroplasty patients is less when compared to Western literature, the need of revision will be more. Hence by preserving the posterior cruciate ligament and the bone stock the subsequent revision will be easier.

**Vi. Case Illustration:
Tourniquet**



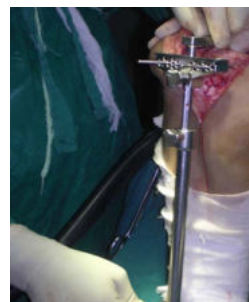
Position



Patella Everted Laterally

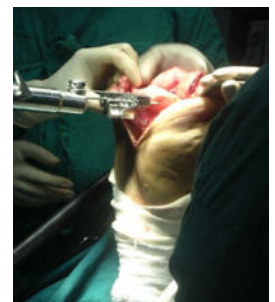


**Extramedullary
Alignment Jig For Tibia**

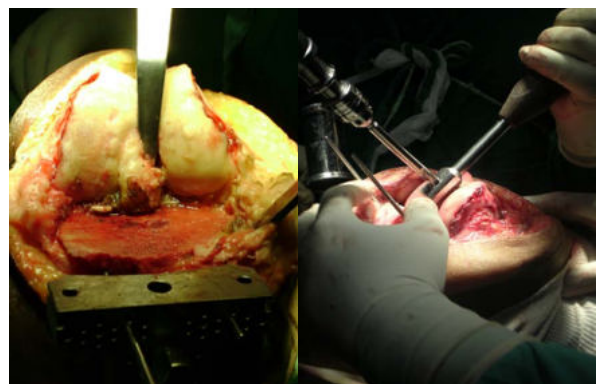


Intact Pcl After Tibial Cut

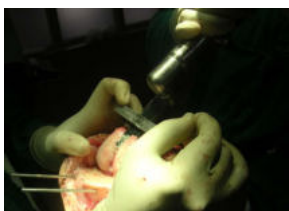
Tibial Cut Made



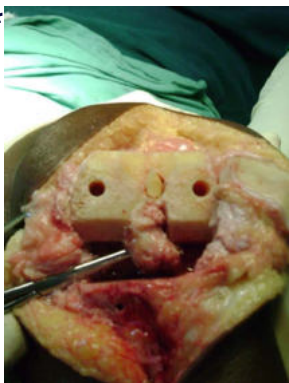
**Intramedullary
Alignment Made For
Femur**



Distal Cut Made



Intact Pcl After



Tibial Implantation After Cementation



Trial Poly In Place



Femoral Implantation After Cementation



Poly Insert



Case (pcl Retained)

Preop Standing



Preop X-ray



Postop Ap View



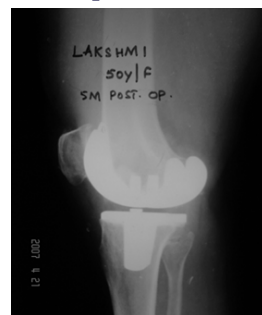
Postop Flexion



Postop Flexion X-ray



Postop Lateral View



Postop SLR



Case (pcl Sacrificed)

Preop Standing



Postop Ap View



Preop X-ray



Postop Lateral View



Postop Flexion



Postop Extension



Postop Slr



Postop Flexion



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V.CONCLUSION:

In our short term analysis of this comparative study good results were obtained in both posterior cruciate retaining Total Knee Arthroplasty and posterior cruciate sacrificing Total Knee Arthroplasty.

However,Posterior cruciate retaining Total Knee Arthroplasty had a marginally better outcome than the posterior cruciate sacrificing Total Knee Arthroplasty but it needs a long term analysis.

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