International Journal of Orthopaedics Sciences

ISSN: 2395-1958

IJOS 2019; 5(2): 155-163

© 2019 IJOS

www.orthopaper.com

Received: 21-02-2019

Accepted: 25-03-2019

Dr. Nadar Raja Chidambaram

Post Graduate, Dept. of
Orthopaedics, Sree Balaji
Medical College and Hospital
BIHER, No.7, CLC Works
Road, Chromepet, Chennai,
Tamil Nadu, India

Dr. Mohd Ismail Irfan

Assistant Professor, Dept. of
Orthopaedics, Sree Balaji
Medical College and Hospital
BIHER, NO.7, CLC Works
Road, Chromepet, Chennai,
Tamil Nadu, India

A comparative study of functional outcome of posterior cruciate retaining versus posterior cruciate sacrificing in primary total knee arthroplasty

Dr. Nadar Raja Chidambaram and Dr. Mohd Ismail Irfan

DOI: <https://doi.org/10.22271/ortho.2019.v5.i2c.29>

Abstract

Total knee arthroplasty for arthritic patients in whom all the conservative measures have been 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 and offers early improvement and faster rehabilitation. This effect levels off after 3 months to a result similar to that in patients who have 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. These include genetic factors, age, sex, obesity, occupation, abnormal loading of the joint in kneeling, squatting and cross-legged sitting.

In 99% of the arthritic knees requiring arthroplasty including rheumatoid, posterior cruciate ligament was found to be intact. The intact PCL may have to sacrificed in rare instances such as in the knees with severe angular deformity requiring an extensive release on the concave side of the deformity, where the intact posterior cruciate ligament can act as a tether and hinder proper balancing of medial and lateral structures.

36 patients were evaluated preoperatively and postoperatively using the knee society score. Translation of the proximal tibia posteriorly in flexed knee is visualised 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 were 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 which are well visualized radiologically after flexing the knee.

Keywords: functional outcome, retaining, knee arthroplasty

1. Introduction

Total knee arthroplasty has evolved over the past decades into a very 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 arthrosis. The success of a total knee replacement is determined by many factors including pain relief, functional outcome, and range of motion, radiographic loosening or component revision^[10].

There have been numerous changes in the total condylar type of total knee arthroplasty during the past 20 years. These modifications include 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 replicated as close as possible. Amongst the several factors affecting the kinematics, variations in surface geometry and the retention or sacrificing the posterior cruciate ligament is considered especially important. Yet, there is no clear evidence of how best to deal with the posterior cruciate ligament at the time of knee replacement surgery. There are four options available to

Correspondence

Dr. Mohd Ismail Irfan

Assistant Professor, Dept. of
Orthopaedics, Sree Balaji
Medical College and Hospital
BIHER, NO.7, CLC Works
Road, Chromepet, Chennai,
Tamil Nadu, India

the surgeon. The first is to retain the ligament and to preserve as much of it as possible for the normal anatomy and function the of knee. Preservation of the ligament is thought to enhance stability, femoral rollback, mechanical advantage of the quadriceps muscle and proprioceptive properties [11, 12, 13]. The second option is to excise the ligament in order to facilitate the correction of any fixed deformities 14. This allows more accurate and reliable soft tissue balancing resulting in improved fixation of the components.

The third option is to substitute the ligament with a posterior stabilized tibial insert. These inserts have a central post, which can engage on a femoral cam during flexion, mimic femoral rollback and reproduce near normal kinematic profiles [15]. The central post may also allow some stability in the anteroposterior plane and act as a secondary stabilizer to a varus or valgus stress [16, 18].

The fourth option is to release the ligament; this offers a compromise between preservation and excision [17].

2. Aim and Objectives

The aim of the study is to “A Comparative Study of Functional outcome of posterior cruciate retaining versus posterior cruciate sacrificing in primary total knee arthroplasty” at the department of orthopaedics, Sree Balaji Medical College, Chennai between January 2017 and January 2019.

3. Materials and Methods

3.1 Inclusion Criteria

This is a prospective study, done in Sree Balaji Medical College from January 2017 and January 2019. Who have undergone total knee arthroplasty for various indications, which includes varus as well as valgus knee.

During this study period 52 knees were replaced in 36 patients. All patients were followed at 3weeks, 6weeks, 12weeks, thereafter every 6 months.

3.2 Exclusion Criteria

Patients who did not turn up for follow-up and patients who had prior patellectomy were excluded.

3.3 Age Group

Range 47years to 77years
Mean 60.11 years

Table 1: Sex Ratio

Total	36
Male	06
Female	30

Table 2: Indication

Disease	Number
Osteoarthritis	36
Rheumatoid arthritis	12
Posttraumatic arthritis	04

Table 3: Side

Side	Number
Right	10
Left	10
Bilateral	16

Table 4: Type of Deformity

Deformity	Number
Varus	40
Valgus	12

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 [19].

Preoperative weight bearing radiograph taken to all patients who underwent knee replacement surgery. Radiological grading system 20 as advocated by Kellegren and Lawrence used to evaluate the severity of arthritis and graded from I to IV as follows.

Table 5: KL Grading

Grade		Definition
I	Doubtful	Minute osteophytes, doubtful significance
II	Mild	Definite osteophytes, unimpaired joint space
III	Moderate	Moderate diminution of joint space
IV	Severe	Joint space greatly impaired with sclerosis of subchondral bone

The severity of the arthritis was assessed with the Kellegren and Lawrence scoring system which revealed that 61% (n=32) of our patient had grade IV arthritis at presentation.

Fig 1: Kellegren and Lawrence Grading

All 36 cases were performed by same group surgeons at various periods of time during the study period. Tourniquet was routinely used in all cases. Posterior cruciate was retained in 28 knees and sacrificed in 24 knees. In retained cases, congruent poly used as insert and in sacrificed cases, ultra-congruent poly was used.

Table 6: Implant type

Implant design	Number
Congruent poly insert	28
Ultra congruent poly insert	24

DVT prophylaxis was given to all of our patients as per protocol.

Postoperative protocol as in American knee society. Patients discharged after suture removal on the 12th postoperative day. Follow up done at 2 weeks, 6weeks, 12weeks and then every 6months. Post operatively patients functional outcome was studied using knee society scores.

4. Results

4.1 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.

Fig 2: Age distribution

4.2 Height

The range in our series was from 150cms to 174cms. The mean was 158.11cms.

4.3 Weight

The weight of the patients ranges from 48kgs to 80kgs. The average weight was 60.03kgs.

4.4 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.

Table 7: Knee society score

		Knee Score	Functional Score
Preoperative		46.73	48.46
Post operative	Cruciate retained	93.71	85.28
	Cruciate sacrificed	90.83	71.66

Fig. 3: Knee society score

Of the 40 patients entered into the study, 36 (52 total knee replacements) patients were available for review. Their mean age was 60 years. Total knee arthroplasty was performed on 36 knees for osteoarthritis and 8 for rheumatoid arthritis and 4 for posttraumatic arthritis. 40 varus and 12 valgus knees. Two patients did not return for 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.

Table 8: Mean pain score

Group	Group
Cruciate retained	48.92
Cruciate retained	47.08

Fig 4: Mean pain score

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

Table 9: Mean of movement

Group	Mean of movement
Retained	105 degrees
Sacrificed	100 degrees

Fig 5: Mean of movement

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

Table 10: Mean knee society score

Group	Mean knee society score
Retained	93.71
Sacrificed	90.83

Stability assessed in both the anteroposterior and mediolateral planes. The cruciate retained knees were more stable with 83% (32 cases) having less than 5mm of anteroposterior tibial translation and 100% having less than 5 degree of tibial tilt in mediolateral plane. 75% (28 cases) of excised group had less than 5mm of tibial translation. This laxity was not reflected in mediolateral planes.

Table 11: Stability

Knee	Normal anteroposterior stability	Normal mediolateral stability
Retained	83%	100%
Sacrificed	75%	100%

Fig 6: Antero-posterior stability

The walking distance between the sacrificed and retained group did not show any significant difference, but stair climbing and functional score favoured cruciate retaining knee arthroplasty.

Table 12: Functional scoring

Group	Walking distance	Stair climbing score	Function score
Retained	36.42	42.5	85.28
Sacrificed	36.66	34.16	71.66

Fig 7: Stair climbing score

5. Procedure

Fig 8: Tourniquet

Fig. 9: Position

Fig 10: Patella everted laterally

Fig 11: Extramedullary alignment jig for tibia

Fig 12: Tibial cut made

Fig 12: Intact Pcl after Tibial Cut

Fig 13: Intramedullary alignment made for femur

Fig 14: Distal cut made

Fig. 15: Intact Pcl after Femoral and Tibial Cuts

Fig 16: Tibial implantation after Cementation

Fig 17: Femoral implantation after Cementation

Fig 18: Trial poly in place

Fig 19: Poly Insert

6. Case Illustrations

Case 1: PCL Retained

Fig 20: Pre-op standing photo

Fig 21: Pre-op X-ray (AP, Lateral)

Fig 22: Pre-op full length X-ray

Fig 23: Post-op X-ray (AP, Lateral)

Fig 24: Post-op standing photo

Case 2: PCL Sacrificing

Fig 25: Pre-op clinical photo

Fig 26: Pre-op full length X-ray

Fig 27: Operative picture

Fig 28: Post- operative X-ray

Fig 29: Post-operative standing photo.

7. Discussion

Total knee arthroplasty for arthritic patients in whom all the conservative measures have been 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. Impaired functionality after total knee arthroplasty is attributed to sequelae of the arthritic disease, the surgical trauma and the design of the prosthesis. Recent information on the outcome of minimally invasive procedures suggests the reduction of the surgical trauma and offers early improvement and faster rehabilitation. This effect levels off after 3 months to a result similar to that in patients who have 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 [1-6]. These include genetic factors, age, sex, obesity, occupation, abnormal loading of the joint in kneeling, squatting and cross-legged sitting.

Out of 36 patients 22 had complete obliteration of joint space at the time of presentation.

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 and to increase flexion, and to assist in maintaining the joint proprioception. 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 exhibited better femoral rollback when compared to the PCL sacrificed knees.

In 99% of the arthritic knees requiring arthroplasty including rheumatoid, posterior cruciate ligament was found to be intact. 7 The intact PCL may have to sacrificed in rare instances such as in the knees with severe angular deformity requiring an extensive release on the concave side of the deformity, where the intact posterior cruciate ligament can act as a tether and hinder proper balancing of medial and lateral structures.8 In our experience, this has occurred twice in 24 knees encountered. Each knee has presented with an 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 i.e.pain, stability, range of motion judged.

Flexion contracture, extensor lag and misalignment are dealt with as deductions. Thus, 100 points are given to a 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 reasonably 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. 36 patients were evaluated preoperatively and postoperatively using the knee society score. Statistically no

significant differences in the follow-up mean pain score and mean knee society score was observed in both the cruciate retained and sacrificed groups. Anteroposterior and mediolateral instability did not show any significant differences in both the groups. Translation of the proximal tibia posteriorly in flexed knee is visualised 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 were 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 which are well visualised radiologically after flexing the knee. In addition, a significantly greater improvement in stair climbing and the mean functional score was observed in the 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. 9 Ours is a small series with maximum follow up of only two years, we cannot draw any conclusion from our findings in order to advocate the superiority of our technique over the other.

In general the average age of our total knee arthroplasty patients is less when compared to Western literature and hence the need of revision will be more. Hence by preserving the posterior cruciate ligament and the bonestock the subsequent revision will be technically easier.

8. Conclusion

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

However, the Posterior cruciate retaining Total Knee Arthroplasty cases had a marginally better outcome than the posterior cruciate sacrificing Total Knee Arthroplasty with regards to proprioception, kinematics and were able to handle stair climbing with greater ease.

9. References

- Jensen LK, Eenberg W. occupation as a risk factor for knee disorders. Scand J Work Environ Health. 1996; 22(3):165-75.
- Coggon D, Croft P, Kellingray S, Barrett D, McLaren M, Cooper C. occupational physical activities and osteoarthritis of the knee. Arthritis Rheum. 2000; 43(7):1443-9.
- Jensen LK. Knee-straining work activities, self reported knee disorders and radiographically determined knee oarthritis. Scand J Work Environ Health. 2005; 31(2):68-74.
- Manninen P, Heliovaara M, Riihimaki H, Suoma-Iainen O. physical work load and the risk of severe knee osteoarthritis. Scand J Work Environ Health. 2002; 28(1):25-32.
- Kuster M, Wood GA, Sakurai S, Blatter G. stress on the biomechanical femoral patellar joint in downhill walking a biomechanical study. Unfallchir Versicherungsmed. 1993; 86(3):178-83.
- Kujala UM, Kettunen J, Paananen H, Aalto T, Battie MC, Impivaara O *et al.* knee osteoarthritis in former runners, soccer players, weight lifters, and shooters. Arthritis Rheum. 1995; 38(4):539-46.
- Scott RD. Duo Patellar total knee replacement: The Brigham experience. Orthop. Clin. North Am. 1982; 13:17.
- Richard Scott D, Thomas Volatile B. Twelve years' experience with posterior cruciate – retaining total knee arthroplasty. ClinOrthop, 1986, 205.
- THR in patients 50 years and younger. James P. McAuley, Edward S, Szuszczewicz, Anthony Young MSE and Charles A, Engh. Sr. Corr. No.418, 2004, 119-125.
- Merrill Ritter A, Michael Berend E, John Meding B, Brain Crites M. Long term followup of anatomic graduated components posterior cruciate retaining total knee replacement. ClinOrthop. 2001; 388:51-57.
- Scott RD, Volatile TB. Twelve years' experience with posterior retaining total knee arthroplasty. ClinOrthop. 1986; 205:100-7.
- Insall JN. Presidential address to the knee society. Choices and compromises in total knee arthroplasty. ClinOrthop. 1998; 226:43-8.
- Kleinert FA, Bryk E, Evangelista J, Scott WN, Vigorita VJ. Histological comparison of posterior cruciate ligaments from arthritic and age matched knee specimens. J Arthroplasty. 1996; 11:726-31.
- Freeman MAR, Insall N, Besser W, Walker PS, Hallel T. Excision of the cruciate ligaments in total knee replacement. ClinOrthop. 1977; 126:209-12.
- Matuda S, Whiteside LA, White SE, McCarthy DS. Knee kinematics of posterior cruciate ligament sacrificed total knee arthroplasty. ClinOrthop. 1997; 341:257-66.
- Dennis DA, Komistek RD, Hoff WA, Gabriel SM. *In vivo* knee kinematics derived using an inverse perspective technique. ClinOrthop. 1996; 331:107-17.
- Scott RD, Thornhill TS. Posterior cruciate supplementing total knee replacement using conforming inserts and cruciate recession; effect on range of motion and radiolucent lines. ClinOrthop. 1994; 309:146-9.
- Straw R, Kulkarni S, Attfield S, Wilton TJ. Posterior cruciate ligament at total knee replacement J Bone Joint Surg. 2003; 85-B:671-4.
- John Insall N, Lawrence Dorr D, Richard Scott D, Norman Scott W. Rationale of the knee society clinical rating system. ClinOrthop. 1989; (248):13-14.
- Kellgren JH, Lawrence JS. Radiological assessment of osteoarthritis. Ann Rheum Dis. 1957; 16:494-502.