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Dr. M Devendra
Sanjay Gandhi Institute of
Trauma & Orthopaedics,
Bangalore, Karnataka, India

Dr. Shekar M
Sanjay Gandhi Institute of
Trauma & Orthopaedics,
Bangalore, Karnataka, India

Dr. HS Chandrashekar
Sanjay Gandhi Institute of
Trauma & Orthopaedics,
Bangalore, Karnataka, India

Functional outcome following total knee replacement using posterior cruciate retaining implants

Dr. M Devendra, Dr. Shekar M and Dr. HS Chandrashekar

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Abstract

Twenty-eight total knee replacement (TKR) surgeries were performed using cruciate retaining implants at Sanjay Gandhi institute of trauma and orthopedics from October 2016 to October 2018. All patients were evaluated pre-operatively & post-operatively with knee society clinical, functional score. Average pre-operative knee society clinical score was 47.1 & functional score was 34.32. Main indication for T.K.R was osteoarthritis. Follow up period ranged from 6 months to 2 years.

96.5% of our patients scored 80 points or better for a rating of excellent by knee society clinical, functional score system. The mean post-operative knee society clinical score was 91.6, knee society functional score was 89.28. 90% patients had little/no pain post operatively, whereas walking ability similarly improved & was unlimited in 85% of the patients postoperatively. Average alignment of prosthesis was 4.9 degrees valgus. No radiolucency's about the tibial component & femoral component were found at the end of 2 years of follow up. No evidence of

D.V.T /pulmonary embolism. Post-operative complications included knee stiffness in 2 post op cases, extensor lag in 2 cases, post-operative surgical site infection in 2 post-operative case and persistent fixed flexion and varus deformity in 1 case. 96.5% of the patients had excellent results (knee score of >80) 3.6% of the patients had good (knee score between 60 to 80) results.

T.K.R provided pain relief, adequate stability, and measurable change in the range of motion in severely painful, refractory unstable knees. Total knee arthroplasty has in the past 4 decades revolutionized the treatment of primary osteoarthritic and secondary osteoarthritic knees.

With these excellent results we conclude that cruciate retaining total knee arthroplasty provided measurable pain relief, adequate stability, remarkable range of motion in severely painful knees refractory to conservative management. If performed taking into consideration proper selection of patients, meticulous attention to surgical technique and asepsis, Intra-operative soft tissue balancing, correct alignment of prosthesis and postoperative rehabilitation of patients, cruciate retaining total knee replacement has yielded excellent results.

By this we can conclude that cruciate retaining total knee replacement is an established effective surgery in the treatment of osteoarthritic knees.

Keywords: knee replacement, posterior cruciate retaining implants

Introduction

Total knee arthroplasty, or surgical replacement of the knee joint with an artificial prosthesis is a reconstructive procedure that has improved the management of knee arthritis patients who have responded poorly to conventional medical therapy. Primary symptomatic osteoarthritis occurs in 10-13% of the adult population over the age of 60years or older ^[1]. The number is only expected to increase due to the aging population and obesity epidemic. Old age, female gender, obesity, knee injury, repetitive use of the joints, decreased bone mineral density, muscle weakness and joint laxity all play roles in the development in the development of osteoarthritis. Total knee replacement is an established procedure in the definitive treatment of osteoarthritis of the knee joint. Total knee replacement in osteoarthritis reduces stiffness and pain and may enhance motion and provides stability.

Survivorship of cemented TKA ranges from 91%-99% over 10 years and 91%-96% over 15 years. Many authors have now reported long-term survivorships of well over 75% at 15- to 20-year follow-up. ^[1]

Correspondence
Dr. M Devendra
Sanjay Gandhi Institute of
Trauma & Orthopaedics,
Bangalore, Karnataka, India

The most common condition for which total knee arthroplasty is done is severe osteoarthritis of knee, others include rheumatoid arthritis, inflammatory arthritis, post traumatic secondary osteoarthritis, hemophilic arthritis, arthritis due to chondrocalcinosis & pseudogout. [2]

Since the concurrent development of PCL-retaining and PCL-substituting prostheses, the relative merits of each design have been debated. Each design has multiple series with comparable excellent 10- to 15-year results. In multiple studies comparing PCL-retaining and PCL-substituting prostheses, the average flexion attained, knee society scores, subjective performance or patient satisfaction at long-term follow-up has been similar. The main role of posterior cruciate ligament was to allow femoral rollback that occurs with knee flexion theoretically this should allow increased knee flexion. Proprioception is also better after cruciate retaining total knee replacement. [3].

PCL can be retained and carefully balanced to reproduce the normal femoral rollback or can be sacrificed. Posterior glide and roll of the femorotibial contact region with flexion is influenced by the PCL. Isolated removal of the PCL increases the flexion gap. While it may be attractive in gaining surgical access and subsequent flexion, PCL sacrifice encourages posterior tibial subluxation. [4]

The advantages for retaining the PCL during TKA include-

1. Improved stability, maintenance of normal knee kinematics.
2. Reduced shear stresses at the fixation interface.
3. Improved proprioception and more efficient gait patterns during level walking and stair climbing.
4. Less bone resection, the loads are transferred to the

central ligamentous structure than a mechanical one.

The most commonly cited reasons for retaining the PCL is to preserve femoral rollback, which improves the range of flexion. [5]

The majority of the studies conducted in India and throughout the world on cruciate retaining total knee arthroplasty are comparative studies comparing it with posterior stabilized type of arthroplasty. We intend to do a study in our setup on the functional outcome of cruciate ligament retention in total knee arthroplasty and compare our result with existing studies.

Aims and Objectives

The main aim of our study was to assess functional outcome following total knee replacement using cruciate retaining implants and also to compare our study with existing studies.

Material and Methods

This is a prospective study of 28 total knee replacements from 27 patients operated between November 2016 to May 2018 at our institute. Patients suffering from grade 3 and grade 4 osteoarthritis were included and patients with inflammatory arthritis and severe deformity were excluded.

The age of the patient varied from 50 to 78 years, average being 64 years. There were 11 females and 17 male patients, most were leading sedentary workers. All the patients were evaluated preoperatively with relevant investigations and underwent surgery with standard technique.

Radiographic evaluation of post-op x-ray was done by knee society roentgenographic scoring system. CT scanogram were used to evaluate the preoperative varus or valgus deformity

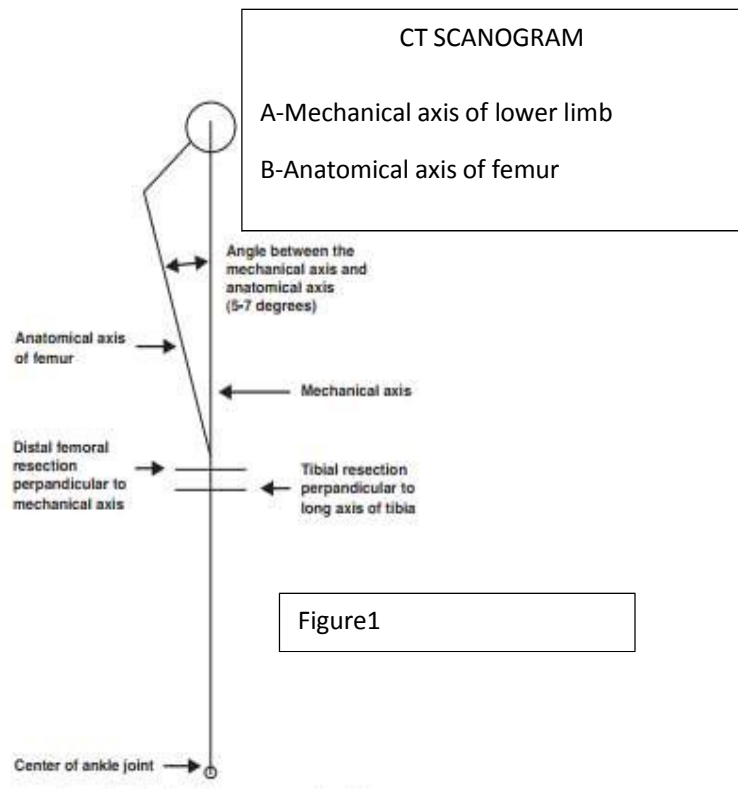
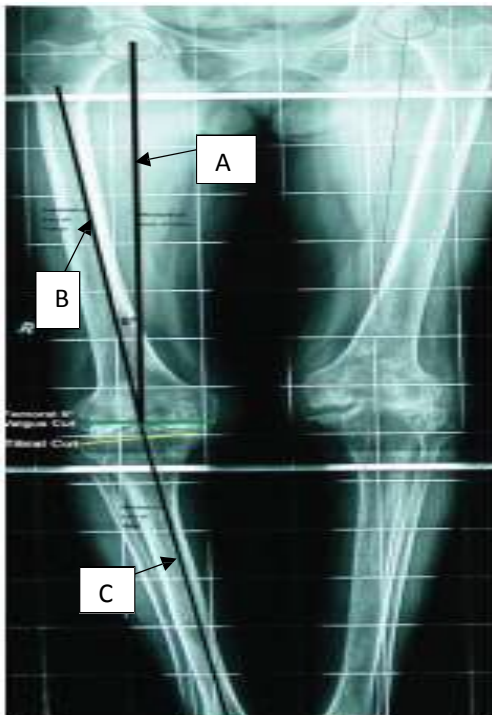


Figure1

All the patients were followed up in OPD at 6 weeks, 3 months and 6 months post-operative periods.

Results

Table 1: Hospital stay in days of the patient studied.

Hospital stay (days)	Percentage
<10 days	25%
11-12	42.85%
13-14	25%
15-16	7.142%
>16	Nil
Total	100%

Table 2: Knee society clinical score of patients studied

Knee Society Clinical Score	Pre-Operative (%)	Post- Operative (%)	Percentage Change
<60	89.5	0	89.5
60-69	3.5	0	3.5
70-79	7.0	3.5	3.5
80-100	0	96.4	96.4
TOTAL	100	100	-

Table 3: Knee society functional score of patients studied-

Knee society functional score	Pre -op (%)	Post-op (%)	Percentage change
<60	100	0	100
60-69	0	0	0
70-79	0	3.5	3.5
80-100	0	97.5	97.5
total	100		

The average preoperative knee society clinical score was 47.1 which improved to 91.67. The average pre-operative knee society functional score was 31.32 which improved post operatively to 89.28. Knee society score of 80 to 100 represented excellent result, score of 79-80 is good, 60-69 fair score, score <60 is poor [6]. 27 knees (97.5%) were rated excellent, 1 knee (3.5%) as good. There were no fair or poor results.

Pre-operatively all patients had moderate to severe pain. Postoperatively 60% patients had mild pain at 3 weeks. At 6 weeks post operatively only 10% patients had mild discomfort.

With knee society clinical rating system, a knee scoring of 80 or more points were close to normal, considering factors such as age and the general state of the patient’s health. Thus, knees with an excellent rating were painless, stable with at least 90 degrees of flexion and did not limit the patient’s activity.

There was one patient with post-operative infection to operated knee. We did debridement of the affected knee. Later patient has developed knee Stiffness and mild pain during walking.

Complications like deep vein thrombosis were absent due to thromboprophylaxis for at least one week postoperatively. Other complications like infection, vascular injuries skin

necrosis, thromboembolism, fat embolism, joint instability, patellar fractures were absent.

Table 4: Complications of patients studied

Complications	% (No. of patients)
No	82.14(25)
Yes	17.85(5)
Post op extension lag-10 degrees	7.2(2)
Post op infection	7.2(2)
Post op knee stiffness	7.2(2)
Post -op persistent deformity	3.57(1)

In 82.14% (23) of patients no post-operative complications were seen.

Among the remaining 17.85% (5) patients 7.2% (2) had post-operative extensor lag, 7.2% (2) had post-operative superficial infection. 7.2% (2) had post-operative stiffness. 3.5% (1) patient had persistent F.F.D of 10° & persistent varus deformity of 10°.

Table 5: Functional outcome (Results) of patients studied

Result	%
Fair	0
Good	3.6
Excellent	96.4
Total	100

Radiological Analysis

Radiologically in anteroposterior view, the tibial implant and bone interface and femoral implant and bone interfaces were assessed for the presence of either radiolucent areas & lines of reactive sclerotic bone of both. Femoral and tibial angles were measured [7, 8, 9].

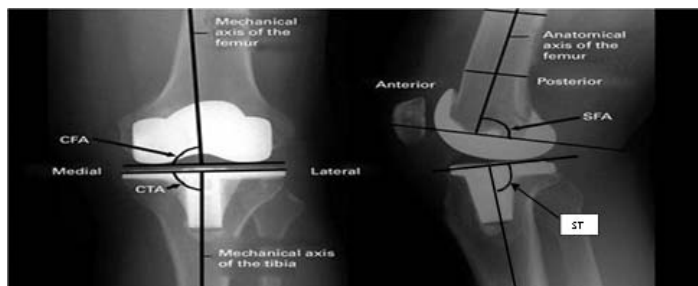


Fig 2

In the lateral view, femoral flexion, tibial angle, femoral component bone interface and patellar interface was assessed. Till the last follow up there were no radiolucent lines present beneath both tibial and femoral component.

Long term complications, like implant failure, loosening, polyethylene wear was absent because of short duration of the study.

Maximum varus deformity correction was 150, fixed flexion deformity being corrected was 150. There was no instability of knee in any of the cases postoperatively. Two patients underwent medial collateral ligament repair for which the knee was immobilized. The overall average alignment of the knee postoperatively was 4.90 valgus.

On radiological assessment, overall alignment averaged 4.90 valgus, mean femoral angle was 950 and mean tibial angle 900. Mean femoral flexion was 120 mean lateral tibial angle 87.50.

This study reveals 96.5% excellent, 3.5% good results. There were no poor results. Pre-operative mean clinical score was 47.1 which improved post operatively to 91.6 Total pain, range of motion, stability score. (Clinical score)

Table 6

Study	Pre-op mean	Postop mean
Our study	47.1	91.6
Fitch, Sedacki K, Yang Y(2014) ^[10]	46	84
Richard D. Scott (2006) ^[11]	48	86
Martin <i>et al.</i> (1997)	51	89
Callahan C.M <i>et al</i> J arthroplasty (1995) ^[12]	40	80
Christopher (1994) (JAMA) ^[13]	45	89
Krray <i>et al.</i> (1991)	32	93
Rand (1991) ^[14]	32	84
Rosenberg <i>et al.</i> (1991)	36	90

This study reveals 96.5% excellent, 3.5% good results. There were no poor results. Pre-operative mean clinical score was 47.1 which improved post operatively to 91.6 Total pain, range of motion, stability score. (Clinical score) Total mean functional score (knee society functional score) preoperatively it was 34.32 which improved to 89.28 post-operative.

Table-7

Study	Pre-op mean	Postop mean
Our study	34.32	89.28
Fitch, SedackiK, Yang Y (2014) ^[10]	48	89
Richard D.Scott (2006) ^[11]	44	82
Martin <i>et al.</i> (1997)	49	72
Cllahanetal J.arthroplasty 1995 ^[12]	38	89
Christopher(1994)(JAMA) ^[13]	42	88
Krray <i>et al</i> (1991)	47	79
Rand (1991) ^[14]	49	86

Discussion

Cruciate retaining TKR was the dominant modality in the early 1980s with upto 85% of the TKR surgeries being done. In the recent years there has been a gradual decline in the cruciate retaining TKR due to steeper learning curve of the surgery, unsuitability for correcting severe deformities and inflammatory arthritis. Posterior stabilized total knee replacement is on the rise as it has equally good outcomes on long term follow up studies and is less technically demanding. However, there are many advantages of retaining the cruciate ligament quoted in literature which include ^[5].

1. Improved stability, maintenance of normal knee

kinematics.

2. Reduced shear stresses at the fixation interface.
3. Improved proprioception and more efficient gait patterns during level walking and stair climbing.
4. Less bone resection.
5. The most commonly cited reasons for retaining the PCL is to preserve femoral rollback, which theoretically improves the range of flexion.

Cruciate retention in TKR had overall excellent outcome in our study. This impression is further documented by the fact that 96.5% of our patients scored 80 points or better for a rating of excellent by knee society scoring system. All of the patients in our study were of primary osteoarthritis. All the patients in our study were above 50 years maximum age of the patient being 79. Majority of our patients were farmers or retired employees or housewives.

In our study mean preoperative pain score was 14.9 and mean postoperative pain score was 46.5 which showed a significant improvement. Similar improvements in pain score from 14.1 to 49.3 and 6.9 to 42.6 has been previously reported with TKA ^[15].

Preoperatively none of the patients could walk for more than 10 blocks, in the postoperative period 80% of the patients could walk an unlimited distance. Similar improvements were seen in a study conducted by Dorr *et al* in 1998. ^[16]

The average range of motion in our study preoperatively was 90.5 degrees of flexion which increased to 115.5 degrees postoperatively with an improvement of 25 degrees. Similar benefits were reported in most of the previous studies. ^[17-21] except for study by kolisek *et al.* ^[22].

In the study one knee had a F.F.D of 20o. 4 knees had F.F.D of 10-20 degrees and 22 knees had F.F.D of <10°. Post-operatively 27 patients had no F.F.D. Only one patient had F.F.D of 10°. similar outcomes were seen in studies done by Wang *et al* and Hanusch *et al.* ^[17-21]

Preoperatively there were 3 knees with varus deformity of 15to20 degrees, 14 knees with varus deformity of 5 to 15 degrees and 7 knees with varus deformity of 0 to 5 degrees and 4 knees with 0 to 10 degrees of valgus deformity. In the post-operative period one knee had a varus deformity of 10o.Remaining knees had valgus between 0 to 10 degrees with an average of 4.9°.

Wang *et al* showed average alignment of 7.6 in 146 knees and average valgus alignment of 12.2 in 11 knees preoperatively was reduced to valgus alignment was 6.9 degrees postoperatively ^[19]. Ideal alignment has been found to between 50-100 of valgus by Insall and Burstein *et al* in their study in 1978 ^[23, 24].

Postoperatively 2 patients had extensor lag of 10 and 20 degrees which improved with physiotherapy over a span of 2 months.

In our study average knee clinical score was preoperatively 47.1 which improved 91.6 in the postoperative period. Postoperatively 29 knees had a score of 80 and above which can be quantified as excellent result. These results are comparable with the most of the previous studies where they also indicated a significant improvement in knee score following cruciate retaining TKA ^[19, 20, 21].

In our study mean preoperative functional score was 34.2 which improved 89.28 in the postoperative period. These results are comparable with previous studies which also showed a significant improvement in function score with TKA ^[25].

In comparison to studies conducted by other authors like Krray *et al* Rand, Rosenberg, Bergman *et al*, Christopher,

Callahan *et al*, Martin, Richard Fitch *et al*, we have got comparatively same results, as both knee society clinical and functional score improve from 47.1 to 91.6 and 34.32 to 89.28 respectively.

There were no radiolucencies about the tibial component and femoral component at the end of two years follow up.

In this study we started LMWH i.e. Injection clexane 40 mg subcutaneously post operatively and as a result out of 28 knees, there were no evidence of DVT or PE in a single patient.

We had no patient with injury to peroneal nerve, after correction of flexion deformity of knee. We had no patient with peri-prosthetic supracondylar fracture of femur or tibia. We had 2 patients of superficial surgical site infection which was conservatively managed with parenteral followed by oral antibiotics, one patient required debridement but both would healed over a span of 2 weeks.

Conclusion

Total knee arthroplasty has in the past four decades revolutionized the treatment of osteoarthritic knees. Cruciate retaining design has had excellent long-term outcomes as proved by many existing studies.

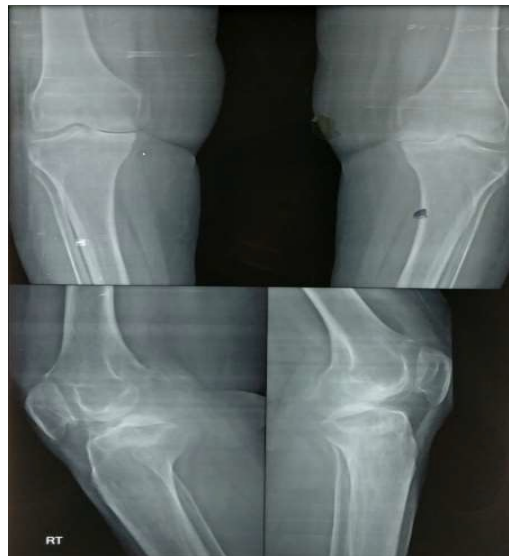
Case Illustration 1-

With the excellent results of our present study we conclude that cruciate retaining total knee arthroplasty provided total relief of pain, adequate stability, remarkable range of motion in all OA knees.

In the short-term study conducted at our institution all the patients operated with cruciate retaining design had good to excellent results. At end of 2 year follow up none of the patients developed any radiological lucencies and required revision surgery. Knee replacement proved to be a cost-effective measure in the long run.

Total knee arthroplasty is a relative safe and sure procedure in the hands of the experienced. It forms the integrals part of the general orthopedic set up. We conclude that if performed taking into consideration proper pre-operation selection of patients, intra operative soft tissue balancing, correct overall alignment of prosthesis, strict adherence to aseptic protocol and proper postoperative proper rehabilitation of patients the cruciate retaining knee arthroplasty will deliver excellent results.

Longer study period is required for determining the long term outcome of cruciate retaining TKR.



Pre-op x-ray with grade 4 OA knee in both knee with varus deformity.
Patient was operated on the left knee first.



Postoperative AP and lateral x ray of left knee.

Patient was operated on the right knee 1 month later



Post-operative x-ray of right knee



At 6 months post-operative period

Case Illustration-2



Preoperative x-ray of both knees AP and lateral.

Pre-operative scanogram



Patient operated on left knee first

postoperative scanogram of the patient



Post-operative x-ray of right knee

Post-operative knee scanogram



At 6 Months Follow Up

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