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**Dr. Sriphani kumar K**  
Assistant Professor, Department  
of Orthopedics, Pinnamaneni  
Siddhartha Institute of Medical  
Sciences and Research  
Foundation, Chinna Avutapalli,  
Vijayawada, Andhra Pradesh,  
India

**Dr. Srikanth SCV**  
Assistant Professor, Department  
of Orthopedics, Pinnamaneni  
Siddhartha Institute of Medical  
Sciences and Research  
Foundation, Chinna Avutapalli,  
Vijayawada, Andhra Pradesh,  
India

**Dr. Sreenivasa Chowdary J**  
Consultant Radiologist in  
American Oncology Institute,  
Kanuru, Vijayawada, Andhra  
Pradesh, India

## Study of functional outcome in total knee arthroplasty in primary osteoarthritis patients with varus deformity in department of orthopedics at PSIMS and RF

**Dr. Sriphani kumar K, Dr. Srikanth SCV and Dr. Sreenivasa Chowdary J**

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### Abstract

**Background and Objectives:** To study the functional outcome following total knee replacement in primary osteoarthritis patients with varus deformity.

**Method:** In our study, we had analysed the functional outcome of patients with chronic osteoarthritis of knee between the ages of 50-76 and had undergone total knee replacement in Dr PSIMS & RF, Chinnaoutpalli. Out of 26 patients who had undergone knee replacement 15 were female patients and 11 were males. We had evaluated the functional outcome using American knee society score and documented the complications.

**Results:** In our study, 58% of the patients comprised of females and 42% of males. In this study 57% of patients of patients had excellent results, 33% of patients had good results, 10% of patients had fair results. Relief of pain was excellent in most patients: 86% had no pain or very mild pain postoperatively. The average post- op anatomical alignment of tibiofemoral angle was found to be 4.1° valgus on radiographic evaluation.

**Conclusion:** In our study, we found that total knee replacement in symptomatic primary osteoarthritis is a very effective procedure in management of pain and in regaining good range of movements. We also conclude that American Knee Society Score is a very useful tool to assess the outcome of the surgery. In our series, cemented total knee arthroplasty has demonstrated well to excellent results. Further follow-up studies are required to see if this performance is maintained in the long term results.

**Keywords:** Osteoarthritis (OA), varus deformity, total knee replacement (TKR), total knee arthroplasty (TKA).

### Introduction

Degenerative primary osteoarthritis of knee is a common affliction in our Indian population causing a great amount of hardship and suffering for patients. It has major functional, medical, psychosocial and financial effects on the affected person, family and society. Management of severe degenerative arthritis by conservative methods yields poor results. Degenerative arthritis is not a static condition hence with conservative treatment we cannot stall the process of degeneration.

Degenerative arthritis causes pain, functional restriction, and deformities. Knee replacement provides a way to overcome all afflictions of arthritis. Knee replacements is one of the most successful orthopedic surgery with immense patient satisfaction. In the modern era of orthopedic surgery, replacements constitute a major modality of providing source to patients with arthritis. In the past several techniques were used for the management of an arthritic knee with unsatisfactory results. The methods consisted of analgesics, heat, physiotherapy, osteotomies, arthrodesis all produce suboptimal results of all the methods replacements gives the best results consistently and reproducibly. With replacement the patients pain is relieved, functional mobility is obtained, if any preexisting deformity is present can be corrected.

Varus deformity is a common finding in candidates for total knee arthroplasty (TKA), but very little has been written concerning the problems encountered in correcting these deformities at the time of arthroplasty [1] Compared to patients without deformities, this group of patients require more attention to the technical aspects of the arthroplasty, especially bony alignment and ligament balancing.

**Corresponding Author:**  
**Dr. Srikanth SCV**  
Assistant Professor, Department  
of Orthopedics, Pinnamaneni  
Siddhartha Institute of Medical  
Sciences and Research  
Foundation, Chinna Avutapalli,  
Vijayawada, Andhra Pradesh,  
India

Specific operative techniques used to correct severe varus deformities at primary TKA were evaluated, and the clinical and roentgenographic results were compared with those of a control group of patients without preoperative angular deformity.

### Aims and Objectives

1. To assess the improvement in
2. Pain relief post-operatively
3. Stability and mobility of the joint
4. To assess the correction of deformities

### To assess the complications associated with Total Knee Replacement

#### Materials and Methods

This observational study was carried out from June 2017 to November 2019 in patients admitted with primary osteoarthritis of knee with varus deformity arthritis in the Department of Orthopedics, Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Chinnaoutpalli. 30 cases according to the inclusion criteria were taken up for the study. Patients and their relatives will be explained the condition, informed consent obtained and all details of the patients will be collected in a proforma.

Following discharge, regular follow up will be done on outpatient department for a period of 6 months.

#### Methods of collecting data

##### By interview

By follow up at intervals 1st, 3rd, 6th months postoperatively. The cases at follow up will be analysed both clinically and radio logically and proforma will be filled.

The results of surgical procedure will be analysed on the basis of Knee Society Score. Patients will be mainly assessed for

#### Knee pain

1. Total range of movement
2. Varus and Valgus alignments
3. Stability antero-posteriorly and medio-laterally
4. Functionally for
5. Walking
6. Climbing stairs
7. Walking aids used

#### Inclusion criteria

1. Patients aged above 50 years including both sexes.
2. Patients with Primary osteoarthritis with varus deformity
3. Patients medically fit for surgery and willing to give consent for surgery

#### Exclusion criteria:

1. Patients below the age of 50 years
2. Patients with secondary osteoarthritis.
3. Patients having long bone fractures in ipsilateral lower limbs
4. Patients with valgus deformity of knee
5. Patients with local sepsis of the knee joint
6. Patients who are medically unfit for anesthesia

#### Evaluating the results

Patients will be assessed by knee society score

#### American Knee Society Score <sup>[2-4]</sup>

##### Patient Category

- a. Unilateral or bilateral (opposite knee successfully

replaced)

- b. Unilateral, other knee symptomatic
- c. Multiple arthritis or medical infirmity

Pain	Points
None	50
Mild or occasional	45
Stairs only	40
Walking and stairs	30
Moderate	
Occasional	20
Continual	10
Severe	0
Range of Motion	
(5 degrees =1 point)	25

#### Stability (Maximal Movement in Any Position)

Anteroposterior <5 mm	10
5-10 mm	5
> 10 mm	0
Mediolateral	
<5 degrees	15
6-9 degrees	10
10-14 degrees	5
>15 degrees	0

#### Deductions (minus) Flexion contracture

5-10 degrees	2
10-15 degrees	5
16-20 degrees	10
>20 degrees	15
Extension lag	
<10 degrees	5
10-20 degrees	10
>20 degrees	15
Alignment	
5-10 degrees	0
0-4 degrees	3 points each degree
11-15 degrees	3 points each degree
Other	20

#### Total deductions Knee score Functional scoring Walking

Unlimited	50
>10 blocks	40
5-10 blocks	30
<5 blocks	20
Housebound	10
Unable	0
Stairs	
Normal up and down	50
Normal up; down with rail	40
Up and down with rail	30
Up with rail; unable down	15
Unable	0
Subtotal Deductions (minus)	
Cane	5
Two canes	10
Crutches or walker	20
Total deductions Function score	

#### Protocol of Management

All patients presenting with symptoms of degenerative arthritis were thoroughly evaluated. Based on clinical examination, laboratory investigations and radiological data, the etiology was established as primary osteoarthritis.

All patients who were able to carry out most of their day-to-day activities without much pain were treated conservatively, with physiotherapy program and advice regarding modification of life styles and occasional usage of analgesics. The subset of people who were unable to carry out even household activities due to pain was evaluated in detail as to establish their current functional status. All patients with diagnosis of primary osteoarthritis were initially treated with rest, analgesic medication and physiotherapy under supervision to decrease the pain. They were encouraged to perform quadriceps exercises and other physiotherapeutic measures. Patients were given supervised physiotherapy as in case of primary OA. Functional status was reassessed using Knee Society score.

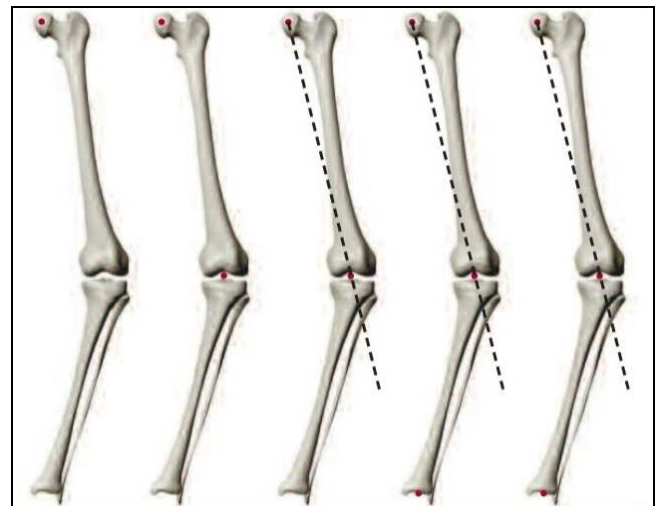
Surgical management was advised to those patients who did not improve with supervised conservative therapy and such patients were admitted. Majority of patients are poor and belong to low socio economic group.

### Preoperative assessment

Pre-operative, all the patients were evaluated for any concomitant medical illness. Routine investigations like complete blood picture, ESR, Blood sugar, Renal and Liver parameters coagulations profile (PT, APTT), chest and ECG were taken. Blood, Urine and throat swab were taken for culture and sensitivity. In the eventuality of the cultures yielding a positive result, treatment with appropriate antibiotics was started and the surgery performed only after the cultures are proved to be negative. Pre-operative roentgenograms for the assessment of patients included the standing AP view in 14 x 17 film and the lateral radiographs. Long leg films (using CT Scanogram) depicting hip to ankle joint were occasionally taken to assess malalignment in case of gross varus or valgus deformities, which also helped in preoperative planning of distal femoral cut. Measurement of lower extremity deformity when femoral head is not visible - using the anatomic tibio-femoral angle. Certain characteristics, however, may impede visibility of the femoral head, including height, obesity, and radiograph quality. In these cases, the tibiofemoral angle that is present is measured and compared to an assumed value (such as 6° valgus), and the difference is taken as the amount of deformity. If the femoral head is not visible:

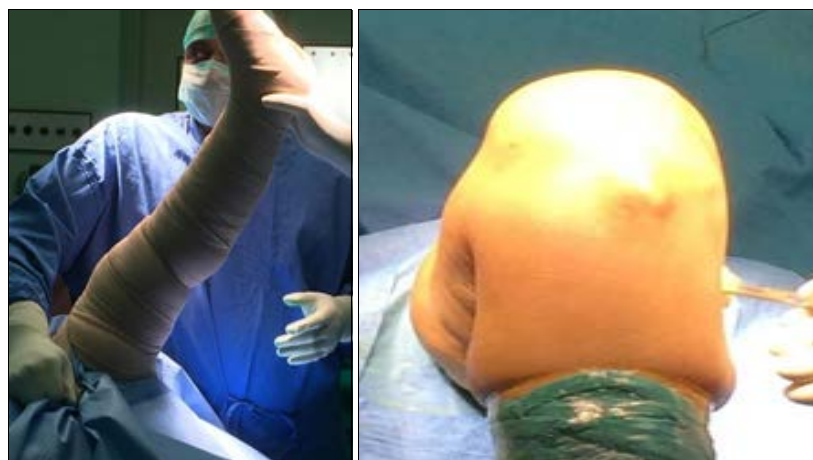
1. Locate the midpoint of the proximal femur in the region of the lesser trochanter.
2. Locate the center of the knee.
3. Draw a line from the proximal femur to the center of the knee.
4. Locate (or approximate) the center of the ankle.
5. Draw a line from the center of the knee to the center of the ankle.
6. Measure the angle between the 2 lines and label as varus or valgus, depending on position of tibia (pointed inward or laterally).
7. Compare the measured angle to a normal value (i.e., 6° valgus).

It is similar to Q angle when femoral head is visible.



**Fig 1:** varus deformity correction

One dose of IV antibiotics (Ceftriaxone 1000 mg and amikacin 500 mg) was given three hours before surgery and at the time of induction of anesthesia. Surgical procedure was carried out under regional (spinal, epidural) or general anesthesia.



**Torniquet Positioning**





Surface Marking

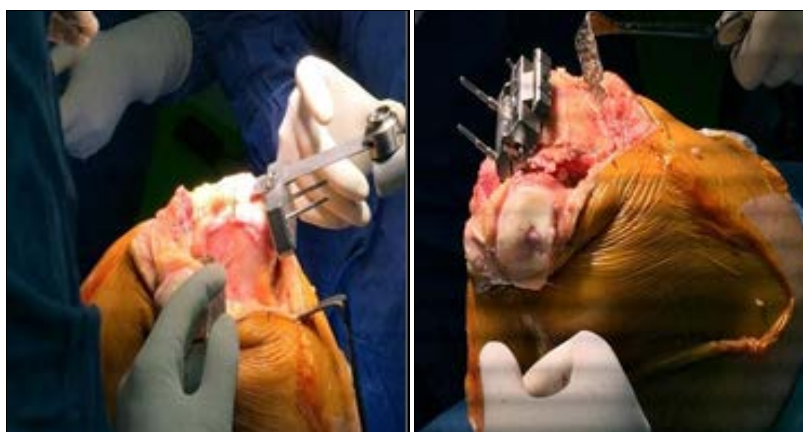
Incision

**Fig 2:** Synopsis of Surgical Technique



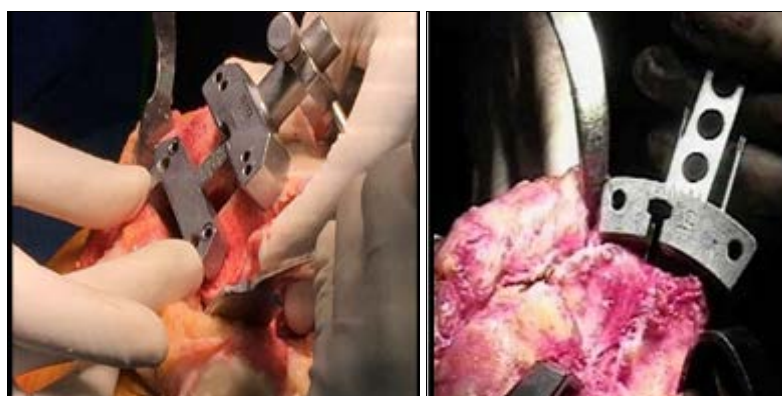
Exposure

Femoral Condyle Exposure



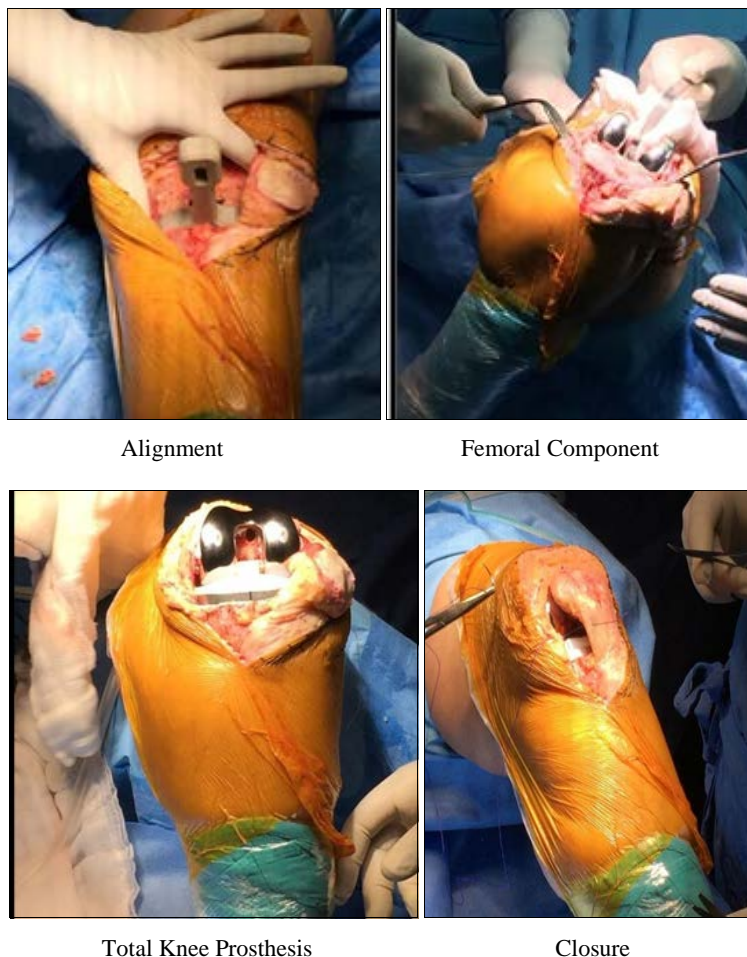
Anterior Femoral Cut

Anterior & Posterior Chamfer Cuts



Femoral Notching

Jig Tibial Cut



**Follow up:** Patients were followed in the first, third and sixth month with complete evaluation of knee joint function, scoring done and radiographs obtained.

### Results and Analysis

- 30 Arthroplasties were performed in 26 patients with in the study period.
- The mean age of the patients at the time of surgery was 60.83 years (range 50-76) while median is 60 years.
- There were 11 male and 15 female patients included in the study there were 12 left knees and 10 right knees. (04 bilateral cases)
- The average duration of the symptoms was 7.2 years (range, 5-10 years) Comorbidities-
- 18 patients were hypertensive and 2 were diabetic. 2 were both hypertensive and diabetic. 4 had no co morbidities.

**Table 1:** details of the patients who received TKA's

S. No	Characteristic	No. of patients
1.	Total number of TKAs	30
2.	Number of patients	26
3.	<b>Gender</b>	
	Male	11
	Female	15
4.	<b>Side distribution</b>	
	Right	14
	Left	16
5.	Mean age	60.83 (50 – 76)
6.	Mean time of follow up	6

We have used 3 types of femoral and tibial components each being graded into large, medium and small. Large femoral component was used in 7 patients (23%); medium in 18 (60%) and small in 5 patients (17%). While large tibial components used in 7 patients comprising 23%, medium in 16 (54%) and small in 7 patients (23%). Equal sizes of femoral and tibial components are used in 28 cases (93.3%) while in 2 cases femoral component used was larger than tibial component. the tibial insert used was also of 3 different sizes – 9mm, 11mm and 14mm. 9mm was used in 15 cases (50%), 11mm used in 10 cases (33%) and 14mm is used in 5 cases constituting 17%

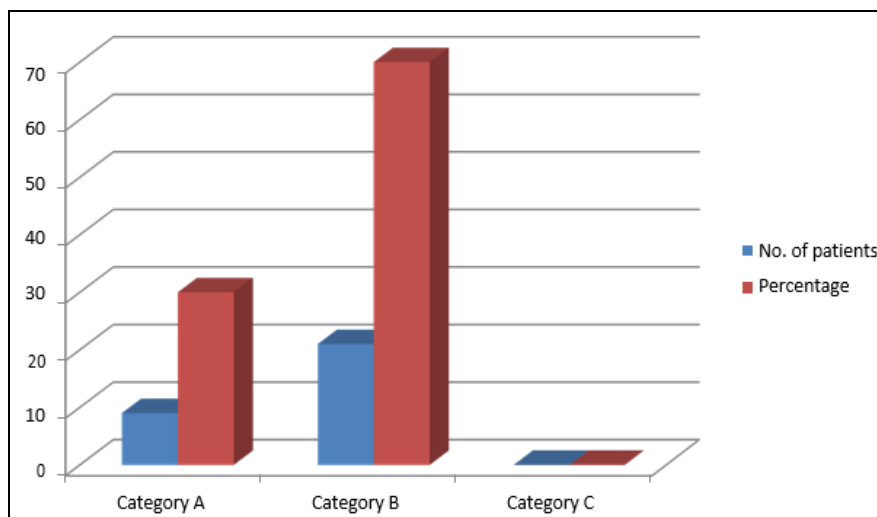
The most commonly used femoral & tibial component sizes were of medium size and the most frequently used tibial insert was 9 mm thick (50%).

### Clinical results

Patients were stratified into 3 categories according to Halley and Charnley: 9 in category A (unilateral or bilateral TKA), 21 in category B (one knee symptomatic but not replaced), and 0 in category C. At follow-up, patients were evaluated clinically by an independent observer using the American Knee Society Score.

**Table 2:** Halley and Charnley categories of patients

Patient Category	Number of patients	Percentage
A	9	30
B	21	70
C	0	0



Graph 1: showing patient categories

Table 3: Knee score results

Result	Knee score	KSS
Excellent (100-85)	23 (76.67%)	17 (56.67%)
Good (84-70)	6 (20%)	10 (33.33%)
Fair (60-69)	-	3 (10%)
Poor (<60)	1 (3.33%)	-

Table 4: Knee society score pre op and post op results

	Pre-operative KSS	Post-operative KSS
Average	26.22	89.7

**KNEE SCORE** -The average pre-operative knee score was 28.9 points (range 6- 45). The average postoperative knee score was 88.7 (range 58-97).

Table 5: Function score pre- op and post op

	Pre-operative Function score	Post-operative function score
Average	16.36	73.33

The average pre-operative functional score was 16.39 points (range 0-40).

The average post-operative functional score was 73.33 points range (60-90).

ROM: The average preoperative range of motion was 78.3°.

The mean post-operative active flexion was 92.2°.

#### Post op instabilities and deformities

No knee had more than 10 mm anteroposterior instability and no patient had a flexion deformity > 10°

#### Pain relief and walking abilities

At the most recent follow-up, relief of pain was excellent in most patients: 26 out of 30, (86%) had no pain or very mild pain. 20 out of 30 patients (66.6%) could walk farther than 10 blocks, and 30 out of 30 patients (100%) did not use assistive devices for ambulation.

#### Radiographic Results

##### Alignment

The mean femoral component alignment (a) from the anteroposterior view was 96.33° range, 90°-100° and the mean tibial component alignment (b) from the (Tibiofemoral angle) was 89.13° (range 83°-92°). The average of initial tibiofemoral angle was 10.67° (range 8° to 15°). The average

post-op anatomical alignment tibiofemoral angle was 4.1° valgus (range 1° to 6° valgus). Mean of total varus deformity correction attained was 14.9° (range 9° to 20°). The mean posterior slope of the tibia 3.5° (range, 0° to 8°) i.e., tibial angle on lateral view was 86.5° (range, 82°-90°). The average femoral flexion angle was 7.06° (range -2° to 11°).

#### Radiolucencies

No knee had evidence of radiographic loosening which required revision. Among all other radiographs, radio lucent lines of 1 mm thick were present around zones 1 & 2 in 3 tibial components and around zone 1 in 2 femoral components. No radiolucency was progressive, was more than 2 mm or extend beyond 2 zones

#### Complications

None of the patients had clinically evident DVT.

Wound healing was delayed in three cases, of which, there was superficial wound infection in one case and in another case the wound needed secondary suturing. All the knees had no local skin or wound problems on follow-up.

#### Discussion

Total knee arthroplasty for arthritic patients in whom all the conservative measures are exhausted, is an excellent procedure if proper attention is paid to the patient selection. Meticulous surgical technique must be performed to attain satisfactory postoperative alignment.

Various factors are associated with the onset and progression of clinical osteoarthritis. These include genetic factors, age, sex, obesity, occupation, abnormal loading of the joint as in kneeling, squatting and cross legged sitting

Total Knee Arthroplasty can provide excellent pain relief and restoration of function for patients with primary or secondary osteoarthritis. The success of the procedure is based on prosthesis survival, in addition to pain relief and restoration of function. This study found good-to excellent short-term results with cemented arthroplasty.

The mean age of the patients at the time of surgery was 60.83 years (range 50-76 years). Females (15) outnumbered males (11). This is observed in most of the studies. 28 of the knees had equal tibial and femoral components while in 2 cases femoral component was larger than tibial component.

Various scoring system are in vogue to assess the outcome of total knee arthroplasty: Knee injury and Osteoarthritis Outcome Score (KOOS), Western Ontario and McMaster OA



index (WOMAC), Oxford 12-item Knee Questionnaire, American knee society score, The Hospital for Special Surgery Rating System. We have used the scoring system as advocated by the American Knee Society. According to this system only the three main parameters of pain, stability and range of motion should be judged.

All the 30 cases were evaluated both preoperatively and post operatively. Knee score has increased by 59.8 to attain an average of 88.7 points postoperatively. Comparative analysis by paired t<sup>o</sup> test reveals a statistically significant p value of 0.00000001

The functional score has also increased by an average of 16.36 to reach an average of 73.33 postoperatively. Statistical analysis reveal p<sup>o</sup> value which is significant (p=0.0000001).

The mean post-operative Knee Society- knee and function scores in the present study were 87.56 and 73.33, respectively, with mean follow up period of 6 months, whereas, Rodriguez *et al.* [12] with Total Condylar prosthesis reported 88 and 58 respectively at 20 years. Martin *et al.* [5] with PFC Sigma reported 88 and 72, respectively, with mean follow up period of 5-9 years. Claytol *et al.* [6] reported the medium American Knee Society score of 93/100 at 5 years. Asif *et al.* [7] with PFC Sigma reported average post-op knee score of 87 and function score of 72. Alemparte *et al.* [8] with AGC Total knee arthroplasty reported 89 and 64 points, and Buehler *et al.* [9] with PFC PCL retaining design reported 96 and 68 points with mean follow up of 9 years. Dixon *et al.* [10]. Reported 96 and 78 at minimum 15 years follow up.

**Table 6:** Comparison of KSS results with various other studies.

Author	Type of prosthesis	Post op Knee score	Post op functional score
Rodriguez <i>et al.</i> (2001) [11]	Total Condylar prosthesis	88	58
Martin <i>et al.</i> [12]	PFC Sigma	88	72
Alemparte <i>et al.</i> (2003) [8]	AGC	89	64
Our series	Total condylar	87.5	73.3

Considering the classification of result, Knee score is within the range of excellent (85-100 points), however, Function Score is graded as good in our study and is comparable with other studies.

Install *et al.* (1983) [13] reported average post-operative flexion of 98° and Ranawat and Boachie-Adjei (1988) [14] reported average post-operative flexion of 95°. Ranawat *et al.* (1997)

[15] with PFC posterior-stabilized reported average post-operative flexion of 111° (75°–135°). Callaghan *et al.* (2000) with LCS rotating platform (Depuy) reported 102° (15°–120°). In our series we had average post-operative flexion of 92.5°. As we have used total condylar type of prosthesis (due to cost constraints) our results are comparable to studies with total condylar knee prosthesis.

**Table 7:** comparison of pre op and post op flexion with other studies

Author	Type of prosthesis	Pre-operative flexion	Post-operative flexion
Insall <i>et al.</i> (1982) [16]	Insall-Burstein	95°	115°(60°–140°)
Insall <i>et al.</i> (1983) [17]	Total condylar	87° (3°–150°)	98° (75°–125°)
Ranawat and Boachie-Adjei (1988) [18]	Total condylar	Not available	95° (70°–120°)
Ranawat <i>et al.</i>	PFC posterior stabilised	107°(60°–135°)	111°(75°–135°)
Schai <i>et al.</i>	PFC PCL-retaining	Not available	113°(85°–135°)
Callaghan <i>et al.</i> (2000) [19]	LCS rotating platform	110°(45°–140°)	102°(15°–120°)
Sung-Do Cho <i>et al.</i> (2009) [20]	LPS-flex (NexGen)	117° (80°–155°)	131°(95°–155°)
Our series	Total condylar	78.3° (60°–100°)	92.2°(50°–110°)

In our study no knee had more than 10 mm of antero-posterior instability postoperatively similar to the observation made by Martin *et al.* [12] and Asif *et al.* [7] postoperatively, no knee had flexion deformity more than 10°.

In a study by Ranawat *et al.* [14] with 79% of patients had no pain. Pain is an important parameter not only as an indication for TKA, but also for the evaluation of the results. With PFC reported 84% pain free patients at final follow up, 51% of Patients could walk farther than 10 blocks, 71% used no

assistive devices for ambulation. Asif *et al.* [7] reported that at last follow up 82% had no pain or very mild pain, 59% could walk farther than 10 blocks and 91% did not use assistive devices for ambulation. In our series, we found similar results, i.e. excellent pain relief in 7 knees, mild or occasional pain 9 knees, and in two patient's mild pain during walking and stair climbing. 10 patients were able to walk farther than 10 blocks and 100% used no assistive devices for ambulation.

**Table 8:** Comparison of post op pain in various studies

Author	Percentage of patients with no or mild pain post operatively	Patients who walk more than 10 blocks post operatively
Ranawat <i>et al.</i>	79%	-
Asif <i>et al.</i>	82%	51%
Martin <i>et al.</i> [12]	84%	59%
Our series	86%	66%

In our study, the average post-operative alignment as 4.1° valgus (range, 1° valgus to 8° valgus), the mean posterior slope of tibia (s) was 3.5° (range, 0-8°), the average femoral flexion angle 7.6° and the average of total varus deformity correction attained was 14.9° (range 9° to 20°).

As the knee is aligned in increasing varus, the patella tracks with an increasing load on the medial patellar facet. By

observing during surgery the frequency of medial patello femoral cartilage changes in varus knee, it appears that subsequent redirection of patellar forces to lateral patellofemoral cartilage would be favorable.

Infection is the most dreaded complication following total knee replacement. Infection can produce devastating results ranging from revision arthroplasty, arthrodesis, to amputation.

Only 3 patients had superficial infection which cleared with oral antibiotics for 1 week. No patient had deep infections. The factors increasing the risk of infection were prior open surgical procedures, immunosuppressive therapy, poor nutrition, diabetes mellitus, obesity, and a history of smoking. 2 patients who are graded as fair has 50° ROM with mild instability for which bracing was done for few weeks followed by mobilization. No patient required reoperation in the study period. Total joint arthroplasty is one of the most successful and cost-effective treatments for end-stage arthritis. Understanding the disparity of outcomes associated with total knee arthroplasty is crucial in the treatment of arthritis.

### Conclusion

1. Total Knee replacement is a very effective procedure in the management of symptomatic primary osteoarthritis of

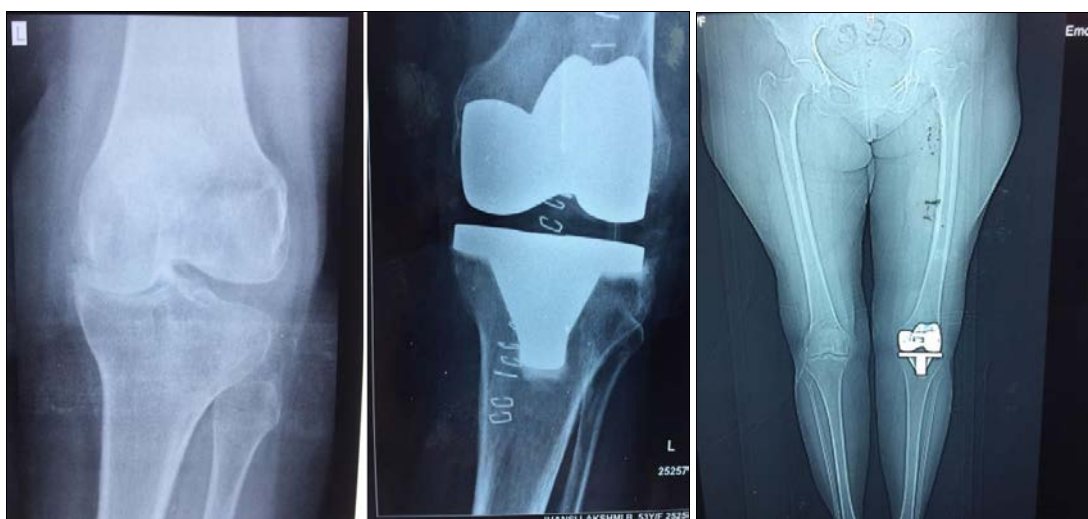
the knee in terms of pain relief and regaining good range of movements.

2. Excellent improvement in pain scores is possible in most of the patients even with total condylar type of knee prosthesis
3. In the assessment of post-operative outcome of total knee arthroplasty, Knee Society Score is a very useful tool
4. Knee scores and functional scores have improved significantly in all the cases.
5. Restoration to normal knee alignment is possible with conventional surgical technique.

In our series, cemented total knee arthroplasty has demonstrated well to excellent results. Further follow-up studies are required to assess long term results

### Clinical Photographs

#### Case 1 – A



Pre-OP Xray

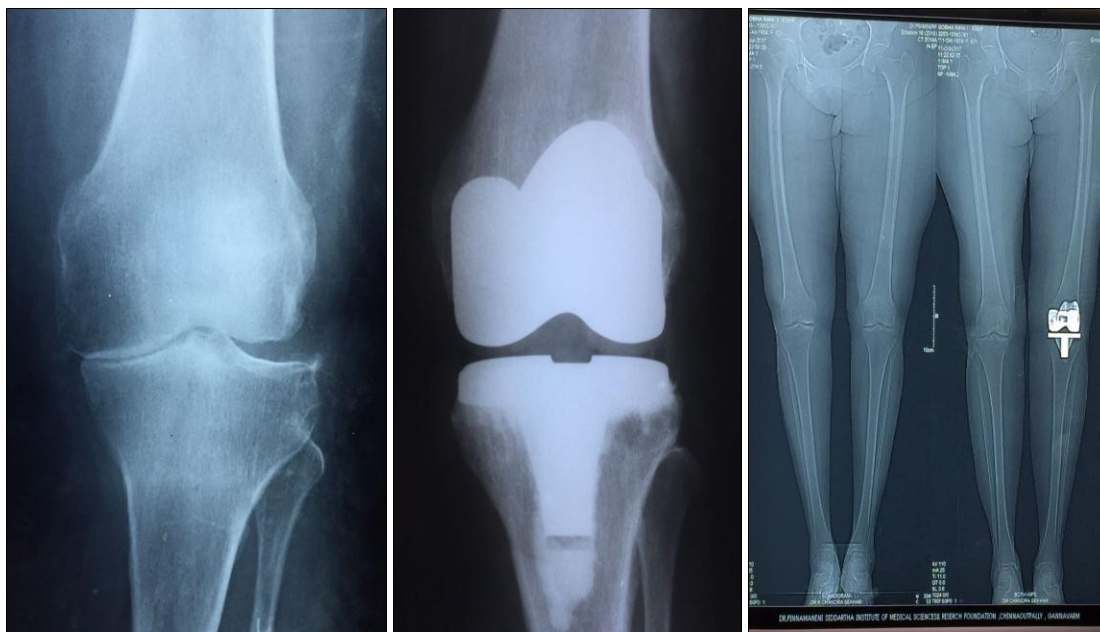
Post-OP Xray



Post OP Photo



## Case 2 – B



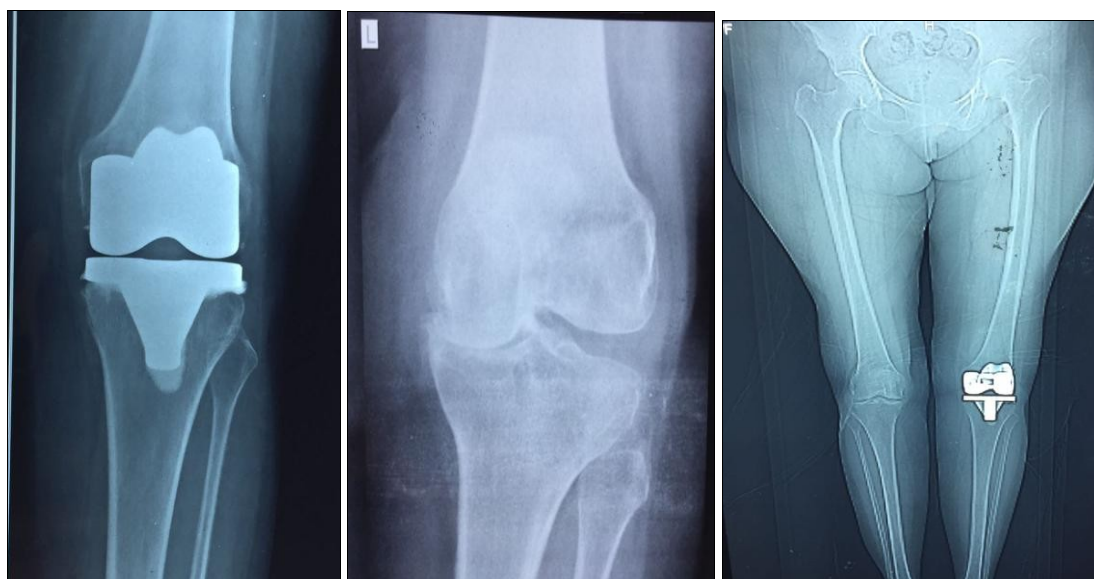
Pre-OP Xray

Post-OP Xray



Post Op Photos

## Case 3- C



Pre-OP Xray

Post OP Xray



Post Op Photos

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