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**Dr. Arun HS**  
Professor and Head of the Department, Department of Orthopaedics, Sri Devaraj URS Medical College, Tamaka, Kolar, Karnataka, India

**Dr. SV Anil Kumar**  
Assistant Professor, Department of Orthopaedics, Sri Devaraj URS Medical College, Tamaka, Kolar, Karnataka, India

**Dr. N Rajyalakshmi Reddy**  
3<sup>rd</sup> Year Postgraduate Student, Department of Orthopaedics, Sri Devaraj URS Medical College, Tamaka, Kolar, Karnataka, India

**Dr. PV Manohar**  
Professor, Department of Orthopaedics, Sri Devaraj URS Medical College, Tamaka, Kolar, Karnataka, India

**Dr. JS Nagakumar**  
Associate Professor, Department of Orthopaedics, Sri Devaraj URS Medical College, Tamaka, Kolar, Karnataka, India

## Evaluation of the functional outcome of total knee replacement in rural population

**Dr. Arun HS, Dr. SV Anil Kumar, Dr. N Rajyalakshmi Reddy, Dr. PV Manohar and Dr. JS Nagakumar**

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### Abstract

Total knee replacement (TKR) is a surgical procedure with predictable outcomes. Rural areas have less specialized doctors and facilities and the people may not understand the various protocols associated with surgeries. This observational study intended to review the outcome of total knee replacements performed in a rural population and evaluate the postoperative clinical, functional and radiological results in the replaced knees and the preoperative and postoperative lower limb alignment correction achieved and the incidence of early complications. We selected 26 people (30 knees) from the outdoor clinic who gave their informed consent for the study and satisfied our criteria. They were evaluated using the knee society score (KSS), preoperatively and postoperatively at the 3 months follow up and the data was analysed using the statistical program for social sciences (SPSS). In our study we observed that the mean knee society score improved from 29 to 83.4 and the mean functional score improved from 35 to 83.5. The knee flexion range increased from 56.2° to 111°. Postoperatively all knees were aligned in valgus except for 3 knees. Complication rate was 6.6%. We found a significant increase in the knee society score after total knee replacement compared to the preoperative scores. We conclude that total knee replacement is a reliable and safe modality of treatment and can be performed in the rural population with results comparable to the other global studies.

**Keywords:** Total knee replacement, rural population, osteoarthritis, rheumatoid arthritis, knee society score

### 1. Introduction

With the advances in science, the life span of people is increasing, leading to a boost in the numbers of the geriatric population.<sup>[1]</sup> In our country there is an increase in the number of people suffering from osteoarthritis; and also a considerable increase in the body mass index (BMI) which when combined with sitting cross legged and squatting play a strong role in joint degeneration

Most of our population hails from a rural background and are usually oblivious to the need of follow up, necessitating a surgical intervention with less complications. Total knee replacement has emerged as a more reliable, longer lasting method of knee arthroplasty, with excellent pain relief and functioning. Most of the functional scores and references are based on western studies and the Indian studies are mostly on the urban population. So this study is intended to do a review of the results of total knee replacement done on patients hailing from rural backgrounds.

### 2. Materials and methods

**2.1 Aim and Objectives:** This study aims to present data on the outcome of total knee replacements regarding the postoperative functional results, correction in the alignment and early complications performed in our rurally based institution, Sri R. L. Jalappa Hospital and Research Centre, Tamaka, Kolar, Karnataka from October 2014 to October 2016 (which includes a 3 month follow up period).

**2.2 Source of data:** Institutional ethical committee clearance was taken prior to the start of study.

**Correspondence**  
**Dr. SV Anil Kumar**  
Assistant Professor,  
Department of Orthopaedics,  
Sri Devaraj URS Medical  
College, Tamaka, Kolar,  
Karnataka, India

All patients attending our institute who were above the age of 45 years and required TKR as a treatment modality for degenerative, inflammatory or post traumatic arthritis for unilateral or bilateral knee joints were taken up for the surgery, excluding patients with any local or systemic infective condition, other joint abnormalities deterring mobilization, neuropathic arthritis or comorbid conditions rendering the patient unfit for surgery. Informed consent was obtained from all the patients who participated in the study.

**2.3 Method of collecting data:** Patients who fulfilled the above said criteria were evaluated clinically, radiologically and through laboratory tests to ascertain need for the surgery and fitness to undergo the procedure. All patients were treated with the same category of medication, similar anaesthetic and intraoperative techniques. Subjects were evaluated preoperatively and postoperatively on follow up at 3 months, on their recovery and progress using Knee society score. A preoperative examination and assessment proforma was made and used in all cases.

**2.4 Scoring system:** Assessment was done by the knee society score (KSS) (Insall, 1989), which is divided into three sections: a clinical knee score which assesses pain, range of motion and stability in anteroposterior and mediolateral directions and has deductions for flexion contractures, extension lag and malalignment, to have a maximum score of 100 points; a functional score which assesses the ability to walk and ascend and descend stairs and deductions are made if patient needs ambulatory aids to walk, and has a maximum score of 100 points; patient categorisation to explain how other physical conditions can affect the score. Scores between 100 & 80 are excellent; between 79& 70 are good; between 69 & 60 are fair and less than 60 are poor.

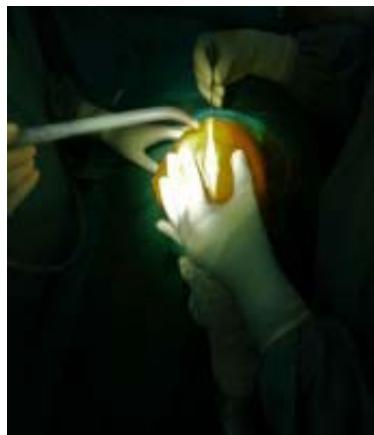
In radiological assessment alignment, femoral notching in lateral view and implant sizing were looked for. Implant loosening was not looked for in our study in view of the short follow up period.

**2.5 Statistical analysis:** Subjects were evaluated using knee society score and the data so obtained was entered into Microsoft excel data sheet and was analysed using SPSS 22

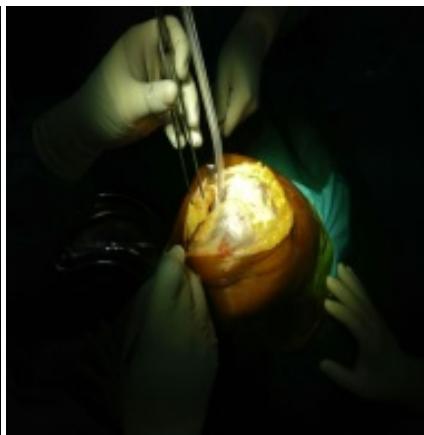
version software (Statistical Program for Social Sciences). Categorical data was represented in the form of frequencies and proportions. Chi-square was used as test of significance. Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two groups. Paired t test is the test of significance for paired data such as before and after surgery. A probability value p value .05 was considered as statistically significant.

**2.6 Surgical technique:** Under tourniquet control, a midline skin incision was given (Pic 1) followed by a medial parapatellar approach to facilitate eversion of the patella (Pic 2). ACL, PCL and both the menisci were removed to perform a posterior cruciate substituting TKR. Ligament balancing was performed prior to bone resection. Distal femoral cut was given at 5° of valgus to the anatomical axis and perpendicularly in sagittal plane. This was followed by anterior-posterior and chamfer cuts, femoral notch cut and peg holes and tibial notch cut (Pic 3, 4). The tibial cut was given at 90° to the long axis and less than 5° of posterior sloping and sizing was done (Pic 5, 6). Extension and flexion gaps were checked (Pic 7, 8). After this trial implants were placed and stability was checked (Pic 9). Then the appropriate size original implants were fixed with cement (Pic 10). Patelloplasty was done (Pic 11) and knee joint was closed (Pic 12, 13).

Postoperatively the knee was immobilized in a Jones compression bandage and knee immobilizer and postoperative check radiographs were taken. Patient was advised to continue static quadriceps exercises. On the first postoperative day the patient was made to ambulate with the help of walker. On the second postoperative day the wound was inspected and epidural catheter and drain (if present) was removed and knee flexion was started. DVT prophylaxis was given in the form of low molecular weight heparin for three days from the next day. On the fifth postoperative day intravenous antibiotics were changed to oral antibiotics and were given for another 5 more days. Patient was discharged on the 12th postoperative day after sutures/ staples were removed. Patient was followed up every month for 3 months and more frequently if complications occurred.



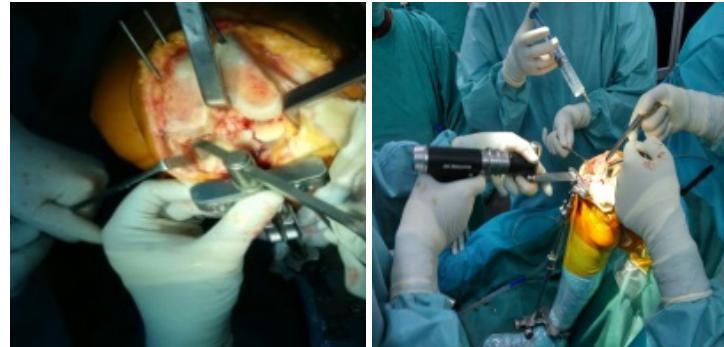
Pic 1: skin incision



Pic 2: exposing the knee joint



**Pic 3, 4:** femoral cuts



**Pic 5, 6:** Tibial cuts



**Pic 7, 8:** Checking extension and flexion gaps



**Pic 9:** Fitting of trial implants

**Pic 10:** Implantation

**Pic 11:** Soft tissue release



**Pic 12, 13:** Closure

**Operative photographs**

### 3. Results

**3.1 Age:** Majority of subjects were in the age group 61 to 70 years (36.7%). Mean age of subjects was  $61.87 \pm 11.67$  years. (Table 1)

**Table 1:** Age distribution of subjects

Age	Number of knees	Percentage
<50 years	7	23.3%
51 to 60 years	7	23.3%
61 to 70 years	11	36.7%
> 70 years	5	16.7%

**3.2 Gender:** Majority of subjects were females (56.7%, 17 knees) and 43.3% were males.

**3.3 BMI classification:** Mean weight of subjects in the study was  $63.1 \pm 11.8$  kg, mean height was  $156.5 \pm 10.1$  cm and mean BMI was  $25.6 \pm 3.5$ . 50% of subjects in the study had normal BMI, 40% were overweight and 10% were obese.

**3.4 Diagnosis of subjects:** All the patients in this study suffered from arthritis. The majority of them had osteoarthritis i.e. 63.3% (19 knees). The remaining 36.7% had

rheumatoid arthritis.

**3.5 Preoperative and postoperative comparison of knee society scores:** Mean clinical outcome at preoperative period was  $29 \pm 21.6$  and in postoperative period was  $83.4 \pm 8$ . Similarly mean functional outcome at preoperative period was  $35 \pm 16.3$  and in postoperative period was  $83.5 \pm 8.9$ . There was significant improvement in clinical and functional outcome after surgery. (Table 2)

**Table 2:** Preoperative and postoperative comparison of Knee Society Scores

Knee Society Score	Diagnosis		P value
	Mean	SD	
Preoperative Clinical Score	29.0	21.6	<0.001*
Postoperative Clinical Score	83.4	8.0	
Preoperative Functional Score	35.0	16.3	<0.001*
Postoperative Functional Score	83.5	8.9	

**3.6 Pre and post-operative knee society grading:** In our series a majority of the patients were graded poor preoperatively whereas postoperatively the majority had improved to have an excellent grade. (Table 3)

**Table 3:** Pre and postoperative knee society grading

Grade	Preoperative mean knee society grading				Postoperative mean knee society grading			
	Clinical Knee grade		Functional Knee grade		Clinical Knee grade		Functional Knee grade	
	Number of knees	%	Number of knees	%	Number of knees	%	Number of knees	%
Excellent	01	3.3	00	00	21	70	24	80
Good	00	00	02	6.7	08	26.7	05	16.7
Fair	01	3.3	00	00	01	3.3	01	3.3
Poor	28	93.3	28	93.3	00	00	00	00

**3.7 Patient classification:** 13.3% of subjects (4 knees) were operated previously on opposite side, 66.7% (20 knees) of them were operated for the first time and 20% (6 knees) in the study had co morbidities.

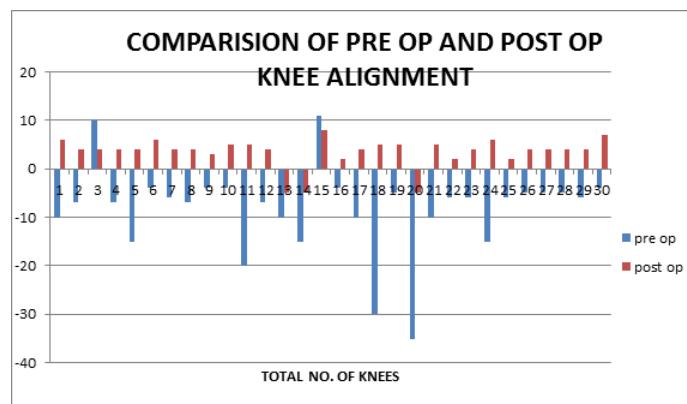
**3.8 Range of movements:** Average Range of movements in preoperative period was  $56.2 \pm 22.7$  and during postoperative period was  $111 \pm 9.9$ . Hence there was significant increase in average range of movements before and after surgery. (Table 4)

**Table 4:** Range of movement's comparison at preoperative and postoperative period

	Diagnosis	
	Mean	SD
Pre op ROM	56.2	22.7
Post op ROM	111.0	9.9
P value		<0.001*

**3.9 Preoperative and postoperative comparison of knee alignment:** Preoperatively 28 knees had varus alignment (maximum  $35^\circ$ ) and 2 knees had valgus alignment (maximum

$11^\circ$ ). Postoperatively all the knees were aligned in valgus except for 3 knees which had a varus alignment of  $5^\circ$ . (Figure 1)



**Fig 1:** Comparison of the preoperative and postoperative alignment of the knee joint

**Radiological and clinical photographs**



**Pic 14, 15, 16:** standing



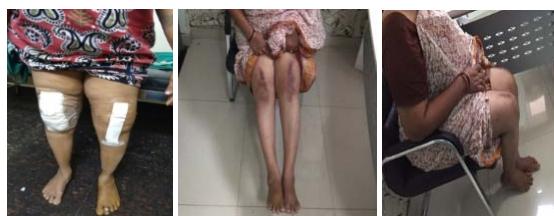
**Pic 17, 18:** knee flexion



**Pic 19, 20:** knee extension



**Pic 21, 22:** Preoperative radiological photographs



**Pic 23, 24, 25:** Postoperative clinical photographs



**Pic 26, 27, 28, 29:** Postoperative radiological photographs

**Case 1:** Preoperative clinical photographs



**Pic 30, 31, 32:** Preoperative clinical photographs



**Pic 33, 34, 35:** Preoperative radiological photographs



**Pic 36, 37:** Postoperative clinical photographs



**Pic 38, 39, 40:** Postoperative radiological photographs

#### Case 2

##### 3.10 Complications

Postoperatively 1 patient of rheumatoid aetiology had anterior knee pain after surgery which was relieved by physiotherapy. The lateral view postoperative radiograph of one patient showed notching of the femur and anterior sloping of the tibia (Pic 27). However this patient did not have any problem related to this in the 3 months she was followed up.

##### 4. Discussion

After repeated trials and failure we can now say unanimously that the only long term treatment for any progressive pathological condition of the knee joint is total knee

arthroplasty. There is drastic pain relief, a good functional outcome and it can safely be advised for patients especially in the middle age or elderly age groups. In the younger age groups it must be advised and performed with caution as the chances of loosening with increased activity and the need for revision arthroplasty is more.

In India, as patients have a habit of squatting and sitting cross legged, they must be counselled about the gross lifestyle modification which is required after surgery.

Preoperative evaluation is very important to select the type of implant as well as to determine postoperative recovery, wound healing, chance of complications etc.

In this study, knees affected with osteoarthritis or rheumatoid arthritis with the patient being clinically symptomatic, not responding to the usual conservative methods of treatment and with or without radiological evidence of tri-compartmental involvement were taken up for surgery. Our inclusion criteria intended to involve and treat all the cases which justified a TKR, and the age mentioned was not necessarily the youngest age limit for all the aetiologies. The subjects suffering from rheumatoid arthritis had an earlier onset of symptoms compared to those suffering from osteoarthritis. This can be accounted to the inflammatory pathology. In our study the age of the youngest operated rheumatoid patient was 46 years whereas it was 53 years in an osteoarthritic patient. No other aetiology was observed in our study.

**4.1 Age:** In our series the mean age of patients was 61.87 years, which was comparable to the mean age of patients in the study conducted by Back *et al* where it was 61<sup>[2]</sup>. In the study conducted by Hooper *et al*, the mean age of patients was 66.9 years<sup>[3]</sup>.

**4.2 Gender:** In 2007, Hooper *et al* conducted a study where it was found that there were predominantly males (56.45%)<sup>[3]</sup>. In our study there were more female patients (56.67%).

**4.3 Weight and BMI:** The mean weight of the patients in our series was 63.1 kg and the mean BMI was 25.6 kg/m<sup>2</sup> which were comparable to other studies. 50% of subjects in the study had normal BMI, 40% were overweight and 10% were obese.

#### 4.4 Comparative overall results

In a study conducted by Suhail *et al* (2009), the outcome according to the clinical knee score was 77.3% knees excellent, 21.3% good and 1.3% fair. The outcome according to the functional knee score was 64% knees were excellent, 29.3% good and 6.7% fair<sup>[4]</sup>. In an another study conducted by Williams *et al* (2010) the clinical knee score rated 92% knees as excellent, 1.6% good and 6.5% fair<sup>[5]</sup>. Senan *et al* (2011) also showed similar outcome, the clinical knee score rated 60% knees excellent, 13.3% good, and 13.3% poor and the functional knee score outcome showed 34.6% knees as excellent, 46.1% good and 46.1% poor<sup>[6]</sup>. In a series of cases studied by Reddy *et al* (2013) the outcome according to the functional knee score was found to be excellent in 79.4% knees, good in 5.8%, and poor in 5.8%<sup>[7]</sup>. In our series the clinical knee score graded 70% knees excellent, 26.7% good, 3.3% fair, and functional knee score showed 80% knees excellent, 16.7% good and 3.3% fair which were comparable to results of other studies performed in India and abroad.

A study conducted by Smith *et al* in 2008 showed the mean clinical knee score was 39.0 preoperatively and 93.0 postoperatively and mean functional score was 51.07 preoperatively and 70.0 postoperatively<sup>[8]</sup>. In an another study performed by Kim T. H. *et al* in 2008, the mean clinical knee score increased from 30.9 preoperatively to 94.2 postoperatively and the mean functional score improved from 44.9 preoperatively to 84.7 postoperatively<sup>[9]</sup>. In a series of cases studied by Kim Y. H. *et al* in 2010, it was seen that the mean clinical knee score was 35.3 preoperatively and 94 postoperatively and mean functional score was 44.2 preoperatively and 83 postoperatively<sup>[10]</sup>. In our series it was noted that the mean knee society scores were comparable to the means of other studies performed elsewhere; mean clinical

knee score was 29 preoperatively and 83.4 postoperatively and mean functional score was 35 preoperatively and 83.5 postoperatively.

A Study conducted by Li *et al* in 1999 showed that mean preoperative ROM was 88° and mean postoperative ROM was 100°<sup>[11]</sup>. In another study by Nutton *et al* in 2007 showed that the mean ROM had increased from 126° preoperatively to a mean postoperative ROM of 136°<sup>[12]</sup>. In a series of cases studied by Kim *et al* in 2008 showed that mean preoperative ROM was 117.3° and mean postoperative ROM was 134.7°<sup>[9]</sup>. Williams *et al* in 2010 showed that mean preoperative ROM was 99° and mean postoperative ROM was 115.5°<sup>[5]</sup>. It was noted that the range of movement achieved after total knee arthroplasty in our study was comparable to the results of other studies performed elsewhere. In our study the mean preoperative ROM was 56.2° and mean postoperative ROM was 111°. The slight decrease may be attributable to the ill compliance of patients regarding postoperative rehabilitation.

**4.5 Aetiology:** The number of patients with osteoarthritis (19 knees, 63.3%) was more than rheumatoid arthritis of the knee joint. This correlates with the findings of Back *et al*. (2001) in whose series 354 (83%) had osteoarthritis and 59 (14%) had rheumatoid arthritis, and the remaining other aetiologies (2%)<sup>[2]</sup>. In a series of cases of rheumatoid knee studied by Reddy *et al* in 2013 the outcome according to the functional knee score was found to be excellent in 79.4% knees, good in 5.8%, and poor in 5.8%. In our study out of the 11 rheumatoid knees, 90.9% were found to have excellent result and 9.09% good results according to the functional knee score<sup>[7]</sup>. In a series conducted by Suhail *et al* (2009), in osteoarthritic knees, the outcome according to the clinical knee score was 77.3% knees excellent, 21.3% good and 1.3% fair. The outcome according to the functional knee score was 64% knees were excellent, 29.3% good and 6.7% fair<sup>[4]</sup>. In our study out of the 19 osteoarthritic knees the clinical scoring was excellent in 78.9%, good in 15.7%, fair in 9.09%, and the mean functional scoring was 84.2% excellent and 15.7% good. In a study conducted by Krishna Kiran *et al* (2005), they reported that rheumatoid knees have a lower pre and postoperative scores when compared to osteoarthritic knees<sup>[13]</sup>. Hooper *et al* (2009) however did not find any relation to the pathology of the arthritis<sup>[3]</sup>. In our study we did see any difference. In our study the outcome of knees affected with osteoarthritis and rheumatoid arthritis were comparable.

In our series, pain not amenable to conservative treatment was the strongest factor for surgery, all the 30 patients walked less than 5 blocks preoperatively and were further restricted from walking by pain, flexion deformity up to 300, and instability up to 50 with restricted or painful range of motion. Postoperatively, all the patients could walk more than 10 blocks, there was no evidence of flexion deformity and three knees had mild varus alignment of the lower limb.

#### 5. Conclusion

The increase of awareness of joint replacement and its acceptance has been noted in the rural population. Patients have pain relief which is often total, with an increased walking ability and stability of the joint. Our results are on par with the other global studies; more than 96% of the patients had a good to excellent score. TKR has an excellent outcome in degenerative and inflammatory arthritis. Correction of deformities in majority of our patients to the physiological range of valgus was done in except 3 patients. Complication rate of 6.6% is less compared to other studies which we

attribute to the early mobilisation and use of low molecular weight heparin for DVT prophylaxis and thorough, preoperative work up, aseptic operating conditions and suitable antibiotics to prevent infection. Complications were seen in 2 patients, 1 had anterior knee pain which was treated by physiotherapy, the other patient's postoperative radiograph showed femoral notching and anterior tibial sloping. KSS scoring system is found to be relevant, simple but more exacting and more objective. We conclude that total knee replacement is a reliable and safe modality of treatment and can be performed in the rural population with results comparable to the other global studies provided there is adequate expertise and follow up by the patient to detect any complications early, before they occur.

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