



## A Study of Functional Outcome of Advanced Osteoarthritis Knee Treated with Total Knee Arthroplasty

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### Abstract

**Introduction:** Osteoarthritis is thought to be the most prevalent chronic joint disease. The incidence of arthritis is increasing because of ageing population and rise of obesity. Total knee arthroplasty is now the reliable technique for severe arthritis. Many designs are available with different type of prosthesis it is important to study the outcome of prosthetic replacement. Different types of scoring system are used to assess the functional outcome. Of this the most important is the knee society scoring system. In 1989, the Knee Society published its revised knee rating system

**Objectives of the Study:** 1, To study the Functional Outcome of Advanced Osteoarthritis Knee Treated with Total Knee Arthroplasty. 2, To compare the knee society knee score preoperatively and postoperatively

### Methodology

**Study Design:** Prospective study

**Study Setting:** Department of Orthopedics, Government Medical College Thrissur.

**Inclusion Criteria:** 1, Patient with advanced arthritis knee as per radiological grading 2, Consenting patients 3, Age: Adult patients > 18 years 4, Sex: Both male and female 5, Physical fitness for surgery

**Exclusion Criteria:** 1, Patients managed conservatively for other medical reasons 2, Any comorbidity that prevents patient from early mobilisation 3, Pre-operative fractures 4, Post-operative infection

**Sample Size:** All patients attending orthopedics department of MCH Thrissur fulfilling inclusion criteria during the study period

**Procedure:** Key features of the proposed surgical technique includes General Anesthesia/Spinal Anesthesia, supine with knee in 90 degree flexion, Tourniquet control, midline skin incision, medial parapatellar approach, distal femoral cut at a valgus angle (usually 5 to 7 degrees), rotational alignment, Cut the tibia perpendicular to its mechanical axis with 0 to 5 degrees of posterior slope, GAP TECHNIQUE by spacer blocks, Femoral Sizer, Anterior, Posterior and Chamfer Resection, Tibial Stem Preparation, bone grafting of defects, Trial Reduction component placement, Extensor Mechanism Repair, wound closure. The patient was assessed 6 weeks post operatively for any signs of post operative infection. Once post operative infection was ruled out clinically the patient was assessed clinically and functionally using the Knee Society Score at an interval of 3 months and 6 months. Other complications were also looked for and treated appropriately.

**Discussion:** Elderly patients who were having difficulty in mobilizing because of degenerative arthritis found good relief after Total Knee Arthroplasty. All the parameters measured and results obtained were comparable with literature and the results were showing a excellent outcome

**Conclusion:** All the patients were treated with posterior cruciate substituting type of total knee arthroplasty. At 6 months follow up knee clinical score improved from an average of 27 to 87.90 showing an excellent outcome and knee functional score improved from an average of 40 to 81.05 showing an excellent outcome and patients were able to have pain free mobile joint.

## Introduction

According to Symmons et al osteoarthritis is a 'condition characterised by the focal areas of loss of cartilage within synovial joint, associated with hypertrophy of the bone (osteophyte and subchondral bone sclerosis) and thickening of the capsule'. There is usually joint space narrowing and osteophyte formation as seen in x-ray<sup>1</sup>

Most prevalent chronic joint disease is considered to be osteoarthritis. Incidence of osteoarthritis is on the rise because of increase in longevity in the population and obesity. Main clinical features that lead to treatment which include both surgical and non-surgical are pain and loss of function<sup>2</sup>

The common causes of arthritis of the knee include Primary Osteoarthritis, Rheumatoid Arthritis, Juvenile Rheumatoid Arthritis, Post traumatic Arthritis or secondary Osteoarthritis and other inflammatory arthritis.

From 19th century the concept for improvement of knee joint function by modifying the articular surfaces has been studied. The surgical techniques have varied from soft tissue interposition arthroplasty to resection arthroplasty to surface replacement arthroplasty.

Total Knee Arthroplasty is now a reliable treatment for advanced arthritis. Many systems are available with specific features regarding the degree of conformity of the articulating surface, the geometry of the components, and the anchoring technique. With the advent of these varied types of prosthesis it became necessary to conduct studies for assessing the outcome of prosthesis of different types. It can be measured by the Knee Society Scoring system. The Knee Society Score System is subdivided into two for measurement - clinical and functional score<sup>3</sup>

Hence it was planned to conduct the study on 40 patients with advanced osteoarthritis knee treated with Total Knee Arthroplasty to assess the clinical and functional outcome using Knee Society Scoring system

## Aim

To study the clinical and functional outcome of Total Knee Arthroplasty in a series of patients

with advanced osteoarthritis knee using knee society score

## Objective

1. To compare knee society clinical score preoperatively and postoperatively in patients with advanced osteoarthritis knee with Total Knee Arthroplasty
2. To compare knee society functional score preoperatively and postoperatively in patients with advanced osteoarthritis knee with Total Knee Arthroplasty

## Methodology

### Materials and Methods

**Study Design :** Prospective study

**Study Setting:** Department of Orthopedics, Government Medical College Thrissur.

**Study Period:** 1-3-2015 to 30-9-2016

**Study Duration:** 18 months [12 months' data collection + 6 months follow up]

**Sample Size:** All patients attending orthopedics department of MCH Thrissur during the study period and who fulfill the inclusion criteria

### Inclusion Criteria

1. Patient with advanced arthritis knee as per radiological grading<sup>103</sup>
2. Consenting patients
3. Age: Adult patients > 18 years
4. Sex: Both male and female
5. Physical fitness for surgery

### Exclusion Criteria

1. Patients managed conservatively for other medical reasons
2. Any co-morbidity that prevents patient from early mobilisation
3. Pre-operative fractures
4. Post-operative infection

## Methodology

The following data were obtained for all study patients as per the Proforma attached below: Age, Sex, Occupation, Socioeconomic Status, Side, Co Morbidities.

After proper history taking, clinical examination,

radiological work up, pre operative work up and informed written consent, patients were taken up for surgery after assessing pre operative knee society score. Surgery was done by the guide with the assistance of the principal investigator. Patients were taken up for surgery as early as possible after general blood and radiological work up

### Procedure

After scrubbing, cleaning and draping patient was positioned in 90 degree of knee flexion, tourniquet control and an anterior midline incision was made. Incision was from 3cm to 5 cm above the superior pole of patella to below the level of the tibial tubercle.

Medial parapatellar retinacular approach was taken to open the joint so as to gain easy access to the diseased medial compartment and prevent fibrosis over the lateral side of patella which will predispose to patella dislocation post operatively.

The patella was retracted laterally. The retro patellar fat pad was excised. With the knee extended, subperiosteal sleeve of soft tissue was elevated from the proximal medial tibia, medial collateral ligament. Elevation was continued with a periosteal elevator and the posterior fibers were freed. So as to improve the exposure during the release, subperiosteal sleeve was retracted using a retractor preferably Homans retractor. The insertion of the semimembranosus muscle from the posteromedial tibia is released. Continue the release distally to the anteromedial surface of the tibia and strip the periosteum medially. For severe deformities, continue subperiosteal stripping posteriorly and distally. If flexion contracture was present, release or transversely divide the posterior capsule. If it was valgus deformity do a lateral soft tissue release according to the extent of the deformity.

The Whiteside line and the Trans-epicondylar line were made over the femoral condyles after exposing the condyles. Whiteside line is the vertical line cutting through the middle of distal femoral sulcus. Trans-epicondylar line is the horizontal line linking the medial and lateral epicondyle. The starter hole was created at the

intersection between the vertical Whiteside Line and the horizontal Epicondylar Line. The hole was placed medial and anterior to the anteromedial corner of the intercondylar notch

Distal femur was resected with the standard resection slot. Assemble the Distal Resection Guide and Valgus Alignment Guide onto the intramedullary alignment rod. The 5 to 7 degree valgus cut was made in order to get a distal cut that is perpendicular to the mechanical axis. Resect the distal femur using the standard resection slot which provides a 9mm resection from the prominent distal condyle.

The extramedullary tibial guide was assembled. The long axis of the tibial resection guide should be parallel to the tibia. The resection slot should be located a few millimeters below the lowest articular surface (usually medial). Use the stylus to check the amount of tibial cut 2 mm for medial referencing, 10 mm for lateral referencing. The final tibial cut was completed with an osteotome to prevent over penetration of saw blade posteriorly which risked popliteal artery cut.

The extension gap was checked and should be able to accept a minimum of 10 mm base. A symmetrical and rectangular extension gap must be obtained. The extension gap must be the same as flexion gap. Then femoral sizing was done

Place the femoral resection block flush against the distal and anterior femoral surfaces. Stabilize the block. The recommended order of resection is: 1. Posterior, 2. Posterior chamfer, 3. Anterior, 4. Anterior chamfer.

The tibial insert size must match the femoral implant size. There are two tibial base sizes that can be used with any one size femoral component. An alignment rod can be inserted through the handle to check alignment to the ankle anterior superior iliac spine; patella and 2<sup>nd</sup> toe should be on same level

Attach the keel punch guide to the keel punch handle and secure it to the trial base by turning the knurled handle. Using the threaded punch handle and appropriate keel punch, slide the punch through the guide until the punch is fully seated.

The trial base and stem were left in place for a

trial reduction. After satisfactory reduction, the patella was denervated circumferentially using the cautery. Place the appropriate size femoral trial on the distal femur using the femoral impactor and trial reduction was checked

Bone cement was spread over the cut surfaces of femur and tibia for preparing for the femoral and tibial component implantation. Once the cement surrounding the tibial base has cured, the appropriate tibial insert may be locked into place

After attaining hemostasis and a drain was put Wound was closed in layers using 1-0 vicryl starting with closure of capsule, subcutaneous sutures and skin was closed in staplers. Post operative dressings were given and knee was immobilized in a long knee brace. Operation details were recorded and patient was shifted to post operative ward



**Figure 26:** Extramedullary alignment of tibia

**Operative Photographs**



**Figure 24:** Medial parapatellar approach



**Figure 27:** Tibial cut



**Figure 25:** Joint opened



**Figure 28:** Femoral cut



**Figure 29:** After completing cuts



**Figure 33:** After reduction



**Figure 30:** Trial insertion after checking extension and flexion gap



**Figure 31:** Checking alignment after trial insertion



**Figure 32:** Both tibial and femoral component insertion

### Post-operative Protocol

Post Operative Protocol which included compression bandage and long knee brace from day 1, Early Mobilization on Day 3 with dressing change and drain removal, dressing change every 3 days, 4<sup>th</sup> post op day knee flexion and dynamic quadriceps exercise, intravenous antibiotics from day 1, suture removal on post op day 12 with continuation of physiotherapy were done

### Follow-up

The patient was assessed 6 weeks post operatively for any signs of post operative infection. Once post operative infection was ruled out clinically the patient was assessed clinically, functionally using the Knee Society Score at an interval of 3 months, 6 months. Knee Society Score included both clinical and functional scores. In clinical score pain, range of motion, alignment, contractures and deformities were assessed and score were given. In functional score walking distance, climbing stairs and need of support were assessed. Other complications were looked for and treated appropriately. Scores were given excellent [80-100], good [70-79], fair [60-69], poor [>60]

### Observations and Results

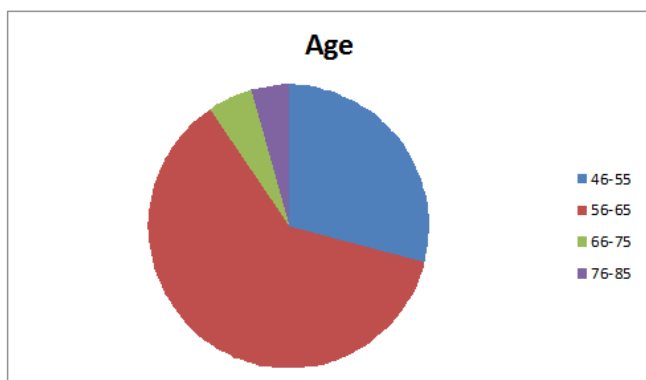
The following observations were made from the data collected from 40 patients with advanced osteoarthritis knee treated with total knee

arthroplasty in Government Medical College, Thrissur during the period 1-3-2015 to 30-9-2016

**Age distribution**

**Table 2:** Age distribution

Age	46-55	56-65	66-75	76-85	TOTAL
No. of Cases	8	17	12	3	40
Percentage	20	42.5	30	7.5	100



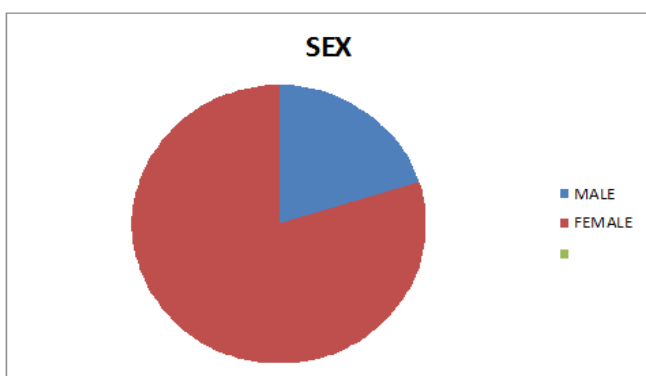
**Graph 1:** Age Distribution

In this study most of the age group were from 56-65 which was 42.5% followed by 66-75 which was 30%

**Sex Distribution**

**Table 3:** Sex distribution

SEX	No. OF PATIENTS	PERCENTAGE
MALE	8	20
FEMALE	32	80
TOTAL	40	100



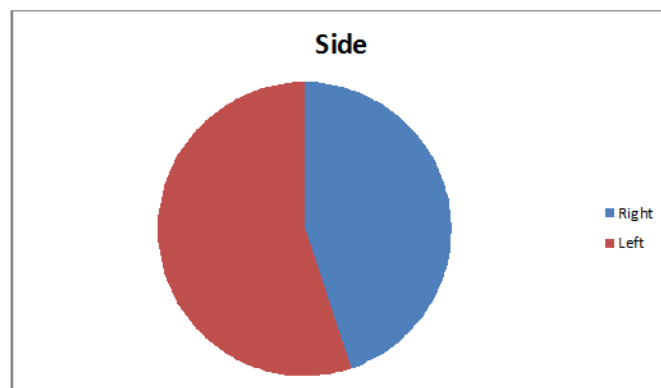
**Graph 2:** Sex Distribution

Out of the 40 patients, 32(80%) were females. This could be due to higher incidence of osteoarthritis in females

**Side Distribution**

**Table 4:** Side distribution

	Right	Left	Total
No of cases	18	22	40
Percentage	45	55	100



**Graph 3:** Side distribution

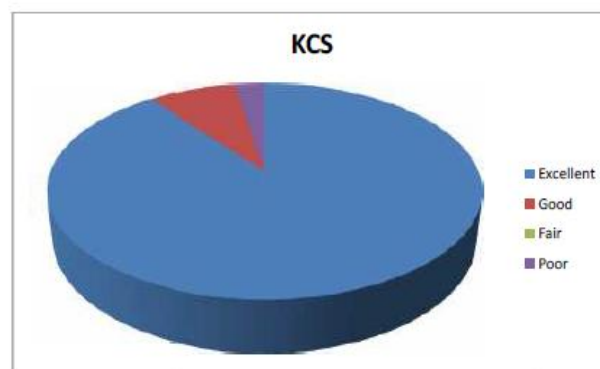
Out of 40 cases operated 22 cases were operated on the left side which accounts for 55% of the cases

**Functional Outcome**

**Knee Clinical Score**

**Table 5:** Functional outcome of Knee clinical score

KCS	Number	Percentage
Excellent	34	89.4
Good	3	7.8
Fair	0	0
Poor	1	2.6
Total	38	100



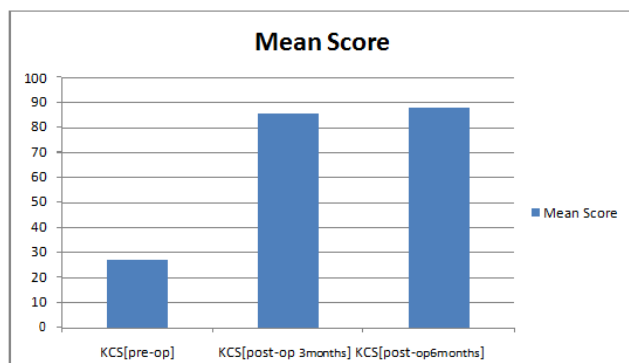
**Graph 4:** Functional outcome of Knee clinical score

40 patients who were done surgery 34 had excellent knee clinical score after 6 months 3 had good results and 1 had poor results 2 patients were excluded due to postoperative infections.

**Comparison of knee clinical score**

**Table 6:** Knee clinical score comparison

	N	MEAN	STANDARD DEVIATION
Pre-op	40	27	6.06
Post-op[3 months]	38	85.47	8.16
Post-op[6 months]	38	87.90	7.03



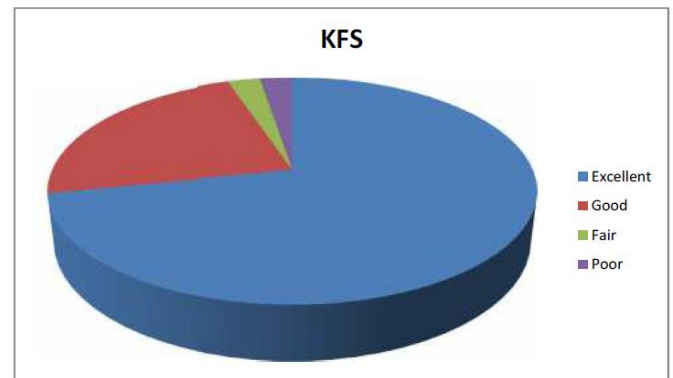
**Graph 5:** Knee clinical score comparison

38 patients who underwent surgery had a mean pre-op score of 27 with a standard deviation of 6.06. After 3 months the mean post-op score was found to have increased to 85.47 with a standard deviation of 8.16 which further increased to 87.90 with a standard deviation of 7.03 indicating an excellent outcome

**Knee Functional Score**

**Table 7:** Functional outcome of Knee functional score

KFS	Number	Percentage
Excellent	28	73.6
Good	8	21.05
Fair	1	2.6
Poor	1	2.6
Total	38	100

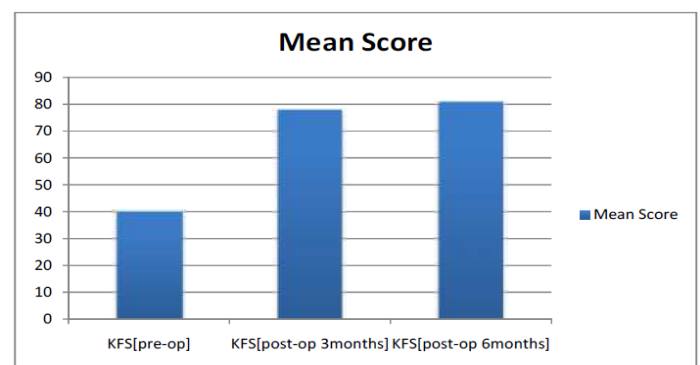


**Graph 6:** Functional outcome of Knee functional score

Out of the 40 patients operated 28 had excellent outcome with which was 73.6% and 8 had good results and one each had fair and poor results. 2 were excluded from study due to post operative infection

**Table 8:** Knee functional score comparison  
Comparison of knee functional score

	N	MEAN	STANDARD DEVIATION
Pre-op	40	40.37	7.71
Post-op[3 months]	38	78.28	7.63
Post-op[6 months]	38	81.05	7.18



**Graph 7:** Knee functional score comparison

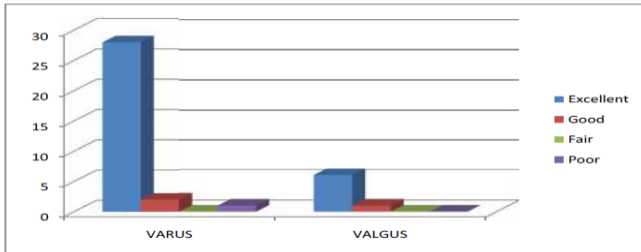
40 patients who underwent surgery had a mean pre-op score of 40.37 with a standard deviation of 7.71. After 3 months post operative score was found to have increased to 78.28 with a standard deviation of 7.63 which further increased to 81.05 with a standard deviation of 7.18 indicating an excellent outcome

**Difference in outcome of knee society score in valgus and varus knee**

**Knee Clinical Score**

**Table 9:** Knee clinical score in varus and valgus knee

ALIGNMENT	Excellent	Good	Fair	Poor	Total
VARUS	28(90.4%)	2(6.4%)	0(0%)	1(3.2%)	31(100%)
VALGUS	6(85.7%)	1(14.2%)	0(0%)	0(0%)	7(100%)



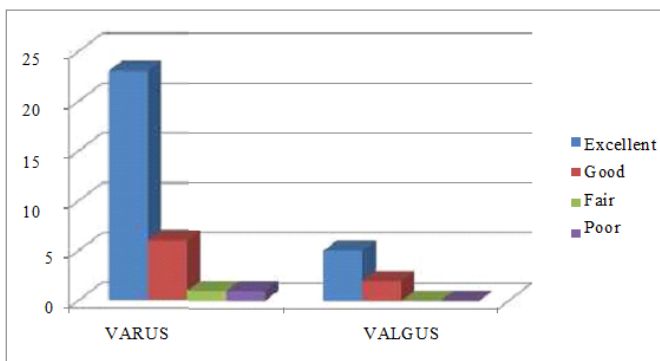
**Graph 8:** Knee clinical score in varus and valgus knee

Out of 38 patients who underwent surgery 31 had varus knee and 7 had valgus knee. On follow up it was seen that 28(90.4%) among the 31 had excellent outcome, 2(6.4%) had a good outcome and 1(3.2%) had poor outcome. Among the 7 with valgus knee 6(85.7%) had an excellent outcome, 1(14.2%) had good outcome and none had poor results

**Table 10:** Knee functional score in varus and valgus knee

**KNEE FUNCTIONAL SCORE**

ALIGNMENT	Excellent	Good	Fair	Poor	Total
VARUS	23(74.2%)	6(19.3%)	1(3.2%)	1(3.2%)	31(100%)
VALGUS	5(71.4%)	2(28.6%)	0(0%)	0(0%)	7(100%)



**Graph 9:** Knee functional score in varus and valgus knee

Out of 38 patients who underwent surgery 31 had varus knee and 7 had valgus knee. On follow up it was seen that 23(74.2%) among the 31 had excellent outcome,6(19.3%) had a good outcome, 1(3.2%) had a fair outcome and 1(3.2%) had poor outcome. Among the 7 with valgus knee 5(71.4%) had an excellent outcome,2(28.6%)had good outcome and none had poor results

**Clinical and Radiological Photographs**

**Case no: 1**



**Figure 34.2:** Pre operative radiograph





**Figure 34.3:** Post operative radiograph



**Figure 35.2:** Pre operative radiograph



**Figure 34.4:** Range of motion after 6 month



**Figure 35.3:** Post operative radiograph

**Case no: 2**



**Figure 35.1:** Pre operative picture



**Figure 35.4:** Range of motion on 10<sup>th</sup> post operative day



**Figure 35.4:** Range of motion on 10<sup>th</sup> post operative day

**Case no: 3**



**Figure 36.1:** Pre operative picture



**Figure 36.1:** Pre operative radiograph



**Figure 36.3:** Post operative radiograph



**Figure 36.4:** Post operative alignment

## Case no: 4



**Figure 37.1:** Pre operative picture



**Figure 37.2:** Pre operative radiograph



**Figure 37.3:** Post operative radiograph

### Discussion

Elderly patients who were having difficulty mobilizing because of degenerative arthritis showed good relief after Total Knee Arthroplasty. It was seen there was a substantial relief of pain of joint, increased mobility of the joint, correction of deformity and an improvement in the quality of life of the patients following Total Knee Arthroplasty.

Factors including pain, range of movement (ROM), sociodemographic and clinical data with functional status are discussed. In this study 40 patients who satisfied the inclusion criteria and all the knees were operated using a Posterior cruciate substituting design.

In this study 29 [72%] subjects were 56 to 77 years old. This is to be expected, as an American profile from 1986-2002, states that arthritic changes in the over 65 years' population, are considered normal<sup>105</sup>. 49.7% of adults more than 65 years reported doctor-diagnosed arthritis from 2010-2012.<sup>106</sup> The age range of study subjects was comparable to literature.

Woman has more chance of getting osteoarthritis knee than men and severe osteoarthritis knee is also more in woman<sup>107</sup>. 32 [80%] subjects in this study were female which is comparable to other studies. In a study on sociodemographic factors affecting total knee arthroplasty outcomes, in the United Kingdom, United States of America and Canada it was found that the majority of participants for TKA's were female [70%] by davis et al<sup>108</sup>. The incidence of osteoarthritis knee in females is hypothesized as hormonal. But studies show conflicting results<sup>109,110</sup>.

In vivo studies by Stiehl et al.; Victor, Banks, and Bellemans and Dennis et al., who used fluoroscopy during single-stance deep knee bends to show in some PCL-retaining knees a paradoxical forward translation of the femorotibial contact point while weight bearing and flexion; PCL-substituting knees studied showed more uniform femoral rollback.<sup>38,39</sup> C. Buz Swanik found that following total knee arthroplasty, patients were able to reproduce the joint position and improve mobility of the joint significantly.

Retensioned capsulo-ligamentous structure reduces pain and inflammation. Retention of the posterior cruciate ligament does not appear to significantly improve the proprioception and balance compared with those functions in patients with a posterior stabilized total knee design were also seen in the study.<sup>111</sup>

In our study the patella of all patients was circumferentially denervated. Total knee arthroplasty with retention of the patella had clinical results that were comparable with those after total knee arthroplasty with patellar resurfacing which was studied by BARRACK et al<sup>112</sup>. He also found out that component design and rotation causes anterior knee pain rather than the patella is resurfaced. Similar study was done by Nutton with the same result as that of BARRACK et al<sup>113</sup>.

Total knee arthroplasty with resurfacing of the patella exhibited significant limitation of extension of knee, which was found to be associated with the presence of anterior knee pain as proposed by Wood<sup>114</sup>

The Knee Society Score rating system was the logical outgrowth of the Hospital for Special Surgery (HSS) rating system. All patients were assessed with Knee Society Scoring system. The Knee Society Score system separates findings in the operated knee with findings in the patient's function. The scoring system combines a relatively objective Knee Clinical Score that is based on the clinical parameters and a Knee Functional Score based on how the patients perceives that knee function with specific activities.

In our study a significant improvement in scores was observed confirming that arthroplasty is a good operating technique allowing persons to get a good functional ability and range of motion with advanced osteoarthritis knee

Knee Society Score 85.5 which is obtained in our study is comparable to that obtained by Giesinger in a one year follow up<sup>115</sup>. The average pre-op Knee Clinical Score was 28.13 which improved to an average post-op score of 95.38 while the average pre-op Knee Functional Score of 41.53,

improved to a post-op score of 88.49 in a study done by CHANDRAN R SHETTY<sup>116</sup>

In a study published by A Suhail the average American Knee Society Knee score was found out to be 87.9% (standard deviation 5.7) with 77.3% of patients (58 knees) rated excellent, 21.3% (16 knees) rated good and 1.3% of patients (1 knee) rated fair. None were rated poor<sup>117</sup>

In our study functional outcome in relation to valgus and varus knee was also studied showing an excellent functional outcome in 90% of cases with varus knee and excellent functional outcome in 85% cases with valgus knee in Knee Clinical Score and in Knee Functional Score 74% of cases showing excellent functional outcome with varus knee and 71% of cases showing excellent functional outcome in valgus knee.

In a study published by Krackow et al functional outcome of valgus knee was found to be excellent in 87% of cases<sup>118</sup>. Ranawat et al showed improvements of Knee Clinical Score from a pre operative mean score of 30 points to post operative mean score of 93 points and improvement of Knee Functional Score from a pre operative mean score of 30 to a post operative mean score of 81 in a 5 year follow-up<sup>119</sup>.

In a study published by Kadam et al the mean preoperative Knee Clinical Score of varus knee was 49.40 which increased to a postoperative score of 86.08 at the end of 6 months. Similarly, the mean preoperative Knee Functional Score of varus knee was 32.75 which increased to a postoperative score of 84.43 at the end of 6 months showing an excellent outcome<sup>120</sup>

Almost all patients were able to have a good range of motion and a good functional outcome following surgery in our study

### Summary

This study was done in 40 patients aged above 18 years attending Orthopedics department of Medical College Thrissur who underwent Total Knee Arthroplasty from March 1<sup>st</sup> 2015 to September 30<sup>th</sup> 2016. All these patients were assessed clinically and radiologically preoperatively and evaluated postoperatively with

Knee Society Scoring system. The findings are summarized below

- Majority of the subjects belonged to age group 56-65 [42.5%] followed by 66- 75 [30%]
- Out of the 40 patients 32[80%] were female showing a higher incidence of Osteoarthritis in female
- Out of the 40 cases operated 22 cases were operated on the left side which accounts for 55% of the cases
- Out of the 40 patients who were operated 34 had excellent Knee Clinical Score after 6 months, 3 had good results and 1 had poor results. 2 patients were excluded due to post operative infection
- Out of the 38 patients who were operated pre-op Knee Clinical Score had a mean of 27 with a standard deviation of 6.06. After 3 months post operative score was increased to 85.47 with a standard deviation of 8.16 which further increased to an average of 87.90 with a standard deviation of 7.03 at 6months showing an excellent outcome
- Out of the 40 patients operated 28 had excellent Knee Functional Score after 6 months, 8 had good results and one each had fair and poor results. 2 were excluded from study due to post operative infection
- Out of the 40 patients who were done surgery pre-op Knee Functional Score had a mean of 40.37 with a standard deviation of 7.71. After 3 months post operative score was increased to 78.28 with a standard deviation of 7.63 which further increased to an average of 81.05 with a standard deviation of 7.18 showing an excellent outcome
- Out of the 38 patients who were operated 31 had varus knee and 7 had valgus knee. On follow up it was seen that 28among the 31 had excellent outcome, 2had a good outcome and 1had poor outcome. Among the 7 with valgus knee 6had an excellent outcome, 1had good outcome and none had poor results.

Out of 38 patients who underwent surgery 31 had varus knee and 7 had valgus knee. On follow up it was seen that 23among the 31 had excellent outcome, 6 had a good outcome, 1 each had a fair had poor outcome. Among the 7 with valgus knee 5had an excellent outcome, 2had good outcome and none had poor results

- Almost all patients were able to have a good range of motion and a good functional outcome following surgery

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