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Study of functional and radiological outcome of total knee arthroplasty using the knee society score

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Abstract
The common causes of arthritis of the knee include Osteoarthritis (OA), Rheumatoid Arthritis (RA), Juvenile Rheumatoid Arthritis, Post traumatic Arthritis or secondary Osteoarthritis and other types of inflammatory arthritis. Osteoarthritis is thought to be the most prevalent chronic joint disease. The surgical techniques have varied from soft tissue interposition arthroplasty to resection arthroplasty to surface replacement arthroplasty. In surface replacement arthroplasty different types of prosthesis were developed to address the complex knee kinematics. Total Knee Arthroplasty (TKA) is now a reliable treatment for severe arthritis. Various systems are available with specific features regarding the geometry of the components, the degree of conformity of the articulating surface and the anchoring technique.
Aim: To study the clinical, functional and radiological outcome in a consecutive series of Total Knee Arthroplasty using Knee Society Score.
Materials and Methods: This study was done to analyse the clinical, functional and radiological outcome of Total Knee Arthroplasty using Knee Society score using a Posterior Cruciate substituting (Indus Knee Prosthesis). A Prospective study consisting of 30 patients who consented and underwent Total Knee Arthroplasty. The follow up period was at 3 months, 6 months and 1 year.
Results and Discussion: According to the Knee Society Functional Scoring system, 30 patients were assessed in this study. 16 patients (53%) had Excellent, 11 patients (37%) had Good, 2 patients (7%) had Fair and 1 patient (3%) poor results. The results were found to be comparable with other studies.
Conclusion: Total Knee Arthroplasty improves the functional ability of the patient and the ability of the patient to get back to pre-disease state, which is to have a pain free mobile joint, as reflected by the improvement in the post-op Knee Clinical Score and Knee Functional Score.

Keywords: Functional, radiological outcome, knee arthroplasty, knee society score

Introduction
In most arthritic knees, some degree of instability, deformity, contracture or a combination of these elements, can be found [1-3] The common causes of arthritis of the knee include Osteoarthritis (OA), Rheumatoid Arthritis (RA), Juvenile Rheumatoid Arthritis, Post traumatic Arthritis or secondary Osteoarthritis and other types of inflammatory arthritis.
Osteoarthritis is thought to be the most prevalent chronic joint disease. The incidence of osteoarthritis is rising because of the ageing population and the epidemic of obesity. Pain and loss of function are the main clinical features that lead to treatment, including non-pharmacological, pharmacological, and surgical approaches [4].
The concept of improving knee joint function by modifying the articular surfaces has received attention since the 19th century.
The surgical techniques have varied from soft tissue interposition arthroplasty to resection arthroplasty to surface replacement arthroplasty. In surface replacement arthroplasty different types of prosthesis were developed to address the complex knee kinematics. Total Knee Arthroplasty (TKA) is now a reliable treatment for severe arthritis. Various systems are available with specific features regarding the geometry of the components, the degree of conformity of the articulating surface and the anchoring technique.
With the advent of these varied types of prosthesis it became necessary to conduct studies for assessing the outcome of different prosthesis. Hence different scoring systems were devised for assessing the outcome of total knee replacement. The Knee Society Score System is subdivided into a knee score that rates only the knee joint itself and a functional score that rates the patient's ability to walk and climb stairs. The dual rating system eliminates the problem of declining knee scores associated with patient infirmity [5]. This is a consecutive study of thirty patients; the clinical, functional and radiological outcome of Total Knee Arthroplasty.

Aim

To study the clinical, functional and radiological outcome in a consecutive series of Total Knee Arthroplasty using Knee Society Score.

Materials and Methods

This study was done to analyse the clinical, functional and radiological outcome of Total Knee Arthroplasty using Knee Society score using a Posterior Cruciate substituting (Indus Knee Prosthesis). A Prospective study was done between the period of September 2009 – May 2011. 30 patients who conse nted and underwent Total Knee Arthroplasty in Pondicherry Institute of Medical Sciences, Pondicherry were assessed clinically, functionally and radiologically using Knee Society score.[5] The follow up period was at 3 months, 6 months and 1 year. The study was conducted at the Department of Orthopaedics, Pondicherry Institute of Medical Sciences, Pondicherry. This was a hostipal based cross-sectional study. The data was entered in Microsoft Excel 2007 and analysed using SPSS 16.0 version. Stastistical tests like Paired ' t ' test and Chi-Square test were used.

Inclusion Criteria

All patients who underwent Total Knee Arthroplasty in Pondicherry Institute of Medical Sciences, (both bilateral and unilateral Total Knee Arthroplasty) using the Indus Knee,were included in this study

Exclusion Criteria

Intraoperative and Postoperative fractures. (Periprosthetic fractures). Any co morbidity that prevents the patient from early mobilisation.

Pre-Operative Evaluation

Clinical Assessment

Detailed history of all patients was taken. All patients were assessed clinically and functionally using the Knee Society Score.[5] The preoperative medical evaluation of all patients were done to prevent potential complications that can be life-threatening or limb-threatening. Any limb length discrepancies were noted. Presence of any hip and foot deformities was assessed. The extensor mechanism was assessed for any quadriceps contractures. The knee deformities were examined for any fixed varus or valgus deformities or presence of any fixed flexion contracture.

Radiographic Assessment

Standard guidelines were utilized to get knee radiograph standing anteroposterior view and a lateral view and a skyline view of the patella [10, 9] Any collateral ligament laxity, subluxation of tibia, presence of osteophytes, any bone defects in the tibia and femur and the quality of bone is assessed. Sizing of the femoral and tibial components can also be done.

Operative Procedure

All patients after thorough pre-op evaluation were taken up for surgery by the same surgical team under general or regional anaesthesia, patient in supine position with knee flexed to 90 degree. Tourniquet was applied at the thigh region and sterile preparation done from thighs to toes and drapped.

Total Knee Replacement Components

There are 3 separate components of TKR

1. Femoral component
2. Polyethylene insert
3. Tibial component

Surgical Technique

With the knee in 90 degree of flexion an anterior midline incision was made. Begin the incision 3cm to 5 cm above the superior pole of patella. Extend it distally to below the level of the tibial tubercle.

The retinacular incision was a medial parapatellar retinacular approach, so as to gain easy access to the diseased medial compartment and prevent fibrosis over the lateral side of patella that will predispose to patella dislocation post operatively.

The patella was retracted laterally. The patella was not everted as it will cause risk of patellar tendon rupture. The degenerated femoral condyle was exposed. The retro patellar fat pad was excised to prevent post operative arthrofibrosis.

With the knee extended, a subperiosteal sleeve of soft tissue from the proximal medial tibia was elevated, including the deep medial collateral ligament, superficial medial collateral ligament, and insertion of the pes anserinus tendons. The elevation was continued with a periosteal elevator to free the posterior fibers. To improve exposure during the release, this subperiosteal sleeve was retracted using a Homan retractor. The insertion of the semimembranosus muscle was released from the posteromedial tibia. The release was continued distally on the anteromedial surface of the tibia and the periosteum was stripped medially from the tibia. For more severe deformities, subperiosteal stripping was continued posteriorly and distally. If flexion contracture was present, the posterior capsule was released or transversely divided.

The Whiteside line and the Trans-epicondylar line was 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. Initiate an opening in the femoral canal with the 9.5mm diameter drill bit.

Distal femur was resected with either the standard resection slot, which provides a 9mm resection from the prominent distal condyle, or the +4mm resection slot which provides a 13mm resection. If headless pins are used, the resection block can be adjusted 2mm proximally or distally. 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. Ensure that the resection block is seated flush against the anterior rough cut and lock the assembly with the thumbscrew. Fix the distal femoral resection block to the anterior cortex with two headless pins. Resect the distal femur using the standard resection slot which provides a 9mm resection from the prominent distal condyle.

The extramedulary tibial guide was assembled composing of the cross head with pin, resection guide and ankle yoke. Use the adjustment screw at the ankle to align the resection guide. The long axis of the tibial resection guide should be parallel to the tibia. The bar holding the resection guide was raised and pinned to the upper tibia when the guide was centered on the proximal tibia. The resection slot should be located a few millimeters below the lowest articular surface (usually medial). The stylus was used 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.

Extension gap was checked with Trial Tibial Base. The extension gap should be able to accept a minimum of 10 mm base. A symmetrical and rectangular extension gap must be obtained. A trapezoidal gap is not accepted. If this was the case, more soft tissue was released to get a rectangle. The extension gap must be the same as flexion gap.

The A-P femoral sizer flush was placed against the resected distal femur and the sizer was adjusted so the feet contact the posterior condyles and the stylus contacts the shaft of femur. The anterior or posterior size was indicated on the distal face of the A-P femoral sizer. If the sizing was between sizes, the smaller of the two sizes was selected. The femoral resection block (4 in 1 resection block) was selected corresponding to the size indicated by the A-P femoral sizer. The femoral resection block flush was placed against the distal and anterior femoral surfaces. The block was stabilised against the bone using 3.2mm diameter headed pins on the medial and lateral sides of the block. The recommended order of resection was:

1. Posterior, 2. Posterior chamfer, 3. Anterior, 4. Anterior chamfer. Trochlear groove resection is done. The trial tibial base was assembeled equal in size to the femoral implant with the trial base handle and place against the proximal tibial surface. If the size was appropriate, the base was alligned and pinned to the tibia using short headed anchoring pins. If the tibial size was too small, a "plus size" provided additional tibial coverage.

Note: 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 could be inserted through the handle to check alignment to the ankle. The keel punch guide was attached to the keel punch handle and secured it to the trial base by turning the knurled handle. The entry hole was prepared for the tibial stem using the 1/2" drill guide and oversize reamer. Using the threaded punch handle and appropriate keel punch, the punch was slided through the guide until the punch was fully seated. The rim of the punch is designed to engage the trial base, keeping it from being inserted too deep. The threaded handle has a mark indicating the depth that the punch should be impacted. Once the punch was seated,the punch guide was removed leaving the trial base and stem in place for a trial reduction. After satisfactory reduction, the patella was denervated circumferentially using the cautry.

With the knee flexed, the appropriate size femoral trial was placed on the distal femur using the femoral impactor. The trial tibial insert of equal size and appropriate thickness was inserted onto the trial base and complete the trial reduction.

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 closure of the capsule and the extensor mechanism patella femoral tracking was assessed. Wound closure done in layers. Compressive dressing was given.

Post – OP Protocol

The patients knee was immobilised in a Jones compressive bandage and a knee immobiliser immediately post operatively. The patients were started on IV antibiotics and DVT prophylaxis in the form of subcutaneous low molecular weight heparin.

1st post op day, patient was taught static quadriceps exercises. 2nd post op day, the dressing was debulked and wound inspected. Patient was made to walk full weight bearing within the limits of pain with the knee immobiliser and advised to continue static quadriceps exercises.

4th post op day, knee flexion was started and patient was taught dynamic quadriceps exercises. IV antibiotics were given for the first 48 hours post op and the switched over to oral antibiotics for the next five days. DVT prophylaxis was given for the first five days post operatively. 12th post op day, sutures were removed and patient was advised to continue regular physiotherapy.

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 and radiologically using the Knee Society Score at an interval of 3 months, 6 months and 1 year post-operative.

Results

Age Distribution

Table 1: Age Distribution

AGE (YEARS)	FREQUENCY	PERCENT
51- 55	8	26.6
56-60	5	16.7
61-65	11	36.7
66-70	2	6.7
71 -75	3	10
76- 80	1	3.3
Total	30	100

The majority of the patients were from the age group of 61-65 years which accounts for 36.7% of patients in our study. The youngest patient was 52 years of age and the oldest patient was 78 years. The mean age was 61.53 years.

Table 2: Gender Distribution There was a female predominance in the ratio of 3: 2 in our study, accounting for 60% of the patients.

Gender	Frequency	Pe Rcent (%)
Female	18	60.0
Male	12	40.0
Total	30	100.0

Table 3: Side Dis Tribution

Side	Frequency	P Ercent
Left	12	40.0
Right	18	60.0
Total	30	100.0

There was a predominance of right side in the ratio of 3 : 2 in our study, accounting for 60% of the patients

Table 4: Compar Ision of Indication

Indications	Frequency	Percent
Osteoarthritis (OA)	24	80.0
Rheumatoid Arthriti s (RA)	6	20.0
Total	30	100.0

There was a predominance of osteoarthritis in the ratio of 4 : 1 in this study, accounting for 80% of the patients.

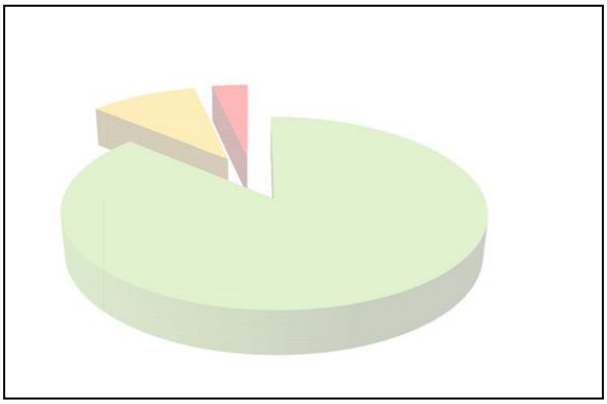
Table 5: Knee Clinical Score

	N	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Pre – op	30	28.13	27.50	26	7.54	14	39
Post - op	29	95.38	97.00	98	5.55	80	99

Note: One patient developed infection post operatively and was not assessed post operatively.
The average pre - op Knee Clinical Score was 28.13 in this study which improved to an average post – op score of 95.38

Table 6: Grading Of Knee Clinical Score

Grade	Frequency	Per Cent
Excellent	26	86.7
Good	3	10.0
Poor	1	3.3
Total	30	100.0



Score

Chart 1: Grading Of Knee Clinic Al Score

According to the Knee Society Clinical Scoring system of the 30 patients assessed in this study 26 patients (87%) had Excellent, 3 patients (10%) had Good, and 1 patient (3%) poor results. (Infection)

Table 7: Knee Functional Score

	N	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Pre – op	30	41.83	45.00	45	9.33	20	50
Post – op	29	83.79	90.00	90	8.62	60	90

Note: One patient developed infection post operatively and was not assessed post operatively

The average pre - op Knee Functional Score was 41.53 in this study which improved to an average post – op score of 88.49

Table 8: Gradin G of Knee Functional Score

	Frequency	Percent
Excellent	16	53.3
Good	11	36.7
Fair	2	6.7
Poor	1	3.3
Total	30	100.0

Distribution

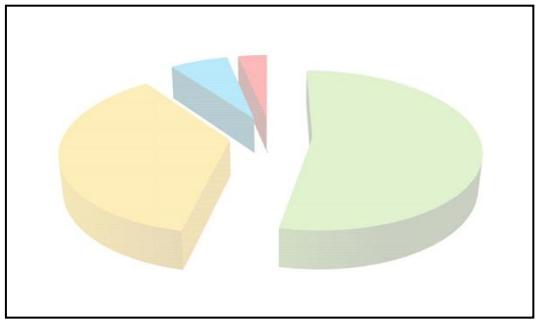


Chart 2: Knee Functional Score Distribution

According to the Knee Society Functional Scoring system of the 30 patients assessed in this study 16 patients (53%) had Excellent, 11 patients (37%) had Good, 2 patients (7%) had Fair and 1 patient (3%) poor results. (infection)

Table 9: Knee Clinical Score and Knee Functional Score Cross-Tabulation

Knee Clinical Score	Knee Functional Score			
	Excellent	**Good**	**Fair**	**Total**
Excellent	16	10		26
Good		1	2	3
Poor	1			

Table 10: Comparison between Pre-OP and Post-OP Knee Clinical and Functional Scores

	Paired Difference		**t**	**df**	**'P'**
	MEAN	Standard Deviation			**Value**
Pre –OP KCS – Post OP KCS	66.93	5.98	60.19	28	< 0.001
Pre- OP KFS – Post – OP KFS	42.06	7.96	28.44	28	< 0.001

The difference between the mean's of pre – op KCS a nd post – op KCS was 66.90 (64.65 to 69.30, 95% CI). The P value was significant (<0.001) when the pre - op and post – op Knee Clinical Scores were compared.

The difference between the mean's of pre – op KFS a nd post – op KFS was 42.06 (39.04 to 45.09, 95%CI). The P value was significant (<0.001) when the pre - op and post – op Knee Functional Scores were compared.

Radiological Results

The ideal placement of the tibial component was defined as 90 +/-5 deg to the long axis of the tibial shaft on both the antero-posterior and lateral X-rays. The desired placement of the femoral component was 5 +/- 5 deg of valgus on the antero-posterior X-rays.

Considering the given range of placement of components, the placement of tibial component in both AP and Lateral views was 90 degrees and the placement of femoral component in AP view was 5 degrees of valgus.

In our one year follow up study the component position and knee alignment was well maintained. There was no significant change in radiological outcome assessment in one year follow up.

Complication

In this study 30 patients were evaluated. One patient developed Infection.

At 6 months review, one patient developed on and off fever, pain and swelling of the knee joint, chronic discharging sinuses and inability to bear weight on the affected leg. X rays showed malposition and loosening of the implants. Wound swab for culture and sensitivity showed growth of MRSA.

Wound debridement and implant removal was done and a knee spanning AO external fixator was applied. Once the discharge had come down, acute docking of the cut surfaces of femur and tibia was done and the knee joint was finally arthrodised.

Discussion

Total Knee Arthroplasty is generally an effective procedure and is associated with substantial functional improvement. Elderly patients who were having difficulty mobilising because of degenerative arthritic found good relief after Total Knee Arthroplasty. There was a substantial relief of joint pain, increased mobility, correction of deformity and an improvement in the quality of life of the patients following Total Knee Arthroplasty.

With the varied amount of implant designs available the posterior cruciate substituting design was found to be effective [7]

C. Buz Swanik found that following total knee arthroplasty, patients were able to reproduce joint position and improve mobility significantly. These changes may result from the retensioned capsulo-ligamentous structures and reduced pain and inflammation. The balance index also improved significantly from the preoperative to the postoperative evaluation. The group treated with the posterior stabilized prosthesis more accurately reproduced joint position when the knee was extended from a flexed position. Retention of the posterior cruciate ligament does not appear to significantly improve proprioception and balance compared with those functions in patients with a posterior stabilized total knee design [8]

In this study 30 patients who met the inclusion criteria, all the knees were operated using a Posterior cruciate substituting design. Robert L Barrack *et al*. found that total knee arthroplasty with retention of the patella yielded clinical results that were comparable with those after total knee arthroplasty with patellar resurfacing.[9] Robert L Barrack *et al*. concluded that postoperative anterior knee pain is related either to the Component design or to the details of the surgical technique, such as component rotation, rather than to whether or not the patella is resurfaced [10]

Nutton concluded that knee function was not improved by patella resurfacing when compared to a matched group of patients without resurfacing [11] Wood *et al* concluded that total knee arthroplasty with patellar resurfacing exhibited inferior clinical results as compared to total knee arthroplasty with patellar retention. Total knee arthroplasty with patellar resurfacing exhibited significant limitation of knee extension, which was significantly associated with the presence of post-surgery anterior knee pain [12] In our study, none of the patellas were resurfaced. All patellas were circumferentially denervated. There was no anterior knee pain in any of our subjects.

The Knee Society Score was used to assess the outcome of Total knee Arthroplasty. The knee Society Score rating system was a logical outgrowth of the Hospital for Special Surgery (HSS) rating system.

The Knee Society Score system separates findings in the operated knee with findings in the patients function. The system is subdivided into a knee clinical score that rates only the knee joint itself and a knee functional score that rates the patient's ability to walk and climb stairs. As such the knee clinical score is not artificially affected by co morbid conditions. 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 there was significant improvement of Knee Clinical Score and Knee Functional Score following Total Knee Arthroplasty.

The Knee Society Roentgenographic evaluation and scoring system was developed for uniform reporting of roentgenographic results of Total Knee Arthroplasty. In our one year follow up study the component position and knee

alignment was well maintained. Long term follow up results are needed to strengthen the study.

Conclusion

Total Knee Arthroplasty improves the functional ability of the patient and the ability of the patient to get back to pre-disease state, which is to have a pain free mobile joint, as reflected by the improvement in the post-op Knee Clinical Score and Knee Functional Score. With the use of posterior cruciate substituting design, at one year follow up an average pre-op Knee Clinical Score of 28.13 improved to an average post-op Knee Clinical Score of 95.38 and an average pre-op Knee Functional Score of 41.53 improved to an average post-op Knee Functional Score of 88.49. There was significant association between the Knee Clinical Score and Knee Functional Score at one year follow up. The Knee Society Score is an effective scoring system as it incorporates clinical and functional outcome following Total Knee Arthroplasty.

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