International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(4): 600-604

www.orthopaper.com
Received: 18-08-2018
Accepted: 19-09-2018

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Total knee arthroplasty in severe varus osteoarthritis knee: A prospective study

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DOI: https://doi.org/10.22271/ortho.2018.v4.i4g.68

Abstract
Introduction: Arthritis is the most common disabling disease that affects millions of people in our India. The incidence of osteoarthritis is increasing with increase in ageing population. The purpose of the study is to prospectively study the functional outcome and radiological outcome of Total Knee Arthroplasty for severe varus deformity.
Materials and methods: In our study 20 cases of arthritis knee treated with Total Knee Arthroplasty. Both cruciate retaining and cruciate substituting prosthesis were used. Out of 20 cases 8 were males and 12 females, left side is more commonly involved than right side. The outcome was measured using the knee society scoring system at 6months and 1 year.
Results: In our study there is significant improvement in knee society scoring system post operatively. The average post-operative Knee Clinical Score was 91.6. The average post-operative Knee Functional Score was 86. In our study out of 20 cases anterior knee pain was noted in 6 cases, superficial infection in 2 cases which was treated with culture sensitive antibiotics and notching of anterior femoral cortex in 1 case.
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: Arthritis, cruciate retaining prosthesis, cruciate substituting prosthesis, knee society scoring system, transepicondylar axis, posterior condylar line, rotational alignment

1. Introduction
Arthritis is the most common disabling disease that affects millions of people in our country. The common causes of knee arthritis include Osteoarthritis (OA), Rheumatoid Arthritis (RA), Juvenile Rheumatoid Arthritis, Post traumatic Arthritis, Secondary Osteoarthritis and other types of inflammatory arthritis. The incidence of osteoarthritis is increasing with increase in ageing population. Osteoarthritis is a chronic and painful disease without a known medical cure. Osteoarthritis causes pain and loss of movement in the knee that lead to difficulty in performing daily activities. Medicines can relieve the pain but they cannot cure the underlying pathology. In most arthritic knees, some degree of instability, deformity, contracture or a combination of these elements, can be found [1, 2, 3].
A successful outcome needs precise surgical technique, sound implant design and kinematics with appropriate materials and compliance of patient in rehabilitation. The use of accurate instrumentation and an understanding of the basic principles inherent to the instruments are necessary to implant reproducibly well-aligned prostheses. The functional outcome of Total knee Arthroplasty can be assessed by using the Knee Society Score System. The Knee Society Scoring system is subdivided in to 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. This dual rating system eliminates the problem of declining knee scores associated with patient infirmity [4]. Functional outcome of total knee arthroplasty in patients with varus deformity has been assessed in this study.

2. Aim
The aim is to prospectively study the "Functional and radiological outcome of Total Knee Arthroplasty for Severe Varus Deformity" at the Department of Orthopaedics and Traumatology, Sri Ramachandra Medical College, Chennai.

3. Materials and Methods

Our study is a prospective study of 20 cases of arthritis of knee joints in 20 persons treated with Total Knee Arthroplasty. This was conducted from January 2016 to October 2018 in Department Of Orthopaedics nd Traumatology, Sri Ramachandra Medical College, Chennai. Our patients were selected based upon following criteria Age 40 to 70 years. (Varus deformity more than 20 degrees), Patients with Grade III and IV osteoarthritis, Rheumatoid Arthritis and Post Traumatic Arthritis. Patients with Grade I and II osteoarthritis, Post septic arthritis sequelae and any co-morbidity that prevents the patient from early mobilization were excluded.

All our patients were evaluated with detailed history and clinical examination. The preoperative medical evaluation was done for all to prevent complications. In the clinical examination, we looked for varus, valgus and fixed flexion deformities. The extensor mechanism was assessed for any quadriceps contracture. We also assessed for any ligamentous instability and laxity. Any limb length discrepancies were noted. The knee function was assessed preoperatively by using knee society score. Routine preoperative laboratory evaluations including complete blood cell count, electrolytes, urine analysis, blood grouping, ECG, chest roentgenogram and coagulation studies were done. Standard guidelines were utilized to get knee radiographs - weight bearing anteroposterior view and lateral view.

The patient is placed in supine position on the operating table. With strict aseptic precautions, painting and draping of the lower limb was done. Pre-operative antibiotics were given just before the skin incision. All cases were done under tourniquet control. We used anterior midline approach for the skin. 10 cm incision was made centering the patella and extending up to the tibial tuberosity. Medial par patellar arthrotomy was done to expose the knee joint. In knees with varus deformity there is sequential release of superficial collateral ligament, deep collateral ligament, pes tendons and semi-membranous muscle from the posteromedial corner of tibia. The trial prosthesis for tibia and femur is fixed with the articular insert, the ligamentous balancing and patellar tracking was assessed. The trial components are removed and bony ends were cleaned with saline. The tibial tray is implanted first with the bone cement. Excess cement is removed from the periphery of the component. The femoral component is cemented in a similar fashion with a few additional considerations. Usually, all components are cemented simultaneously with one batch (40 g) of cement. The press fit articular insert was fixed to the tibial tray. Tourniquet was released. Complete hemostasis achieved. Wound wash was given. Wound closed in layers with the knee in 30 to 40 degrees of flexion with suction drain. Sterile dressing was done. The average tourniquet time was 1 hr and 50 minutes with the average blood loss of 180ml. In the immediate post-operative period compression bandage was applied. Intravenous antibiotics were given for 48 to 72 hrs.

Epidural analgesia is continued for 48 hrs post operatively. Subcutaneous low molecular weight heparin was given as DVT prophylaxis. Static quadriceps strengthening exercise were taught, Patient was ambulated using standard walker with toe touch walking. 2ndPost operative day, the dressing along with drainage tube was removed and wound inspected. Full weight bearing was allowed with walker. 4thpost op day, patient was taught dynamic quadriceps exercises and active knee flexion up to 90^0. Patient continues supervised physiotherapy till discharge and sutures were removed on 12thpost operative day. Patient were advised to increase the active knee flexion to attain full range of knee movement by the end of 6 weeks and allowed climb stairs by the end of one month. Patients were followed up clinically and functionally at 3 months, 6 months and 1 year using the Knee Society Score.

4. Result

Our patient age ranges from 40 to 70 years with an average of 57 years. Most of our patients were between 50 to 70 years Male preponderance was noticed in our series with male to female ratio of 3:2. Osteoarthritis was the most common indication in our series followed by Rheumatoid arthritis and post traumatic arthritis. In our series left side was most commonly involved. The mean preoperative varus was 24 degrees. We had 18 patients in the range of 23-25 degrees. Average preoperative fixed flexion deformity of 10 degrees. 08 knees had lateral instability preoperatively and none had Anteroposterior instability. The mean preoperative walking distance was < 100 meters. Fifteen patients were able to walk only 50mts without pain.03 patients were able to walk >500mts preoperatively. One patient was house bound and one was unable to walk.

All patients were operated with Semi-constrained, Cemented, total knee implants were used. Patella resurfacing was not done. Osteophytes were removed from the patella and patella plasty was done in all patients. The Average operating time was 1hrs 25mins. All the patients underwent contralateral TKR as staged procedure and the time interval ranged between 8 months and 16 months. None of the patients underwent simultaneous bilateral total knee arthroplasty. The average blood loss for the knees were 525.25ml.

In our study anterior knee was seen in 30% of cases, superficial infection in 10% of cases and notching of anterior femoral cortex in 5% of cases. The average pre-operative Knee Clinical Score was 27.15 in this study, which improved to an average post op score of 91.6.According to the Knee Society Clinical scoring system out of 20 patients, 15 patients (75%) had excellent results, 5 patients (20%) had good results and 1patient (5%) had fair results. The average pre-operative Knee Functional Score was 37.25 in this study, which improved to an average post op score of 86. According to the Knee Society Functional scoring system out of 20 patients, 13 patients (65%) had excellent results, 6 patients (30%) had good results and 1patient (5%) had fair results. Out of the 15 patients who had Excellent Knee Clinical Scores, 13 patients (86.5%) had Excellent Knee Functional Scores, 2 patients (13.5%) had Good Knee Functional Scores. Out of the 4 patients who had good Knee Clinical Scores, 4 patients (100%) had Good Knee Functional Score. The difference between the means of pre – op KCS and post – op KCS was 64.45 (67.87 to 61.03, 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 means of pre – op KFS and post – op KFS was 48.75 (54.06 to 43.44, 95%CI). The P value was significant (<0.001) when the pre - op and post – op Knee Functional Scores were compared.

Knee clinical score

	N	MEAN	MEDIAN	MODE	STANDARD DEVIATION	MINIMUM	MAXIMUM
Pre-op	**20**	27.15	28	28	7.45	14	38
Post-op	**20**	91.6	92	98	7.34	75	99

Knee clinical and functional score

	N	MEAN	MEDIAN	MODE	STANDARD DEVIATION	MINIMUM	MAXIMUM
Pre-op	**20**	37.25	45	45	11.5	20	50
Post-op	**20**	86	90	90	5.98	70	90

	Knee Functional Score			
Knee Clinical Score		Excellent	Good	Fair	Total
Excellent		13	2		15
Good			4		4
Fair				1	1

Comparison between pre-op and post-op knee society score

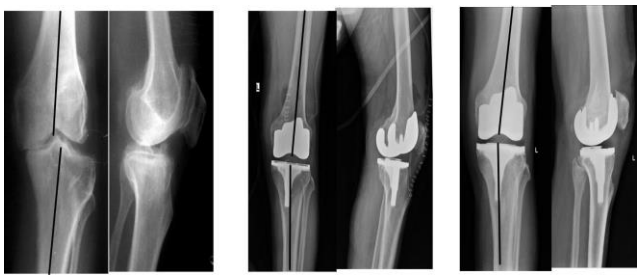
	PAIRED DIFFERENCE		t	df	'P' Value
	MEAN	STANDARD DEVIATION			
Pre –OP KCS – Post OP KCS	64.45	7.31	39.436	19	<0.001
Pre- OP KFS – Post –OP KFS	48.75	11.3	19.224	19	<0.001

5. Examples

Case 1: 52y, Bilateral OA, Right Knee Pre-op varus – 22 deg Observation score – 48 Function score – 40

Post-op valgus – 08 deg Observation score – 88 Function score – 90 Stage 3 soft tissue release. Follow up – 16 months. BMI – 24.

Case 2: 60y, Bilateral OA, Right Knee Pre-op varus – 24 deg Observation score – 40 Function score – 40
Post-op valgus – 02 deg Observation score – 90 Function score – 90 Stage 3 soft tissue releases. Follow up – 18 months. BMI – 24.



Case 3: 55y, OA, Left Knee Pre-op varus – 22 deg Observation score – 30 Function score – 40

Post-op valgus – 02 deg Observation score – 90 Function score – 90 Stage 2 soft tissue release. Follow up – 16 months. BMI – 26.

6. Discussion

Total Knee Arthroplasty in patients with arthritis knee will significantly improve the functional outcome and quality of life. Osteoarthritis was the most common indication followed by Rheumatoid arthritis and other inflammatory arthritis. In our study 20 cases of arthritis knee treated with cemented Total Knee Arthroplasty were studied. Functional outcome was assesed using Knee Society Score. In our study osteoarthritis (90%) is the most common indication followed by Rheumatoid arthritis (10%). In our study we used cruciate retaining prosthesis in 12 cases (60%) and cruciate substituting prosthesis in 8 cases (40%).All patellas were circumferentially denervated. In Total Knee Arthroplasty, an internally rotated femoral component not only leads to patellar maltracking, it also produces relative laxity on the lateral side in flexion and tightness on the medial side. Conversely, excessive external rotation of the femoral component leads to the laxity on the medial side with restriction of flexion due to ligament tightness on the lateral side. Hence, the force through the extensor mechanism is altered and leading to abnormal loading of the patella and polyethylene wear. In our study, the femoral component is rotationally aligned with reference to the transepicondylar axis. Post operatively the rotational alignment of the femoral component was studied and Functional outcome was assessed using Knee Society Score. Miller *et al*. stated that shear force across the patella femoral joint will be minimal when the femoral component is aligned parallel to the transepicondylar axis [5]. Poilvache *et al*. reported that the transepicondylar axis was a reliable axis for establishing rotational alignment, but other studies have documented the difficulty of accurately establishing this axis [6]. Berger *et al*. reported that there was no patellofemoral complication, when the femoral component is aligned between zero degrees (0º) to ten degree (10º) of external rotation [7]. In our study also the femoral component is aligned between 4 degree to 11 degree of external rotation. Hence the chance of patella femoral will be minimal. Alcott, Scott and Miller reported that excessive external rotation has been reported to increase the medial flexion gap and that leads to symptomatic flexion instability, and external rotation of the femoral component by as little as 5° from the transepicondylar axis has been reported to increase shear forces on the patellar component [8, 9].

In our study out of 20 cases, anterior knee pain was noted in 6 cases (30%), superficial infection was noted in two cases (10%) and treated with culture sensitive antibiotics. In our study Tayside grade I notching of anterior femoral cortex was noted in 1case (5%). The patient was advised to review at every 2months to look for increase in notching and per prosthetic fractures. Ritter *et al*. 2005 reported that the incidence of notching of anterior femoral cortex following total knee replacement was 30%. [10] In our study the femoral notching was noted in 5% of cases which is superior to studies by Ritter *et al*. Hirsh *et al*. 1981, Aaron and Scott 1987, Culp *et al*. 1987 reported 0.5% to 52% incidence of supracondylar fracture of the femur in TKR with anterior femoral notching [11, 12].

In our study the post-operative functional outcome was assessed by Knee Society Score. The Knee Society Score system is subdivided in to a knee score that relates only the knee score that rates only the knee joint itself and a functional score that rates the patient's ability to walk and climb stairs. This dual rating system eliminates the problem of declining knee scores associated with patient infirmity [4]. In our study there was significant improvement of Knee Clinical Score and knee Functional Score following Total Knee Arthroplasty. In our study, none of the patella was resurfaced. According to the Knee Society Clinical Scoring System out of 20 patients, 15 patients (75%) had excellent results, 5 patients (20%) had good results and 1patient (5%) had fair results. According to the Knee Society Functional Scoring System out of 20 patients, 13 patients (65%) had excellent results, 6 patients (30%) had good results and 1patient (5%) had fair results.

7. 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. It is possible to achieve the rotational alignment of the components correctly in unmitigated Total

Knee Replacement with appropriate surgical techniques, so that the complications due to malalignment of the components can be avoided.

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