

Functional Outcome of Total Knee Replacement in Osteoarthritic Knee with Fixed Flexion Deformity

Debi Prasad Nanda¹

Abstract

Osteoarthritis gradually leads to a flexion deformity which could be attributed to either soft tissue contractures or bony blocks due to proliferating abnormal osteophytes after which surgical intervention is advocated. The different surgical options which exist are high tibial osteotomy, proximal fibular osteotomy, and knee replacement which could be unicompartmental or Total. Amongst all these Total Knee replacement (TKR) provides a way to overcome all afflictions of arthritis. A prospective study was conducted in the Department of Orthopaedics in S.C.B Medical College & Hospital from October 2018 to October 2020 in 30 Patients who presented with a flexion deformity of the knee due to osteoarthritis. The mean age of the patients was 55.8 ± 6.25 years (range 44-69). The disease is more common in the geriatric age group patients with the highest proportion (36.67%) cases in the 56-60 years age group. The male to female ratio was almost 1:2. The left knee was found slightly more affected 16 (53%) than the right knee 14 (47%). Most of the patients 18 (60%) were in KL Stage III Osteoarthritis which signifies the negligence on part of the patient in seeking early medical care. The mean knee range of motion in flexion was $86.6^\circ \pm 10.5^\circ$ (range 68-110). Additional Varus deformity was seen in 10 (33.3%) cases. No cases of valgus deformity were found in our study. The difference between the means of pre and post-op FFD is 21.9 (18.37-25.42, 95% CI). The difference between the means of pre and post-op scores is 41.3 (35.0-47.5, 95% CI). The difference between the means of pre and post-op scores is 43.19 (37.0-49.3, 95% CI). In an Indian scenario where the patient comes late with gross varus and fixed flexion deformity, Posterior Cruciate Sacrificing Total Knee Replacement will give greater mobility and stability, so it can be the preferred mode of management. This implies the universality of Total Knee Arthroplasty as the Gold standard in the treatment of Osteoarthritis of knee cutting across demographic variation and socio-economic distributions.

Keywords: Total flexion deformity, Total knee replacement, Osteoarthritis, Functional outcome

Introduction

Degenerative arthritis of knee is a common affliction in our Indian population leading to major functional, medical, psychosocial and financial constraints on the affected person, family and society [1]. In developing countries like India the awareness regarding the progression of Osteoarthritis is often overlooked which leads to patients presenting with multiple deformities in their very first visit [2].

With gradually progressing arthritis a flexion deformity appears which could be attributed to either soft tissue contractures or bony blocks due to proliferating abnormal osteophytes [3]. Not only a flexion deformity but also coronal plane deformity like Varus (more common) and valgus (less common) are also seen. Conservative treatments which include physical therapy, anti-inflammatory medications, intraarticular injections, activity modifications and the use of cane for ambulation can only provide relief up to a finite period

of time after which surgical intervention is advocated [4].

The different surgical options which exist are high tibial osteotomy, proximal fibular osteotomy and knee replacement which could be unicompartmental or Total. Amongst all these Total Knee replacement (TKR) provides a way to overcome all afflictions of arthritis [5]. Total Knee Replacement alleviates the suffering of the patient, increases the functional mobility and vis a vis corrects any preexisting deformity if present [6]. As flexion contracture progresses beyond 20 degrees, gait is significantly hampered and difficulty with regaining extension may warrant surgical intervention. Similarly, as Varus or valgus laxity becomes severe, a constrained condylar type of prosthesis becomes necessary to prevent subsequent coronal plane instability [7].

In this study we wish to find out the functional outcome of Total Knee Replacement in Osteoarthritic Knee with Fixed Flexion Deformities and compare the postoperative complications and failures.

Material and methods

This was a prospective study conducted in Department of Orthopaedics in S.C.B Medical College & Hospital from October 2018 to October 2020 who presented with a flexion deformity of the knee due to osteoarthritis.

Ethical approval was obtained from the institutional ethical



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committee [IEC no: 255/26.08.2020]. 30 Patients fulfilling the inclusion/exclusion criteria were included in the study after obtaining informed written consent.

Inclusion Criteria

- Age group of 50 to 70 years
- Patients with OA knee with Flexion Contractures only.
- Patients fit for surgery.

Exclusion Criteria

- Age less than 50 or more than 70 years.
- Patients with inflammatory arthritis.
- Patients with history of recent (<3 months) intra articular injection in knee.
- Patients with deformities in the ipsilateral hip
- Patients who are medically unfit for surgery
- Patients with multiple comorbidities like Diabetes, recurrent UTI, psoriatic diseases on the involved knee.

Soon after admission, patients were kept in a below knee skin traction with 3 kg weight to reduce the amount of flexion deformity before surgery.

Antero posterior and lateral radiographs (Figure 1) of knee were studied to grade the osteoarthritis.



Figure 1: Radiograph of the Diseased Knee in AP & Lateral View



Figure 2: Scannogram for checking Limb Alignment

A scannogram (Figure 2) was done to assess the degree of deformity. written and informed consent was obtained. The need for supervised physical rehabilitation was explained. A lifelong restriction to sitting cross-legged and squatting was described to them.

In our study we used a Cemented Metal on Poly Posterior Substituting

Total knee Replacement system (Smith & Nephew TM, USA). Among the various types of implant design we have used GENESIS IITM Total Knee Replacement system of Smith & Nephew (Figure 1). It has the advantages of deeper, more lateralized trochlear groove which improves patellar contact and tracking, externally rotated femoral implant design which optimizes femorotibial rotational alignment and reduces the likelihood of notching the lateral anterior cortex, anatomically-shaped tibial baseplates having an improved fin design leading to improved coverage of the tibia, polished articular surfaces including the proximal tibia, which reduces wear by improving contact area and reducing contact stress in all articular surfaces. We used 40 grams of PALACOS® MV+G, a medium-viscosity bone cement with added gentamicin for antibiotic prophylaxis

Surgical Procedure for Flexion Deformity Correction

A medial parapatellar retinacular approach was used with keeping the medial skin flap as thick as possible by keeping the dissection just superficial to the extensor mechanism.

To equilibrate the flexion-extension space, a soft tissue release was carried out in stages, checking the extension gap after each step. First, a periosteal elevator was used to elevate the capsule from the posterior femur. Both the anterior and posterior cruciate attachments from the intercondylar notch of the femur were removed and the soft tissue capsular attachments in the posterior femur are dissected from the posterior femur (Figure 3).



Figure 3: Additional bone resection of the distal femur

The extension gap was again measured, and if more release is required, the dissection is carried more proximal releasing the gastrocnemius muscle origins from the femur. Again the extension gap is evaluated. If more release is required, we carefully dissected the medial and lateral corners approaching the posterior aspects of the medial and lateral collateral ligaments. We avoid resecting the collateral ligament attachments. After all of the posterior capsule, gastrocnemius muscular origins, and posterior corners have been resected along with the posterior aspects of the collateral ligaments, if the extension gap remains too tight, we would then resect more bone

from the distal femur. The additional bone resection of the distal femur (Figure 18) was done last because it significantly affects the joint mechanics by migrating the joint line proximally. The soft tissue dissection of the posterior aspect of the joint and modest proximal migration of the joint line would correct most of the deformity and resolve the flexion-extension gap inequality.

Clinical follow-up was done at 2 weeks, 4 weeks, 8 weeks, 4 months, 6 months, 12 months intervals regarding.

- Assessment of movements of knee.
- Improvement in Gait.
- Subsidence of Pain (As measured by VAS score)
- Checking for recurrence of any flexion deformity or any complication
- Improvement in Knee Society Score.

Statistical Analysis

The sample size was calculated using the formula $[n = z^2 pq / d^2]$, $z =$ confidence co-efficient = 1.96, $p =$ proportion of outcome = 0.5, $q = 1 - p = 0.5$, $d =$ absolute precision = 0.2, $n = 24$, with expected dropout of 25% [6] total No. of samples size = 30].

We have used the student's t test for continuous variables like fixed flexion deformity, functional knee society score, clinical knee society score for the test of significance. P value < 0.05 was consider as statistical significant. Confidence interval was set as 95%. We used Microsoft Excel 2013 to calculate mean, percentage mean and range for quantitative data.

Results

In this study 30 patients of Osteoarthritic knee with Fixed Flexion deformity was included. All of these patients underwent Cemented Metal on Poly PCL Substituting Total Knee Replacement (Smith & Nephew TM, USA) by the conventional medial Para patellar approach.

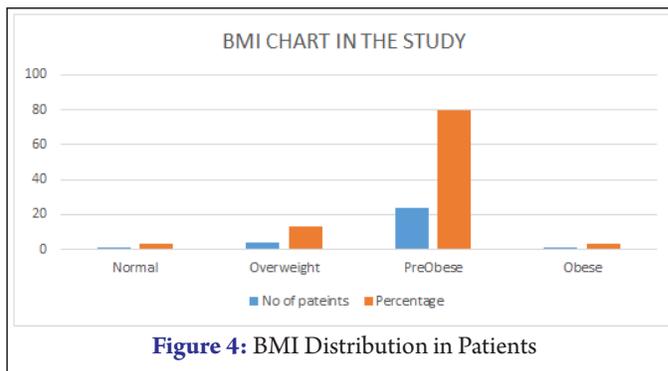
No patient has been lost to follow up. The mean follow up was 9 months \pm 1.2 (range 6.6-11.4 months) with the highest follow up of 14 months.

Age Distribution

The age of the patients varied from 44-69 years. The mean age of the patients was 55.8 ± 6.25 years (range 44-69). The disease is more common in geriatric age group patients with highest proportion (36.67%) cases in 56-60 years age group.

Out of the 30 patients 11 were male (36.67%) and 19 patients were female (63.3%). The male to female ratio was almost 1:2. Left knee

Age Group(in years)	No of Patients	Percentage
40-45	1	3.33%
46-50	5	16.67%
51-55	8	26.67%
56-60	11	36.67%
61-65	3	10%
66-70	2	6.67%



Grade	Radiologic Findings
0	No radiological findings of osteoarthritis
I	Doubtful narrowing of joint space and possible osteophytic lipping
II	Definite osteophytes and possible narrowing of joint space
III	Moderate multiple osteophytes, definite narrowing of joint space, small pseudocystic areas with sclerotic walls and possible deformity of bone contour
IV	Large osteophytes, marked narrowing of joint space, severe sclerosis and definite deformity of bone contour

Grade	No of Patients	Percentage
I	0	0
II	7	23.30%
III	18	60%
IV	5	16.67%

was found slightly more affected 16 (53%) than the right knee 14 (47%).

We used the WHO guideline with modification for Asian population for estimation and categorizing the BMI of our patients.

The majority of our patient 24 (80%) fell under the preobese category. It verifies the fact that being obese is a risk factor for developing early osteoarthritis.

We used the Kellgren-Lawrence radiologic grading system to determine the stage of OA.

Most of the patients 18 (60%) were in KL Stage III Osteoarthritis which signifies the negligence in part of the patient in seeking early medical care.

Pre operative Parameters

The average fixed flexion deformity seen was $24.8^0 \pm 9.25^0$ (range 5-42). The mean knee range of motion in flexion was $86.6^0 \pm 10.5^0$ (range 68-110). Additional Varus deformity was seen in 10 (33.3%) cases. No cases of valgus deformity was found in our study.

The functional Knee Society Score was on an average 44.7 ± 16 (range 14-78). The clinical Knee Society Score was ranging from 11 to 71 with a mean of 35.7 ± 15 .

TABLE 3: Variation in Pre op FFD in Patients		
Range of FFD(in degrees)	No of Patients	Percentage
10-May	4	13.30%
15-Nov	2	6.67%
16-20	0	0
21-25	7	23.30%
26-30	10	33.30%
31-35	5	16.67%
36-40	1	3.33%
41-45	1	3.33%

Post Operative Parameters

We have considered a post-operative residual deformity of $< 5^{\circ}$ as 0° . In the post op period most of the patients 22 (73%) had no residual clinically significant deformity at 1 year follow up. The mean residual deformity was $2.9^{\circ} \pm 2.75^{\circ}$ (range 0-11).

The mean post op flexion achieved was $95.1^{\circ} \pm 7.25^{\circ}$ (range 81-110). The average functional knee society score was 86 ± 5.75 (range 74-97). The mean clinical knee society score was 78.89 ± 7.5 (range 61-91).

As per the Knee society scoring guideline the functional outcomes can be graded as follows.

Considering the functional knee society score as the benchmark the post op outcomes can be clubbed as such

We achieved excellent results in 25(83.3%) cases. None of our cases had a poor or fair outcome.

TABLE 4: Residual FFD Post Operatively		
Range of FFD(in degrees)	No of patients	Percentage
0-5	22	73%
10-Jun	7	23.30%
>11	1	3.33%

TABLE 5: Functional Outcome Grades	
Score	Category
<60	Poor
60-69	Fair
70-79	Good
80-100	Excellent

TABLE 6: Functional Outcome at 1 year follow up		
Category	No of patients	Percentage
Poor	0	0
Fair	0	0
Good	5	16.67%
Excellent	25	83.33%

Comparison of Pre and Post op Scores

We have used the student's t test for the tests of significance. We used the QuickCalc software in Graphpad.com for all our analysis. p value < 0.01 was considered as statistical significant. Confidence interval was set at 95%.

The difference between the means of pre and post op FFD is 21.9

(18.37-25.42, 95% CI). Applying the students t test the p value comes out to be < 0.0001 which signifies that it is extremely statistical significant.

The difference between the means of pre and post op scores is 41.3 (35.0-47.5, 95% CI). The P value is < 0.0001 which means this association is statistical significant.

The difference between the means of pre and post op scores is 43.19 (37.0-49.3, 95% CI). The p value is < 0.0001 which makes the association statistical significant.

A) Fixed Flexion Deformity		
	Pre op	Post op
Sample Size (N=)	30	30
Mean	24.8	2.9
Standard Deviation	9.25	2.75
B) Functional Knee Society Score		
	Pre op	Post op
Sample Size (N=)	30	30
Mean	44.7	86
Standard Deviation	16	5.75
C) Clinical Knee Society Score		
	Pre op	Post op
Sample Size (N=)	30	30
Mean	35.7	78.89
Standard Deviation	15	7.5

Discussion

Our study population was from in and around Odisha. We aimed to analyse the functional outcome in these patients diagnosed with Osteoarthritis of the knees with a flexion contracture who were treated with Total knee arthroplasty. The objectives of our study were to assess the outcome of patients undergoing total knee replacement for osteoarthritis at 2 weeks, 4 weeks, 8 weeks, 4 months, 6 months, and 12 months intervals post operatively with appropriate scoring system.

In our study we understood that our study population was motivated towards arthroplasty by the severity of pain more than the restriction of movements. Many authors had also found that the level of pain correlates with patient satisfaction and predicts the need for subsequent revision. The expectations of our patients were complete pain relief, independent ambulence and use of toilet, ability to climb stairs, use of public transportation and early return to their daily activities.

In our study we found that surgical intervention in form of total knee replacement not only improved the functional knee status but also improved the clinical knee score and it was statistical significant. (p value < 0.0001).

Chethan et al [8] in their study of 34 patients found 11 around the age group of 66-70 years. We found majority of patients in the age group 56-60 years (36.67%). This could be due to increased awareness

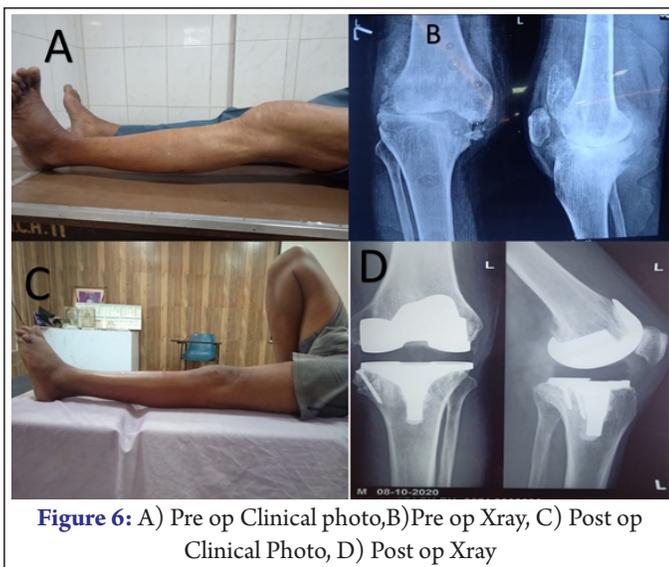


Figure 6: A) Pre op Clinical photo, B) Pre op Xray, C) Post op Clinical Photo, D) Post op Xray

among the patients. Similar to his study our study also had a female preponderance 19 (63.3%).

Both the sides of the knees were equally affected in our study with left side being slightly more. This could be due to the small sample size. Sachin et al [9] found a right side dominance in his study.

Zheng et al [10] did a systematic review and meta-analysis to find out the association between BMI and risk of OA. 14 studies were finally included in the analysis. The results showed that overweight and obesity were significantly associated with higher knee OA risks of 2.45 (95% CI 1.88 to 3.20, $p < 0.001$) and 4.55 (95% CI 2.90 to 7.13, $p < 0.001$), respectively. The risk of knee OA increases by 35% (95% CI 1.18 to 1.53, $p < 0.001$) with a 5 kg/m² increase in BMI. Subgroup analysis showed that obesity was an independent predictor of knee OA risk regardless of the study country, sample size, gender proportion of participants, duration of follow-up, presence of adjusted knee injury and assessed study quality above or below an NOS score of [8]. Our study supports the same as most of our patients 24 (80%) belong to the preobese category.

The landmark Framingham Osteoarthritis Study done in 1987 by Felson et al [11] classifies symptomatic OA beyond KL Stage II i.e. KL-III and KL-IV. Our study still supports this decade old literature as most of the patients 23 (76.67%) were in grade III or IV. The mean pre op FFD of our patients was $24.8^{\circ} \pm 9.2^{\circ}$ which is more than what was seen by Cheng et al [12] $16.88^{\circ} \pm 5.73^{\circ}$ in his study of 689 patients. The discrepancy could be due to low SES of our patients seeking medical care very late. Similarly we observed less mean pre op flexion $86.6^{\circ} \pm 10.5^{\circ}$ than that of him $110.91^{\circ} \pm 15.99^{\circ}$. 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. 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.

Post op X-ray

We achieved a post op Knee clinical score 78.89 ± 7.5 while most of the patient have a pre op score of 35.7 ± 15 . Sachin et al [9] also obtained a pre op Knee society score (Functional) of 41.67 and post operatively 87.33. We obtained almost similar results as our post op Knee society score (functional) was 86 and preoperatively it was 44.7 ± 16 . He obtained excellent outcome in 40 (80%) patients in his study. We got almost similar results i.e. 83.5% patient reported an excellent outcome 1 year after surgery. Chethan et al [8] found 3% incidence of complication like knee stiffness, infection. None of our patients develop any complication like periprosthetic joint infection or knee stiffness. It is possibly due to maintaining strict asepsis in OR and abiding patients to a rehabilitation program. No patients had DVT/PTE, as we advocated active exercises of calf and ankle from the very first postoperative day.

Fixed flexion deformities of the knee can be functionally limiting and physically debilitating due to the increased demands upon the quadriceps mechanism. After TKR, residual flexion contractures are associated with poorer clinical scores and greater forces upon the contralateral knee. Using gait and force plate analysis, Harato et al [13] confirmed that there was greater force placed on the contralateral knee if a flexion contracture persisted after TKA.

Clearly, flexion deformities must be corrected post TKR and the correction maintained in order to maximize functional results after surgery.

Total Knee Arthroplasty is generally an effective procedure and is associated with substantial functional improvement. Elderly patients who were having difficulty mobilizing because of degenerative arthritis 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 Posterior Cruciate Sacrificing Total Knee Arthroplasty. Significant advances have occurred in the type and quality of the metals, polyethylene, and, more recently, ceramics used in the prosthesis manufacturing process, leading to improved longevity.

Conclusion

Total Knee Arthroplasty improves the functional 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. In an Indian scenario where patient comes late with gross varus and fixed flexion deformity, Posterior Cruciate Sacrificing Total Knee Replacement will give greater mobility and stability, so it can be preferred mode of management. The functional outcome analysis in our study population highlights the fact that patients from rural background with moderate activities and from agrarian society when treated with standard operative techniques, post-operative rehabilitation protocol, proper patient education and lifestyle modification can achieve results comparable to any other subset of population in the society. This implies the universality of Total Knee Arthroplasty as the Gold standard in the treatment of Osteoarthritis of knee cutting across demographic variation and socio-economic distributions.

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Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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