

## **Radiographic Outcome of Total Knee Replacement Surgery, In Patients with Osteoarthritis Knee with Greater Than 20 Degrees Flexion Contracture**

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**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

### **Abstract**

**Objectives:** To assess the functional outcome of total knee replacement surgery in patients with Osteoarthritis knee greater than 20 degrees flexion contracture using the Bristol knee score

**Materials and methods:** A prospective observational study was done on 88 cases of osteoarthritis knee with fixed flexion contracture greater than 20 degrees who had undergone primary total knee arthroplasty in orthopedic wards of Government Medical College, Thiruvananthapuram for a period of 6 months. Data was collected using structured proforma and questionnaire. The fixed flexion deformity of knee was calculated radiographically both pre and post operatively. Pre and post operative scores were compared using Wilcoxon sign rank test.

**Results:** The study included 88 patients with fixed flexion deformity of the knee greater than 20 degrees who fulfilled the criteria. The age of patients ranged from 46 to 80 years. The mean age was 61.7. Females (92%) were predominant in our study. Most had right sided involvement (62.5%). The median preoperative fixed flexion deformity measured was  $22^{\circ} \pm 1$  which was corrected to median postoperative flexion deformity of  $5^{\circ} \pm 6$ . Post operatively 60.2% of the patients improved to fixed flexion deformity  $< 5^{\circ}$ , 31.8 % to 6-10  $^{\circ}$  and 8% to 11-15 $^{\circ}$ .

**Conclusion:** Most of the patients in the study who had undergone Total knee replacement surgery had good functional results and high satisfaction as evidenced by improvement in post operative flexion deformity. Total knee replacement surgery enabled the patients to reach pre-disease state.

**Keywords:** Total Knee Arthroplasty, fixed flexion deformity of the knee, Bristol Knee score, Osteoarthritis, Knee.

### Introduction

The most common form of arthritis, osteoarthritis, is a major cause of old age disability. This degenerative and progressive joint illness affects about 250 million people worldwide. <sup>1</sup>African Americans, obese patients, and elderly women (approximately 35% of patients over 65 years old) are most likely to have OA.<sup>2</sup>The propensity of the population to live longer and the rising prevalence of obesity will most probably result in a major increase in the number of patients suffering from OA Knee in the upcoming years. Given the functional impairment and limitations linked to this condition as well as how severely it impacts our society's social and economic components, this is extremely worrying.

The distal femur, proximal tibia, and patella, along with ligaments, a synovial membrane, and other osseous elements together make up the knee, the largest synovial joint in humans.

The avascular cartilage is lubricated and nourished by synovial fluid, which is produced by the synovial membrane. Unfortunately, knee joints are frequently stressed and worn down, which makes it a common site for uncomfortable conditions like osteoarthritis.<sup>3</sup>

Based on the etiology osteoarthritis is classified into two categories:

Primary (Idiopathic) and secondary (due to mechanical misalignment or trauma). According to radiographic data, Kellgren-Lawrence proposed a system for evaluating the severity of OA in 1957. <sup>4</sup>OA was often thought to be a degenerative condition that only affected the cartilage, but current research suggests that it is actually a complicated condition with several potential

causes, including trauma, inflammation, mechanical pressures, biochemical reactions, and metabolic imbalances.<sup>5</sup>

It is also well recognised that tissues other than cartilaginous tissue are involved. The disease is initially painless because cartilage lacks the vascularity and innervation necessary to start an inflammatory response. Therefore, changes to the non-cartilaginous elements of the joint, such as the synovium, joint capsule, ligaments, subchondral bone, and muscles surrounding the joint, are the primary source of pain. <sup>6</sup>As the condition worsens, the above structures are impacted, and changes such as bone remodelling, osteophyte growth, weakened muscles around joints, synovial effusion, and ligament laxity can be noted. <sup>7</sup> There is ongoing discussion about whether the inflammatory response causes the changes in OA or whether the inflammation is a side effect of the OA changes because the role of inflammation in the development of osteoarthritis is poorly understood.. <sup>6</sup>

A typical finding in OA is synovitis, which can be connected to the severity of the disease and can be present in the early stages of the disease but becomes more pronounced as the disease progresses.<sup>8</sup> Synovial fluid analysis in osteoarthritis will reveal the presence of numerous inflammatory mediators such as plasma proteins (C-reactive protein, which is proposed as a marker for the onset and progression of osteoarthritis), leukotrienes (LTB<sub>4</sub>), prostaglandins (PGE<sub>2</sub>), cytokines (IL6, IL1a, IL17, IL21, IL18, IL15, and TNF), growth factor<sup>s</sup> (NGF, TGFβ, VEGF, FGFs.), nitric oxide, and components of the complement pathway. All of these elements have the ability to locally activate matrix metalloproteinases and hydrolytic enzymes such prostaglandin E and cyclooxygenase 2, which cause the

cartilage to break down by destroying collagen and proteoglycan.<sup>9</sup>

The extracellular matrix is broken down, releasing specific chemicals that the innate immune system can identify (damage-associated molecular patterns), usually as a defence strategy. On the other hand, inflammation can destroy tissue if it persists for a long time and is poorly controlled. Studies on animals have demonstrated that osteophytes, a pathognomic sign of osteoarthritis, are developed by macrophages. Body has protective molecular mechanisms which include various growth factors (platelet-derived, insulin-like, fibroblast 18, and TGF B), unfortunately, these mechanisms are altered in patients with osteoarthritis of knee and may become detrimental to the joint.<sup>10</sup> Since OA is a degenerative disorder, it worsens with age and has fewer chances of reversing and restoring damaged cartilage. As a result, current treatment approaches focus on symptom management unless the disease's severity necessitates arthroplasty surgery.

The knee has a permanent flexion deformity if it cannot passively or actively extend all the way to 0°. Numerous factors, including bone impingement, posterior capsule contracture, hamstring shortening, and ligament contracture, can cause the knee to develop pre-operative fixed flexion deformity. After total knee replacement, flexor contractures that are still present might cause comparable problems and put stresses on the opposing limb.

An effective and secure procedure for regaining function, reducing discomfort, and correcting deformities brought on by arthritis is total knee replacement. Total knee arthroplasty has become a standard of care and a dependable form of treatment for severe knee arthritis, and its popularity is growing across

the globe as a result of technological developments and implants' increased endurance. It was trustworthy and had lasting effects thanks to the cemented attachment. To achieve stable tibiofemoral and patellofemoral joints, which depend on precisely aligning joint components and correct balancing of the soft tissues, is the primary objective of total knee arthroplasty. A complete knee replacement's effectiveness can be measured by a number of variables, including pain reduction, improved functional results, and range of motion.

Total knee replacement surgery has seen numerous changes in the past 20 years and is still undergoing significant change. These alterations include adjustments to component shape, knowledge of the rotational alignment of the components, the availability of numerous sizing alternatives, modularity, and advancements in instruments for precisely rectifying deformities as well as cementing procedures. The alignment and knee kinematics of the replacement knee should be as close to normal as possible. The most prevalent kind of arthritis is thought to be osteoarthritis. It typically affects the hands, hips, knees, spine, and feet, but the hands and weight-bearing joints (such as the hips and knees) are most frequently impacted. Regardless of physical condition, gender, marital status, social class, or ethnic background, arthritis affects adults, particularly older adults, and is one of the primary causes of disability.<sup>11</sup>

OA management is primarily the management of the symptoms. The primary goals of OA management are to relieve pain and maintain range of motion, and prevent joint damage and functional disability<sup>12</sup>. There are several approaches to OA management, including education (e.g., OA management strategies), intra-articular (IA) corticosteroid injections<sup>13</sup>, exercise<sup>14</sup>,

bracing<sup>15</sup>, alternative therapy<sup>16</sup>, physiotherapy<sup>17</sup>, pharmacotherapies (e.g., NSAIDs)<sup>18</sup>, and surgery<sup>19</sup>. Surgery is recommended only after all other treatment modalities have failed to bring the desired outcome.<sup>20</sup>

A difficult issue for the surgeon performing a total knee replacement is fixed flexion contracture. Patients who have flexion contractures greater than 40 degrees are wheelchair-bound. Therefore, it's important to stop flexion contractures from getting worse. In flexed knee while weight bearing, the quadriceps must contract to prevent buckling; hence, in patients with fixed flexion deformity, the quadriceps must expend a significant amount of energy to balance out the increased stresses across the knee joint. Numerous studies have discussed the effects of flexion contractures after total knee replacement and the natural course of events after TKR. Only after anesthesia may flexion deformity be graded because the muscle spasm's impact has been masked. It has been discovered that the flexion deformity is substantially influenced by pain and muscle spasm around the joint.

To achieve the best results, considerations regarding the size of the implant, the thickness of bone to be removed, and the degree of ligamentous imbalance to be rectified must be made when planning TKA in patients with a flexion deformity. Even while certain contractures that persist after TKA may gradually disappear, the deformity is likely to continue if there is still  $> 15^\circ$  of extension 3 months following the operation. The likelihood of developing residual flexion contracture following total knee replacement surgery increases with age and with male sex.

A combination of ligament, capsule, and bone abnormalities leads to a flexion deformity. Intercondylar osteophytes, which prevent mechanical extension during

rheumatoid arthritis, are present. The posterior osteophyte will further aggravate the flexion contracture by pressing against the posterior capsule. Over time, the knee's soft tissues also contract, contributing to the deformity.<sup>21</sup>

Knee osteoarthritis is a condition that can be treated by total knee replacement surgery, which is regarded as a successful intervention. According to reports, TKRs enhance mobility and decrease discomfort. Even though TKR is regarded as a successful intervention, issues have been noted in the research. There hasn't been any research on the results of total knee arthroplasty in Indian patients with fixed flexion contracture. So, the current study is being done to know the radiographic outcome in patients with  $> 20^\circ$  fixed flexion deformity undergoing primary total knee arthroplasty

### **Methodology**

A prospective observational study was conducted on 88 total knee arthroplasties which were performed in 88 patients meeting the inclusion and exclusion criteria in the Department of Orthopaedics, Government Medical College Thiruvananthapuram from 2022-2023.

The age of the patients varied from 46 years to 80 years, average being 61.7 yrs. There were 81 females and 7 males. Those patients who were 18 years and above and with fixed flexion deformity of knee who have osteoarthritis in either unilateral or bilateral knee were included in the study after obtaining informed consent. Patients who were not willing to give consent for study as well as those with history of surgery in the same joint, Loco-regional tumor or metastasis, septic arthritis of knee joint, deformity and/or disability of ipsilateral hip and ankle joint were excluded from the study.

## Sample Size

Sample size is calculated using the formula

$$n = 4PQ / d^2$$

In a study by Keith R. Berend, Adolph V. Lombardi and Joanne B. Adams

titled —Total Knee Arthroplasty in Patients with Greater than 20 Degrees Flexion Contracture

$$P = 67$$

$$Q = 100 - P = 33$$

$$d = \text{absolute precision} = 10$$

$$\text{Hence } n = 88.4$$

Sample size is 88

88 patients who had total knee arthroplasty procedures for arthritic knees with more than 20 degrees of flexion contracture were prospectively enrolled in the study. Following approval by the institutional ethics committee, the study length was limited to six months. The study was carried out at the Government Medical College in Thiruvananthapuram's Department of Orthopaedics.

When the study individual was followed up with six weeks later, radiographs were used to gather data from them. A self-report questionnaire was used to rate difficulty and interference with daily life. FFD was calculated radiographically before and after surgery. The data was collected from individual patient using a study proforma.

When taking knee radiographs, the usual protocols were followed. Standing lateral and anteroposterior images as well as an AP picture of the three joints with the patella facing forward were all captured. Osteophytes, collateral ligament laxity, coronal plane deformity, posterior condylar deficits, tibial subluxation, bone quality, limb alignment, and different angles were assessed. When taking knee radiographs, the usual protocols were

followed. Standing lateral and anteroposterior images as well as an AP picture of the three joints with the patella facing forward were all captured. Osteophytes, collateral ligament laxity, coronal plane deformity, posterior condylar deficits, tibial subluxation, bone quality, limb alignment, and different angles were assessed. All of the patients underwent the required blood, urine, and radiographic pre-operative work-up before being taken for elective surgery. Written & informed consent was obtained from the patients before surgery. All patients were told to wash their limbs with soap and water the day of surgery. The preoperative parenteral antibiotic cefuroxime + sulbactam 1.5g was given one hour before surgery. The X-rays, drugs, and patient are brought into the operation room. The patient will be given post-operative epidural analgesia for 24 hours. Low molecular weight heparin is given as part of a deep vein thrombosis prophylaxis plan after the epidural is withdrawn. Intravenous antibiotics are continued for three to five days. On the first post-operative day, the patient is required to walk while completely weight-bearing and given instructions to conduct isometric quadriceps exercises. Depending on the drainage, the suction drain is normally removed in 36 to 48 hours. The patient is often released from the hospital five or six days after surgery. The 15th post-operative day will see the removal of the sutures. Patients were asked to continue their regular physiotherapy. At six weeks after surgery, the patient is evaluated clinically, functionally, and radiologically. Data analysis has been done using statistical package for social sciences (SPSS-27). Qualitative variables will be expressed in proportion and quantitative variables will be expressed in mean and standard deviation. Wilcoxon sign rank test is used for comparing pre and post FFD values

**Results**

Out of 88 patients, age ranges between 46 to 80 with a mean age of 61.39. (figure 1). The oldest patient was 80 years old, and the youngest patient was 46 years old. 92% of the study's participants were female, making up the majority. (Figure 2). The right side accounted for 62.5% of the cases, while the left side accounted for 37.5%. (figure3)

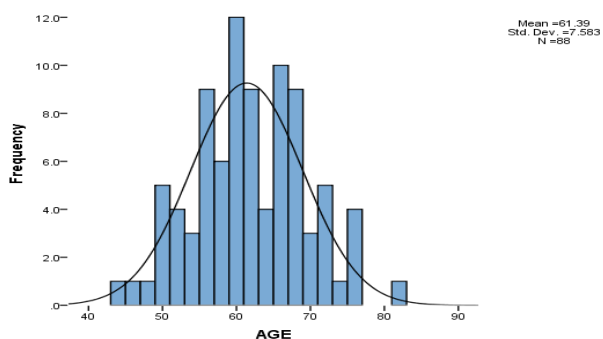


Figure 1: Age distribution of the study participants

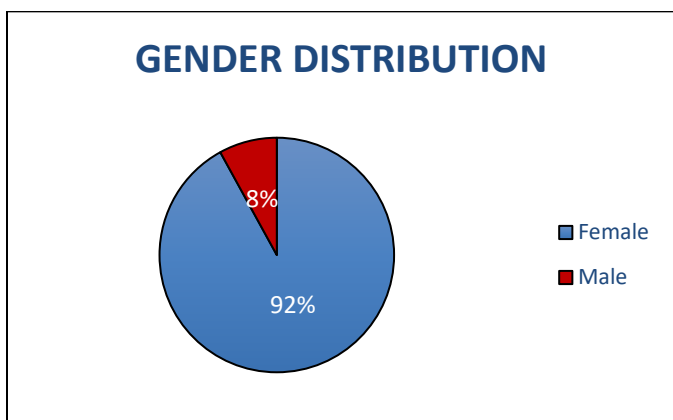


Figure 2: Gender distribution of the study participants

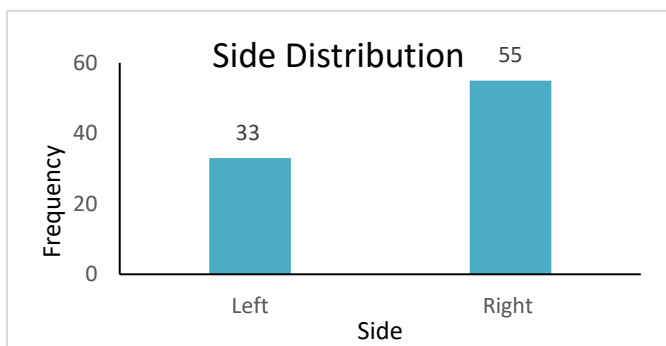


Figure 3: Side distribution among study participants

The median preoperative FFD of the 88 patients that underwent arthroplasty was 22°. The least angle discovered was 21°, and the maximum angle investigated was 26°. (table 1) Of the 88 patients who underwent total knee replacement surgery 22 patients had complete resolution of fixed flexion deformity Post operatively 60.2% patients improved to fixed flexion deformity <5°, 31.8% to 6-10° and 8% to 11-15° (table 2).

Table 1: Preoperative FFD among study participants

Preoperative FFD		
	Frequency	Percentage
≤10	00	00
>10	88	100
Total	88	100

Table 2: Post operative FFD among study participants

Postoperative FFD		
	Frequency	Percentage
≤10	81	92
>10	7	8
Total	88	100

Pre and post-operative FFDs are compared using Wilcoxon sign rank test (normality assumption violated, assessed using Shapiro-wilk test  $p < 0.05$ ) Median FFD is statistically significantly different between pre- and post-operative groups. I.e.,  $z = -8.157$ ,  $p < 0.001$  i.e., median FFD Decreased from the pre-operative group ( $22 \pm 1$ ) to post-operative group ( $5 \pm 6$ ). (Table 3)

Table 3: Comparison of pre and post operative FFD values among study participants.

	Median	Inter- Quartile Range	Z Value	P Value
Pre- Operative FFD	22	1	-8.157	<0.001
Post- Operative FFD	5	6		

Test applied: Wilcoxon sign rank test

P value <0.05 statistically significant

### Discussion

Patients' functional outcomes and quality of life are improved after having a total knee replacement for knee arthritis. The most frequent type of indication was observed to be osteoarthritis, followed by rheumatoid arthritis and other inflammatory arthritis. There are numerous prosthetic options for knee replacement. The patient's knee joint's anatomical condition affects the prosthesis choice. The surgical approach, soft tissue balance, bony correction, rotational alignment of the femoral and tibial components, and cementation of the prosthesis are some of the aspects that affect the functional outcome. The degree of bone resection and soft tissue balance are key factors in the treatment of fixed flexion deformities of the knee. When doing knee replacements, it's important to consider bone alterations such the existence of posterior osteophytes and contracture of the posterior tissues.

The study included 88 patients with knees with fixed flexion deformity of the knee greater than 20 degrees who fulfilled the criteria. The age of patients ranged from 46 to 80 years. The mean age was 61.7. Females

(92%) were predominant in our study. Most had right-sided involvement (62.5%). Patients were treated based on hospital protocol and were followed up at 6 weeks for clinical and radiological evaluation. flexion angle was measured. The median preoperative fixed flexion deformity measured was  $22^{\circ} \pm 1$  which was corrected to median postoperative flexion deformity of  $5^{\circ} \pm 6$ . Post operatively 60.2% of the patients improved to fixed flexion deformity  $<5^{\circ}$ , 31.8 % to 6-10 $^{\circ}$  and 8% to 11-15. $^{\circ}$  Keith R Berend and et al noted in their study in patients with greater than 20 degree flexion contracture who had undergone total knee arthroplasty, 84.5% of knees had full extension or less than 10% contracture after surgery. our study findings are comparable to their findings.<sup>22</sup>

In their investigation of 35 patients with preoperative flexion contractures less than 30 degrees, Tanzer et al. observed that the average flexion contracture was  $2.9^{\circ}$  at the final follow up. Only 5 individuals exceeding  $20^{\circ}$  were included in the investigation by Tanzer and colleagues.<sup>23</sup>

Our study however does have some limitations. Due to the time constraints a greater number of patients couldn't be included. The study included patients with osteoarthritis knee treated with posterior stabilized implant. These factors might have therefore affected the results obtained and might limit the widespread application of the same to patients treated with other implants. To summarize, our study in patients with fixed flexion contracture more than 20 degrees and who had undergone total knee replacement showed that improvement in their fixed flexion after total knee replacement surgery and have improvement in functional outcome which enabled them to enjoy pain free supple joint with near normal function.

## Conclusion

Median fixed flexion deformity is statistically showing significant difference between pre and post operative values which suggests correction of flexion deformity was significant post operatively and total knee replacement surgery is very successful in correcting flexion deformity. Patients who underwent total knee replacement surgery for fixed flexion contracture were able to enjoy the benefit of pain-free mobile joint and get back to a pre-disease state with near-normal functional ability.

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