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Original Research Article

Study Comparing the Function and Quality of Life of Patients Undergoing Total Knee Arthroplasty with Fixed and Mobile Tibial Platforms

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Abstract

Objective: To compare patients receiving total knee arthroplasty (TKA) with fixed tibial platform versus moveable tibial platform in terms of function and quality of life.

Methods: 55 patients in Group A underwent TKA with a fixed tibial platform, and 55 patients in Group B underwent arthroplasty with a mobile platform during the course of our evaluation of 110 patients with knee osteoarthritis. The Western Ontario and McMaster Universities Arthritis Index (WOMAC), the Short Form Health Survey (SF-36), and the Visual Analogue Scale (VAS) of Pain were used to assess patients' function and quality of life before surgery as well as at six months, a year, two years, four years, and eight years after surgery.

Results: Regarding the numerous SF-36 dimensions, we saw that the patient groups' average behaviour in terms of functional capacity scores, physical aspects, pain, and emotional aspects varied statistically over time. There were no significant changes in the other quality of life dimensions. We can see that the pain measured by the VAS and WOMAC pain scores exhibited a mean change in both patient groups throughout follow-up. At a 2-year follow-up, they were statistically worse in group A while being comparable to group B in all other respects.

Conclusion: We found that the fixed platform group had reduced pain ratings and VAS after a two-year follow-up. These changes, however, did not persist at the halfway point, indicating that the mobile tibial platform arthroplasty offers a short-term benefit and may aid in the recovery process.

Keywords: Arthroplasty, Replacement, Knee; Quality of Life; Osteoarthrosis.

Introduction

Osteoarthritis has grown in importance as a health issue over the past several decades as a result of population ageing and the changes that the musculoskeletal system has undergone as a result of this process. [1-3] The signs and symptoms of this degenerative joint cartilage disease result in functional impairment and a decline in elderly people's quality of life. (4-9) These have been criteria for assessing various therapies, such as total knee arthroplasty (TKA). [10,11]

Mortality rates, morbidity, complications, and durability are used to assess the

success of TKA. However, due to the quick development of procedural improvements, these rates no longer accurately reflect the genuine benefit to the person's quality of life. [12-14] As a result, evaluations that included general or tailored questions about therapy have produced useful data. The Short Form Health Survey (SF-36) and the Western Ontario and McMaster Universities Arthritis Index (WOMAC) for TKA stand out among them as reliable measures of quality of life. [10,15] These surveys have demonstrated the positive effects of TKA in enhancing the function and general well-being of aged patients.

The two types of total knee arthroplasty TKA with fixed platform and TKA with moveable platform can be distinguished by the tibial component. The typical TKA with fixed platform, according to Wylde and Potter [16], can result in an increased stress in the posterior region of the tibial component, increasing polyethylene wear, raising the probability of failure, and necessitating revision. Theoretically, TKA with a movable platform has the advantage of self-aligning, minimising the incidence of anterior knee discomfort, and creating improved function since it permits higher rotational movement and better congruence of the polyethylene component.

Given that there is currently no agreement on the best outcomes and prior studies were deemed of low quality, the theoretical benefits of TKA with a mobile platform must be verified clinically. [17]The current study compares the quality of life and function of patients who received TKA on fixed and mobile platforms.

Methods

Our university's research ethics committee gave its approval to all procedures.

From January 2022 to December 2022, a randomised, double-blind clinical investigation was conducted in Varun Arjun Medical college & Nipun Hospital. Age between 55 and 70 years old, clinical symptoms and signs consistent with knee osteoarthritis, radiographic evidence of three-compartment osteoarthritis grades III, IV, and V, as determined by the Ahlbäck classification as modified by Keyes and Goodfellow, were the inclusion criteria. Absence of concomitant disorders affecting the lower limbs [4], neurological condition [5], nerve damage [6], and previous fractures [7]. The following circumstances precluded patients from being considered for the treatment: 1-infection; 2-flexion deformity > 10°; 3-angular deviations in varus and valgus > 25°; 4-focal tumour defect; 5-physical problems that would preclude proper implant support; and 6-coexisting life-threatening disease in the year following the procedure. The study excluded patients who stated that they would be unable to or uncertain about coming for a follow-up visit.

Patients who met the requirements and had a clinical and radiological indication for TKA were asked to take part in the trial. The free and informed consent form was signed by those who confirmed their participation. Block exchange randomization was employed with the goal of keeping a consistent distribution of patients throughout each study group. Eight patient blocks with various combinations were made. The group that each patient belonged to was contained in sealed, opaque envelopes with numbers ranging from 1 to 240. The first group (group A), which underwent TKA using a fixed tibial platform (LCS, Depuy Synthes, Warsaw, IN, USA), and the second group (group B), which underwent TKA using a mobile tibial platform.

Prior to and following surgery, all patients underwent assessments of function (WOMAC), quality of life (SF-36), and subjective pain perception (visual analogue scale [VAS] for pain) using questionnaires at 6, 24, 48, and 96 months.

Sample Size

To accept an alpha risk of 0.05 and a risk of 0.20, 98 patients were required for each group in order to detect an 08-point difference, or clinically significant difference, between the pre- and postoperative mean ratings for the dimensions of pain and function using the WOMAC questionnaire. 18 The anticipated common standard deviation (SD) was 20. To account for potential losses, the sample size was increased by 20%, resulting in a target sample size of 55 patients in each group.

Surgical Method

The same surgeon placed all prosthesis. A spinal anaesthetic block was carried out on each subject. Prophylactic antibiotic therapy with sodium cefazolin was used for 48 hours. The pneumatic tourniquet was frequently employed. The medial parapatellar arthrotomy access route was the anterior one. In each case, the patella was removed and replaced. The femoral component of each prosthesis was similar, and they were all later stabilised. The cruciate ligaments on both sides were cut. First, a horizontal tibial bone cut was made utilising an intramedullary femur guide and an extramedullary tibial guide. The parts were all glued together. A suction drain was routinely employed for 24 hours. Patients received low molecular weight heparin for thromboembolic prophylaxis for a total of 14 days.

Rehabilitation

It was advised to move quickly, thus on the first postoperative day, metabolic ankle exercises and quadriceps isometric workouts were carried out. After the suction drain was taken out on the second postoperative day, gait training with a walker and weight unloading in both limbs started. Each patient's pain and clinical condition tolerance was taken into account when performing gait training. Every one of them received two daily, one-hour bouts of continuous passive movement (CPM), with the angle of movement varying depending on the patient's tolerance for pain. The patient was allowed to leave the hospital on average five days following surgery, when they could independently walk with crutches or a walker and had nearly 90 degrees of knee flexion. One week after being released from the hospital, the outpatient physiotherapy sessions commenced. The duration of the outpatient rehabilitation programme, which was the same for both groups, was an average of two months.

Clinical Assessment

The WOMAC, which is made up of three domains: function, pain, and stiffness, was used to assess the function. The result, which ranges from 0 to 68, is formed by adding the points from each domain. The SF-36, which has a scale from 0 to 100 and 36 response options covering 8 concepts—functional capacity, physical aspect, pain, general health, vitality, social aspects, emotional aspects, and mental health—was used to measure quality of life. Additionally, the EVA was used, ranging from 0 to 10.

Using chi-squared testing, it was discovered that there was a relationship between the prosthesis kinds and the traits. [19] Summary measures (mean, SD, median, and quartiles, P25 and P75) were used to summarise the quantitative characteristics of the patients according to the types of prostheses, and the analysis of t-Studenttests was used to compare between the groups. [19] Due to the asymmetric distribution of scores, generalised estimation equation analyses with a normal marginal distribution and logarithmic link function were used to describe the scores of the evaluated scales according to the types of prosthesis at each evaluation moment and compare between the types of prosthesis and moments. This was done assuming a first-order autoregressive correlation between the moments of assessment. [20] When differences in scores were substantial, multiple comparisons of the Bonferroni

[21] were performed to compare groups and dates. The analyses were carried out using the patient data assessed, even taking follow-up loss into account. The tests were run with a significance threshold of 5%, and the findings were displayed as graphs of average profiles with the corresponding standard errors.

Results

Consecutive patient recruitment took place from January 2022 to December 2022. A final sample of 110 patients was selected after 1,100 out of 1,300 patients were evaluated and excluded. 55 patients received TKA with a fixed platform and 55 received TKA with a mobile platform, according to a randomization process. Six patients from the fixed platform group failed to adhere, and five patients died. In the group of people using mobile platforms, six people passed away, four failed to adhere, one suffered a cerebral vascular accident (CVA), and one ruptured the patellar ligament. After more than two years of follow-up, all fatalities took place. Six of the fixed platform group's 110 randomised patients and five of the mobility platform group's 110 patients had problems. Three cases of infection, two with embolisms, and one with severe venous thrombosis were observed in the fixed platform group. We had two incidences of infection in the mobile platform group, along with one DVT, one CVA, and one ruptured patellar ligament.

The sample's participants ranged in age from 59 to 70, with an average age of 65 years 81% of participants had a body mass index (BMI) of 30 and were female overall. The groups were homogeneous, because neither statistically significant differences nor associations could be found between the analysed personal traits. At the end of the follow-up, there was no difference between the groups in terms of quality of life across the different SF-36 domains. There is a difference between groups at specific times only in some fields. One instance is the pain score in the 1 and 2 years of follow-up, while they appear to be equal at other times.

The mean variations in the other quality of life domains were only evident during the follow-up, at various intervals of evaluation, and there was no difference between groups.

In Table 1, VAS for pain and WOMAC scores showed, on average, statistically different behavior between groups during follow-up ($p < 0.001$). In the WOMAC function and stiffness score, there was a statistically significant mean difference only during the follow-up, at different times of assessment, with no difference between groups ($p < 0.001$).

Visual analogue scale description of pain and functionality scores according to the types of prosthesis and moments of evaluation and statistical results.

Table 1:

Variable	Moment	Prosthesis type						*p* Value Prosthesis type	*p* Value Moment	*p* Value Interaction
		Fixed			Mobile					
		Mean	SD	N	Mean	SD	N			
VAS for Pain	Preoperative	84.2	17.2	130	85.2	17.3	130	0.02	<0.001	<0.001
	6 months	26.1	22.4	130	24.3	22.7	130			
	1 year	25.7	15.2	130	20.3	20.5	130			
	2 years	28.4	19.3	130	16.5	18.9	130			
	4 years	14.06	17.2	130	13.7	18.2	130			
	8 years	13.78	16.2	130	10.2	16.4	130			
WOMAC for Pain	Preoperative	13.60	3.86	130	14.8	3.42	130	0.04	<0.001	<0.001
	6 months	3.3	3.3	130	3.42	3.5	130			
	1 year	3.5	3.5	130	2.67	3.6	130			
	2 years	5.3	3.97	130	2.86	4.2	130			
	4 years	2.7	3.06	130	2.24	3.6	130			
	8 years	2.4	3.21	130	1.77	3.5	130			

WOMAC function	Preoperative	43.6	13.7	130	45.1	12.5	130	0.037	<0.001	0.001
	6 months	14.7	11.6	130	10.5	9.2	130			
	1 year	9.3	9.4	130	8.6	7.5	130			
	2 years	8.5	9.6	130	7.2	7.4	130			
	4 years	13.3	9.7	130	10.5	7.5	130			
	8 years	21.5	10.6	130	18.5	8.2	130			
WOMAC stiffness	Preoperative	4.3	2.2	130	5.2	2.1	130	0.198	<0.001	0.203
	6 months	1.4	1.5	130	1.5	1.3	130			
	1 year	1.1	1.3	130	1.2	1.3	130			
	2 years	0.76	1.2	130	0.45	1.1	130			
	4 years	0.87	1.1	130	0.57	1.2	130			
	8 years	0.67	1.3	130	0.62	1.1	130			

Discussion

The current prospective, randomised, and controlled study discovered that, eight years after surgery, there were no appreciable differences between fixed tibial platform implants and mobile platform implants in terms of the clinical outcome of pain on the SF-36 and WOMAC quality of life questionnaires, as well as in the VAS scores. Recent prospective randomised investigations [16, 22,23] similarly failed to distinguish between fixed and mobile prostheses in terms of clinical evolution, radiological analysis, or survival. The clinical outcomes of the two implant types in the same patient were compared by the same authors, and they discovered no changes in pain and range of motion (ROM) ratings throughout a 5-year follow-up period. Although higher flexion was noted in knees with fixed tibial platforms, Aglietti et al. [24] did not find any significant changes in pain levels after three years of follow-up in their study of patients receiving unilateral knee arthroplasty when comparing the two types of prostheses. It's probable that participant characteristics, particularly those related to age group, were to blame for the absence of difference in clinical outcomes between implants with fixed platform and mobile platform after 8 years of follow-up identified in the current study.

Additionally, the general tool for assessing the SF-36 quality of life of patients in this age range helps to validate these findings, but it doesn't appear adequate when used alone to draw conclusions from a clinical standpoint. Some individuals are perplexed when pain is examined since the problem is with "pain in the body." All of the questions on pain, such as those about emotional factors, temperament, and energy, were frequently replied favourably, but because these are questions with a wider scope, it was practically never possible to explicitly tie the response to the knee.

The participants in the current study had an average age of 65.7 (SD = 3.7) years, and the majority did not engage in sports or leisure activities that needed more joint movement. The moveable tibial support prosthesis, according to Wylde et al., [16] was created to provide a larger range of joint movement and to permit participation in activities that call for more knee mobility in all planes. Therefore, it may be stated that because this is a study of an older population, the implantation of moveable tibial knee support did not perform to its full capacity in this group of patients. Younger, more active patients in a randomised clinical study may be able to identify some functional advantages of one design over another.

The fact that the VAS and WOMAC pain scores were considerably worse in the group with fixed tibial platform within a short period of time-2 years following surgery must be emphasised as a key result of the current study (p 0.05 and p 0.001, respectively). The worst pain scores at the

time had a detrimental effect on patients having TKA with a fixed tibial platform in terms of quality of life.

Interestingly, there were no statistically significant differences between the fixed and mobile groups during this time with 2 years of follow-up, and the groups had the highest functional capacity scores in both the SF-36 quality of life questionnaire assessments and the WOMAC functional assessments.

Even though TKA has already been demonstrated to be an effective treatment for individuals with osteoarthritis, a sizeable portion of patients may still feel discomfort after surgery.[25] The present study's data suggest that, in the group of patients who underwent TKA with a mobile tibial platform as opposed to the group who underwent total prosthesis with fixed platform, the SF-36 pain domain had less influence on quality of life at 2 years of follow-up, even though the results of randomised controlled trials have not yet been conclusive to determine whether the type of implant can affect postoperative knee pain.

The benefits of a project with moveable tibial support may fade over time, according to Aglietti et al [24]. This is also seen in the current study, where it appears that the pain scores are back in alignment after 2 years following surgery and there are no statistically significant changes in pain levels between the groups with 4 and 8 years. However, although anterior knee pain affects patients even temporarily, it is not thought that this restricts the application of TKA with a mobile platform.

The key finding of the current study is that bias was minimised because the same surgeon, who has experience with both forms of TKA, performed all of the procedures. A longer follow-up period and a greater sample size than in most earlier research are also included. The questionnaires were filled out by the patients themselves with assistance from the evaluator in order to lessen application bias. Physical therapists who conducted assessments always had no idea to which group the patients had been randomly assigned.

We can point to the nondivision of patients based on ROM before to the surgical and final operation as a shortcoming of this analysis. Additionally, since evaluating the benefits of one implant over another in terms of the loosening aspect was not the goal of the current study, no radiological examination was done.

Finding out if there were functional and quality of life differences in a group of senior patients with knee osteoarthritis who received both forms of TKA was the main goal of the current study, which was idealised with the aim of determining this. However, as it was being realised, some questions came up that still need to be looked into.

Conclusion

The results of the current study show that the fixed platform TKA group had worse pain scores in the SF-36, VAS, and WOMAC questionnaires 2 years after the surgery. With a medium-term follow-up, people who had TKA with a fixed tibial platform did not exhibit any functional or quality of life differences from people who had arthroplasty with a moveable tibial platform.

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