

Is Achieving High Flexion Necessary for Satisfaction after Total Knee Arthroplasty in Indian Patients?

Abstract

Background: Total knee arthroplasty (TKA) is a very successful operation for the treatment of end-stage arthritis of the knee joint. In spite of improvement in surgical technique, implant design, postoperative pain management, and rehabilitation, some patients are not satisfied with the outcome of the surgery. It is believed that high-flexion (H-F) activities such as cross-legged sitting and squatting are necessary for satisfaction after TKA in Indian patients due to cultural and social reasons. This has led to the development and marketing of implant designs allowing H-F after TKA without strong evidence in the literature. **Materials and Methods:** We carried out a retrospective study to determine the level of satisfaction in 74 patients operated for 120 TKA over a 5 year period. This was determined on the basis of a satisfaction questionnaire which included questions to assess satisfaction regarding pain relief and ability to perform routine daily activities and high knee flexion activities such as squatting and cross-legged sitting. **Results:** Out of a total of 74 patients, 69 patients were overall satisfied with their TKA. Out of these, only 5 patients could squat or sit in a cross-legged position. Majority of the patients were satisfied with the pain relief and improvement in their capacity to work provided by TKA. **Conclusions:** Ability to perform H-F activities after TKA is not a necessary prerequisite for satisfaction in Indian patients. Implant designs allowing H-F should be used in a selected group of patients with good preoperative knee flexion and specific requirements.

Keywords: High-flexion total knee arthroplasty, patient satisfaction after total knee arthroplasty, total knee arthroplasty in Indian patients

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Introduction

Total knee arthroplasty (TKA) is a very successful procedure for the treatment of end-stage osteoarthritis of the knee joint. The procedure which was primarily designed for pain relief and improvement in activities of daily living (ADL) in older age group patients is increasingly carried out in a relatively younger age group patients and the patients from various ethnic and cultural backgrounds.

In spite of excellent clinical outcome of TKA in majority of the patients, some patients are not totally satisfied with the outcome of their surgery. There is a growing concern regarding satisfaction among the patients after undergoing TKA, with one in every five patients not satisfied with the outcome of their TKA.¹⁻³ Therefore, over and above the survivorship of the prosthesis, the patient satisfaction after TKA has been an area of research with a lot of emphasis placed on patient-related outcome

measure. Baker *et al.*,⁴ on the basis of a postal questionnaire, found approximately 18% of the patients to be dissatisfied 1 year following their TKA in England and Wales.

Various factors contribute to the satisfaction after TKA. These include pain relief, ability to carry out ADL, psychological status of the patient, and the patient's preoperative concept of the likely outcome of the procedure. It is known that preoperative range of flexion and varus/valgus tibiofemoral angle affect postoperative range of flexion.⁵ Due to social and cultural reasons, squatting and cross-legged sitting are considered necessary for satisfaction after TKA in Indian patients. As conventional TKA designs cannot provide such high degrees of flexion, certain modifications in the designs have been made.^{6,7} However, many studies comparing the results of conventional TKA and H-F TKA have not shown any difference in the range of motion, clinical outcome, and level of satisfaction.⁸⁻¹⁴ In addition, efforts to increase maximum knee flexion can

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adversely impact the survivorship of the prosthesis.¹⁵⁻¹⁹ A few studies published from the Indian subcontinent have shown that the so-called H-F knee joint does not provide any additional benefit from the conventional knee joint in terms of providing higher satisfaction, movements, and carrying out activities such as kneeling, squatting, and cross-legged sitting.

On the basis of the current evidence, the use of H-F knee joint in Indian patients needs to be carefully evaluated. Given the potential disadvantages of using H-F designs, it is important to determine whether the patients really consider these H-F activities necessary for their satisfaction after surgery. We, therefore, undertook this retrospective study to determine the outcome of TKA in our patients in terms of satisfaction after surgery and whether this had any relation with their ability to perform H-F activities.

Materials and Methods

In this retrospective open study, an attempt was made to contact all the 395 patients operated for TKA by the first author over a 5-year period. The patients who could be contacted and could come for clinical and radiological examination were included in the study. Seventy four patients were available for this study. The study was approved by the institutional ethics committee and all the patients gave informed consent to be enrolled. There were 48 female and 26 male patients with an average age of 71.6 years [Range 60-84 years; Females: 50-85 (median age 69 years), Males: 64-82 years (median age 73 years)] at the time of followup. A total of 120 TKAs were carried out in these 74 patients, with 46 patients receiving bilateral TKA and 28 patients undergoing unilateral TKA. The indications for surgery are summarized in Table 1.

A majority of the patients ($n = 72$) had predominantly medial compartment osteoarthritis with varus deformity, 2 patients with rheumatoid arthritis had valgus deformity, and 15 patients had flexion deformity. Median preoperative range of flexion was 89° (range: 50°–110°). A standard TKA was carried out in every patient with a straight longitudinal incision and anteromedial arthrotomy. PFC® Sigma® (Johnson & Johnson, Warsaw, Indiana) metal back knee prosthesis was used in all the patients. Patella was resurfaced in three knees, while in the remaining 117 knees, a patelloplasty was performed. A posterior cruciate-retaining femoral component was used in 64 knees, posterior cruciate-substituting femoral component in 46 knees, and a rotating platform (RP-F) H-F knee was implanted in 10 knees. Two patients developed late infections which were treated with debridement and antibiotics, resulting in complete cure.

The median length between surgery and this review was 48 months (range: 8–65 months). The patients were evaluated by an independent examiner, both clinically and radiologically. A satisfaction questionnaire [Table 2] was

Table 1: Indications for total knee arthroplasty

Indication for TKA	Number of patients (%*)	
	Bilateral surgery	Unilateral surgery
Osteoarthritis	Males: 18 (24.3) Females: 23 (31.1)	Males: 6 (8.1) Females: 16 (21.5)
Rheumatoid Arthritis	Females: 4 (5.4)	Females: 5 (6.8)
Ochronotic arthritis	Males: 1 (1.4)	-
Posttraumatic arthritis		Males: 1 (1.4)

*The percentage of total 74 patients. TKA=Total knee arthroplasty

Table 2: Satisfaction questionnaire

Overall, how satisfied are you with the result of your knee replacement surgery?

Very dissatisfied/dissatisfied/neutral/satisfied/very satisfied

Overall, how satisfied are you with the result of your knee replacement surgery for reducing your pain in walking on a flat surface, going up or down the stairs, sitting, standing, or lying down?

Very dissatisfied/dissatisfied/neutral/satisfied/very satisfied

How satisfied are you with the result of your knee replacement surgery for improving your ability to perform five functions (going upstairs, getting in/out of a car or on/off bus, rising from bed, lying in bed, performing light domestic duties)?

Very dissatisfied/dissatisfied/neutral/satisfied/very satisfied

If required, would you have surgery again?

Yes/no/not sure

Were your expectations met?

Expectations met/expectations not met/had no expectation

Additional questions

Does your TKR keep you from doing anything you would like to do?

Yes/no

Are you more or less active now than you were before your surgery?

More/less/same

Are you now as active as you had expected before surgery?

Yes/no

How long can you walk without stopping? _____ min

Do you use walking aid?

Yes/no

Stick/walking frame

Can you squat?

Yes/no

Can you sit in a cross-legged position?

Yes/no

Are there other activities, which if you could do after your replacement, but are unable to do now, would have improved your level of satisfaction?

If yes, please mention the activity

TKR=Total knee replacement

prepared by compiling relevant questions used to assess patient satisfaction by Bourne *et al.*² and Noble *et al.*³ Furthermore, other pertinent questions to assess H-F activities such as squatting and cross-legged sitting were included. The questionnaire was thoroughly reviewed by the author and his team before all the patients were asked to complete it.

The answers were graded from 1 to 5 (1-very dissatisfied, 5-very satisfied). The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was also used to assess the outcome.

Statistical analysis

Arithmetic mean was used to calculate average age, whereas for all the other parameters, median was used. Range was used to show the dispersion in the data. As clinical data revealed very clear evidence regarding correlation between overall satisfaction and various other parameters, no statistical method was required to show statistical significance.

Results

As shown in Table 3, out of 74 patients, 69 patients were either very satisfied or satisfied in terms of overall satisfaction.

Figures 1-4 show that “Overall satisfaction” is correlated well with “Satisfaction regarding pain,” “Satisfaction

regarding ability to perform work,” and “Expectations met or not.” However, there does not seem to be any correlation between “Overall satisfaction” and “Ability to perform high-flexion activities.” Sixty eight patients out of 69 satisfied patients expressed satisfaction at the pain relief provided by TKA [Figure 1] and 66 patients out of the 69 satisfied patients were satisfied with their ability to perform routine activities after surgery [Figure 2]. Sixty four patients reported that the result of their TKA met their expectations, while the remaining five patients did not have any expectations before surgery [Figure 3]. Radiologically, all these patients did not show any evidence of prosthetic loosening or malalignment. Out of the total 74 patients, 71 patients were more active after their TKA. Fifty seven patients used a stick for walking, while the remaining 17 could walk unaided. The need of walking aid did not influence the level of satisfaction. Out of the 69 overall satisfied patients, 5 patients could squat and sit in a cross-legged sitting position [Figure 4]. Out of these, three patients had cruciate-substituting prosthesis and two patients had RP-F prosthesis. Three patients who had bilateral TKA using RP-F prosthesis could not perform these activities.

Out of the seven patients who reported inability to perform certain activities, only one patient was dissatisfied with the inability to perform squatting and cross -legged sitting. The remaining six patients expressed dissatisfaction regarding their inability to walk long distance. The median WOMAC score was 91.6 (range 37.5–100). All the satisfied patients had WOMAC score >80.

Out of the 74 patients, five patients were either dissatisfied or neutral. One female patient who was operated for a unilateral TKA was very dissatisfied with the outcome of her TKA. Clinical and radiological examination, however, did not reveal any abnormality to explain her dissatisfaction. Two female patients who were successfully treated for late postoperative infection expressed dissatisfaction from

Table 3: Results (n=74)

Level of Satisfaction	Overall satisfaction	Satisfaction regarding pain	Satisfaction regarding ability to perform work
Very satisfied	49	45	44
	Bilateral: 33 Unilateral: 16	Bilateral: 31 Unilateral: 14	Bilateral: 29 Unilateral: 15
Satisfied	20	23	22
	Bilateral: 9 Unilateral: 11	Bilateral: 11 Unilateral: 12	Bilateral: 11 Unilateral: 11
Neutral	3	3	5
	Bilateral: 3 Unilateral: 0	Bilateral: 2 Unilateral: 1	Bilateral: 3 Unilateral: 2
Dissatisfied	1	2	3
	Bilateral: 1 Unilateral	Bilateral: 2 Unilateral	Bilateral: 3 Unilateral

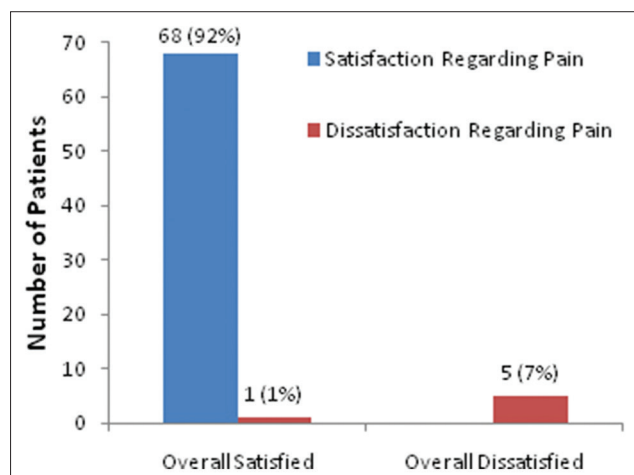


Figure 1: The frequency of “Satisfaction regarding pain” as reported by overall satisfied and dissatisfied patients

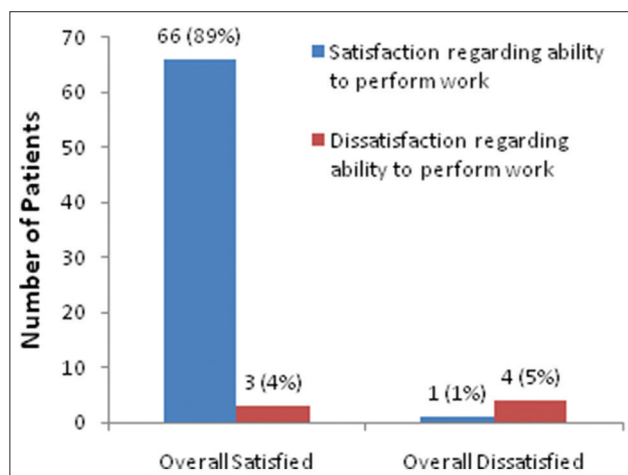


Figure 2: The frequency of “Satisfaction regarding ability to perform work” as reported by overall satisfied and dissatisfied patients

their TKA. In the remaining two patients, one patient had evidence of midflexion instability, while no objective cause for unsatisfactory outcome could be ascertained in the other patient.

Table 4 shows that “satisfaction regarding pain” is an important factor for “overall satisfaction.” One female having (i) WOMAC score of 88.3, (ii) “Satisfaction regarding ability to perform work” scored as 4, (iii) expectations met as yes, (iv) can walk 15 min continuously without any aid, but (v) “Satisfaction regarding pain” scored as 3 gave neutral grading. This supports the hypothesis that “Satisfaction regarding pain” is highly correlated with “Overall satisfaction.”

Discussion

TKA provides excellent result in terms of pain relief in majority of the patients undergoing surgery for the treatment of end-stage arthritis of knee. However, there is a growing concern regarding outcome of this surgery as one in every five patients is either dissatisfied or not totally satisfied after TKA. The Swedish Knee Arthroplasty Registry has previously demonstrated that 17% of patients who had undergone TKA are not satisfied with their outcome. This finding has been replicated in other countries and several authors have shown that satisfaction after TKA is predominantly related to improvement in pain and function, while unmet expectations are significant predictors for dissatisfaction after TKA.^{2,20}

TKA is increasingly carried out in a large number of Indian patients in the recent times. Very few studies have been published to report the outcome of TKA in Indian patients.^{21,22} Unlike Western population, social customs and traditions require Indian patients to perform activities such as cross-legged sitting, squatting, and kneeling, which require high knee flexion (>120°). Since conventional designs of the knee prosthesis do not allow extremes of flexion, modifications in the design of knee prosthesis have been carried out to allow more flexion. However, these modifications have been associated with certain problems. Ranawat¹⁵ noted that H-F designs focus on shortening the radius of curvature which would thicken the posterior condyle and the height of the posterior stabilized box. This requires removal of more bone which would result in excessive wear, patellofemoral complications, and difficult revisions. Nagura *et al.*¹⁶ found that deep flexion activities generate one to thirteen times larger net quadriceps moments (average five) than walking. High flexion may also be associated with TKA cam-post instability. Han *et al.*¹⁷ reported a 38% prevalence of femoral component loosening in the Limb Preservation System (LPS) H-F TKA at a mean followup of 32 months in patients engaging in H-F activities. Sharma *et al.*¹⁸ have shown increasing contact stresses with increasing flexion and this could potentially lead to greater wear, increased patellar fracture,

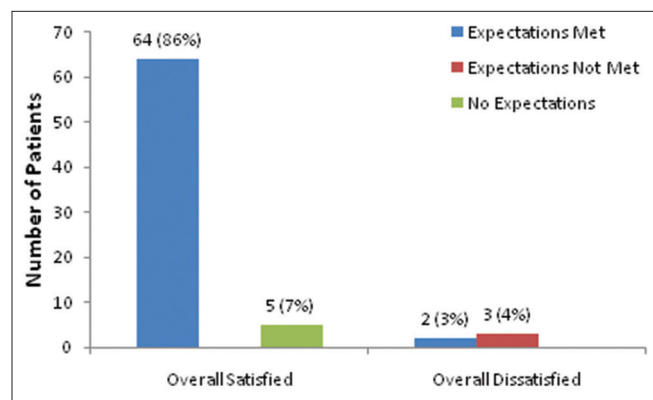


Figure 3: The frequency of “Expectations met or not” as reported by overall satisfied and dissatisfied patients

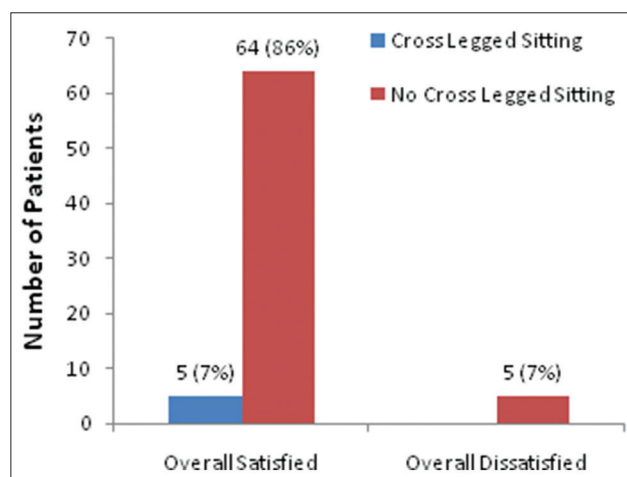


Figure 4: Frequency of “cross-legged sitting” as reported by overall satisfied and dissatisfied patients

Table 4: Data of the neutral or dissatisfied patients (overall satisfaction, satisfaction regarding pain and ability to perform work, walking ability, use of walking aid, and Western Ontario and McMaster Universities Osteoarthritis Index score)

Sex	Age	Diagnosis	Bilateral	Overall satisfaction	Satisfaction regarding pain	Satisfaction regarding ability to perform work	Walking (min)	Walking aid	WOMAC score
Female	67	RA	No	1	1	2	5	Stick	37.5
Female	64	OA	Yes	2	2	2	5	Stick	57.8
Male	72	OA	Yes	3	3	3	5	Stick	75.0
Female	65	OA	No	3	3	4	15	None	88.3
Female	71	RA	No	3	3	3	5	None	87.9

RA=Rheumatoid arthritis, OA=Osteoarthritis WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index

or loosening and earlier failure of polyethylene insert. Moynihan *et al.*¹⁹ studied the *in vivo* knee kinematics of six patients who achieved H-F after seven LPS H-F TKAs using dual-plane fluoroscopy. They observed cam-post disengagement at H-F angles.

Interestingly, H-F joints do not provide additional benefit over conventional cruciate-retaining or cruciate-substituting prosthesis in terms of better range of motion. Li *et al.*⁸ in a meta-analysis of randomized controlled trials involving 18 trials comparing the outcome benefits when using the H-F prosthesis in TKA compared with standard implants found no statistically significant difference between the two designs in terms of range of motion, knee scores, and patient satisfaction. Therefore, with the limited gains of current H-F implants, it is necessary to further investigate ways in which a new generation of TKA implants can improve patient outcome and knee flexion while avoiding potential risk factors of deep flexion.

In the present study, 69 out of 74 patients (93%) were overall satisfied with the outcome of their surgery in terms of pain relief and ability to perform ADL. Although the percentage of satisfied patients is higher than the published literature, it should not be taken into consideration as the patients included in this study were only those who were available for followup. It is possible that the patients who are lost to followup could have a less than satisfactory outcome. Out of these 74 patients, 5 patients were able to sit in a cross-legged position and could squat. The remaining patients either did not attempt or were unable to carry out these activities. Except one patient who was dissatisfied due to the inability to perform H-F activities, the remaining patients expressed satisfaction from their TKA. Our findings are in agreement with the results of Narayan *et al.*²¹ who concluded that the range of motion provided by the standard TKA is associated with high patient satisfaction and deep knee flexion is not an essential prerequisite for patient satisfaction after TKA, even in a population where squatting and sitting cross legged are generally part of the normal lifestyle. The reason for this could be the fact that most of the patients in our study who were operated for TKA had a fairly advanced osteoarthritis and could not perform these H-F activities, anyway, at the time of undergoing TKA. It also reflects change in the social structure, habits, customs, and religious practices in Indian patients. They were, therefore, satisfied with the pain relief and improvement in their ADL after surgery.

In our study, out of the five patients who could sit in a cross-legged position, three had cruciate-substituting prosthesis, while the other two had RP-F prosthesis. Three patients who had bilateral TKA using RP-F prosthesis could neither squat nor sit cross legged. This observation is in line with that reported by Jain *et al.*²² in an Indian study of H-F knees versus conventional TKA. They observed that though H-F knee prosthesis meets demands for obtaining

higher degrees of flexion and performing H-F activities, this cannot be solely attributed to implant design; rather, various other factors including patient selection, thigh calf index, patient compliance, precise surgical technique, and preoperative range of motion could play significant roles.

The two major strengths of our study are that all the cases were operated by a single surgeon and in every patient the same total knee prosthesis was used, thus negating two major variables. The two major limitations of the study are its retrospective nature and sample size. Although a fairly large number of TKAs were carried out in the 5-year period, only 74 patients responded and participated in this study. Though a larger sample size would be desirable to draw a firm conclusion, the fact that majority of the satisfied patients did not consider H-F activities to be a prerequisite for their satisfaction after TKA was a very important and relevant observation to support our hypothesis.

Conclusions

We believe that the ability to perform H-F activities such as cross-legged sitting and squatting is not a necessary prerequisite for satisfaction in Indian patients undergoing TKA. Therefore, until conclusive evidence regarding long term survivorship of implant designs claiming to provide H-F is available, they should be used judiciously in a selected group of well-informed patients whose daily activities demand H-F activities and have good preoperative knee flexion.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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