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Research Article

PREDICTIVE FACTORS FOR OUTCOMES AND PATIENT SATISFACTION 2-YEARS AFTER TOTAL KNEE ARTHROPLASTY

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ABSTRACT

Objectives: There is a lack of strong correlation between functional outcomes and patient satisfaction following total knee arthroplasty (TKA). This study evaluated whether the change in these scores from pre- to post-operative periods predicted patient satisfaction 2 years after TKA.

Methods: We evaluated data from 374 TKAs, assessing knee society score, Oxford knee score (OKS), and Short-Form 36 (SF-36) scores. A satisfaction questionnaire was completed, and logistic regression was performed. Receiver operating characteristic (ROC) curves assessed each scoring system's ability to predict satisfaction at 2 years.

Results: The ROC curve analysis between the physical component of SF-36 and the mean difference in pre-operative and post-operative scores showed that the area under the curve (AUC) was highest for the OKS (0.837, 95% confidence interval [CI]=0.708–0.967). The cutoff value was 12.5. At this threshold, the sensitivity and specificity of the OKS in predicting patient satisfaction were 80% and 77%, respectively. The AUC for Knee society knee score (KSKS) was 0.782 (95% CI=0.649–0.916). The cutoff value for the KSKS difference was 50.5. At this threshold, the sensitivity and specificity of KSKS for predicting patient satisfaction were 77.8% and 83%, respectively. The AUC for Knee society function score (KSFS) was 0.733 (95% CI=0.590–0.877). The cutoff value for the KSFS difference was 22.5. At this threshold, the sensitivity and specificity of KSKS for predicting patient satisfaction were 77.8% and 58.3%, respectively.

Conclusion: The pre- to post-operative change in OKS more accurately predicts patient satisfaction at 2 years than KSKS (cut-off value: 50.5) and KSFS (cut-off value: 22.5), respectively.

Keywords: Knee arthroplasty, Patient satisfaction, Oxford knee score, Knee society knee score, Knee society functional score.

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INTRODUCTION

In India, knee replacement surgery is much cheaper than in other developed nations, attracting both local patients and medical tourists. The country also has skilled orthopedic surgeons with high success rates in these surgeries [1]. The procedure involves excising damaged cartilage and bone from the knee joint and substituting them with prosthetic components, frequently accompanied by the resurfacing of the patella [2].

Knee replacement surgery targets pain relief, function restoration, and quality of life (QoL) improvement for patients with joint issues from osteoarthritis, rheumatoid arthritis, or trauma. Despite good success rates of total knee arthroplasty (TKA), approximately 20% of patients remain dissatisfied with their replaced knees. Studies indicate that surgeons and patients often disagree on the pain and functional outcomes of medical and surgical interventions [3,4]. Having said this, patient-reported outcome measures (PROMs) are important instruments in healthcare regarding patient's health, functional abilities, and QoL from the patient's perspective. The use of PROMs has increased in recent years, especially in surgical fields such as orthopedics, where patient satisfaction and recovery are important for evaluating outcomes [5].

The relationship between patient functional outcome scores and patient satisfaction in joint replacement warrants further investigation [6]. Consequently, alongside enhancements in surgeon-oriented objective outcome measures, patient satisfaction has garnered significant attention as a crucial parameter for evaluating the overall success of TKA [7].

Dissatisfaction has been linked to factors such as gender, age (both younger and older), rheumatoid arthritis, severe pre-operative pain, and personality disorders [8,9]. Patient expectations and mental health scores have shown some correlation with satisfaction, as have post-operative pain and function, but these effects are rarely consistent [10].

The objective of the present study was to determine patient satisfaction 1 year after TKR surgery in Indian patients.

METHODS

Study participants

We collected data from all primary unilateral TKAs performed at our tertiary care teaching institutions between January 2016 and March 2021. Only patients with a primary unilateral TKA, an asymptomatic or successfully replaced other knee, and completed follow-ups and assessments were included in the study. The tenets of the Declaration of Helsinki were followed while obtaining written informed consent from all participating patients. The Institutional Ethics Committee approved the trial (Letter No.GS/-1/2023/6123).

Patients with paralysis in one or both lower limbs, cardiac failure, severe pulmonary disorders, revision arthroplasties (including infections),

prosthetic fractures, or severe hip/spine conditions preventing independent walking were excluded from the study.

Perioperative details
Patients received a cemented, cruciate-retaining, or posterior-stabilized TKA implant with a fixed-bearing tibial component. They got mechanical and oral prophylaxis against venous thromboembolism and followed a standard post-operative rehabilitation protocol. Follow-ups occurred at 1 month, 6 months, 1 year, and 2 years postoperatively. Measurements at 6 months and 2 years postoperatively were analyzed.

Clinical evaluation
An independent observer conducted all pre- and post-operative assessments. Baseline evaluations, including sociodemographic characteristics, body mass index (BMI), and knee arthritis severity using the Oxford Knee score (OKS), were done preoperatively.

The OKS is a 12-question survey that measures knee pain and function over the past 4 weeks. Each question is rated from 1 to 5 on a Likert scale. The total score, ranging from 12 (best) to 60 (worst), reflects symptom severity and joint function [11].

The Knee Society score (KSS) is an objective scale used by surgeons that consist of two separate scores: One for walking, stair climbing, and use of walking aids (functional score), and another for pain, range of motion, and stability (knee score) [12].

The Short-Form 36 (SF-36) is a general health-related quality-of-life questionnaire with eight subscales: Physical functioning, social functioning, role-physical, bodily pain, mental health, role-emotional, vitality, and general health. Summary scores aggregate related subscales to simplify analysis without significant information loss. This study used Ware *et al.*'s medical outcome study approach to derive two summary scores: Physical component score (PCS) and mental component score (MCS), respectively. These scores account for 80–85% of the reliable variance in the eight subscales. They are valid in distinguishing clinically relevant groups and show high internal consistency and test-retest reliability in a general population [13].

Higher OKS scores indicate greater severity, while higher Short Form (SF)-36 and KSS scores indicate less severity. The KSS includes the Knee society knee score (KSKS) and Knee society function score (KSFS). Outcomes were classified as "good" based on the OKS and the physical component summary (PCS) of the SF-36 questionnaire.

Comorbidities were assessed using electronic health records of patients. Alignment was measured on lower-limb long-leg radiographs taken before and after surgery. Varus was positive and valgus was negative in analyses.

Statistics
Statistical analysis was conducted using IBM Statistical Packages for the Social Sciences Statistics version 29. A multiple logistic regression model considered continuous variables like age, BMI, pre-operative flexion range, KSS, OKS, MCS score, PCS score, and mechanical alignment, along with categorical variables such as sex, education level, ethnicity, operative side, comorbidities, implant type, and anesthesia type. Only significant variables from univariate analysis were included in the final model. Sensitivity analyses were performed with good TKA outcomes defined by an OKS under 30 and a PCS score over 50 at 2 years postoperatively. The odds ratio for each predictor's impact on a good outcome was calculated, with p-values below 0.05 deemed significant. A receiver operating characteristic (ROC) curve analysis identified cut-off points for score changes linked to satisfaction 2 years post-surgery.

RESULTS AND DISCUSSION

Pre-operative characteristics of patients: Of the 416 patients who underwent primary TKA with either an asymptomatic contralateral knee or a previous contralateral TKA, 374 patients (90%) were followed for a minimum duration of 2 years. The average age of the patients was 65.2±4.8 years, with an age range of 56–72 years. The demographic and clinical characteristics of these patients are detailed in Table 1.

Post-operative outcomes
Table 2 summarizes the post-operative outcomes 2 years after TKA. The mean changes from pre-operative values were: KSKS increased from 38 to 88, KSFS increased from 52 to 75, OKS decreased from 36 to 20, and SF-36 PCS increased from 36 to 76 ($p<0.0001$).

Predictors of clinical outcome and patient satisfaction (OKS and SF-36)
Multiple logistic regression model revealed that the odds of having a good outcome at 2 years were greater with lower age, worse pre-operative KSKS (or a larger difference in pre- and post-operative scores), and worse pre-operative KSFS (or a larger difference in pre- and post-operative scores), respectively (Table 3).

Table 1: Demographic and clinical characteristics

Parameter	n=376
*Age (years)	65.2±4.8
Gender (Male: Female ratio)	3.8:1
Anthropometric measurements	
*BMI (kg/m2)	28±2.4
Ethnicity	Indian
*Pre-operative range of motion (Flexion)	116.6±5.4
*Pre-operative knee society score	38±2.2
*Knee society function score	51.8±4.8
*Pre-operative Oxford knee score	35.6±4
*Pre-operative alignment (degrees)	7.1±1.8
*Mean SF-36 physical component score	36.2±3
*Mean SF-36 mental component score	51.4±10.4
Perioperative details	
*Number of days to ambulation	1.7±1.5
*Follow-up (years)	2.6±0.6
*Length of stay in hospital (days)	5.8±1.4

SF-36: Short-Form 36, BMI: Body mass index. *Expressed as mean±standard deviation (SD)

Table 2: Post-operative outcomes at 2 years

*Parameter	Measurement	Change	**p-value
Flexion range (deg)	120±3.9	4±2	<0.001
Alignment (deg)	3.5±0.9	3.6±1.5	<0.001
Knee society function score	75±2.4	23±4.2	<0.001
Knee society knee score	88±2.6	50.7±3.7	<0.001
Oxford knee score	20±1.4	15±3.5	<0.001
SF-36 physical component score	76.4±3	40.4±4.7	<0.001

SF-36: Short-Form 36, *Expressed as mean±standard deviation (SD), **Independent t-test

Table 3: Odds of having good outcomes

Absolute criteria	Pre-operative KSKS	Pre-operative KSFS
Parameter	**Odds ratio (95% CI)**	**Odds ratio (95% CI)**
SF-36 PCS >50	1.2 (1.124–1.326)	1.4 (1.321–1.564)
Oxford knee score <30)	1.1 (0.984–1.286)	1.24 (1.034–1.686)

KSKS: Knee society knee score, KSFS: Knee society function score, CI: Confidence interval, SF-36: Short-Form 36, Odds ratio with 95% confidence intervals

Secondary analyses showed that 86.7% of patients had a good outcome at 2 years according to the OKS, and 84% according to the SF-36 PCS.

The ROC curve analysis between the physical component of SF-36 and the mean difference in pre-operative and post-operative scores showed that the area under the curve (AUC) was highest for the OKS (AUC=0.837, 95% confidence interval [CI] = 0.708–0.967) (Fig. 1 and Table 3). The cutoff value for the OKS difference, derived from the coordinate points of the curve, was determined to be 12.5. At this threshold, the sensitivity and specificity of the OKS in predicting patient satisfaction were calculated to be 80% and 77%, respectively. This indicated that the OKS had a moderate accuracy in predicting whether a patient would be satisfied or dissatisfied at 2 years.

Fig. 1 a ROC curve showing predictive value of OKS, Knee society knee score, and Knee society function scores for satisfaction at 2 years.

The AUC for KSKS was 0.782 (95% CI=0.649–0.916). The cutoff value for the KSKS difference was 50.5. At this threshold, the sensitivity and specificity of KSKS for predicting patient satisfaction were 77.8% and 83%, respectively. This shows that KSKS has moderate accuracy (lower than OKS) in predicting patient satisfaction at 2 years.

The AUC for KSFS was 0.733 (95% CI=0.590–0.877). The cutoff value for the KSFS difference was 22.5. At this threshold, the sensitivity and specificity of KSKS for predicting patient satisfaction were 77.8% and 58.3%, respectively. This shows that KSFS has moderately lower accuracy (lower than OKS and KSKS) in predicting patient satisfaction at 2 years.

DISCUSSION

The present study evaluated predictors of outcomes and patient satisfaction in patients who underwent TKA at a tertiary care teaching hospital in the northern part of the Indian subcontinent. The results indicated that 86.7% of patients had a good outcome at 2 years according to the OKS, and 84% based on the SF-36 PCS. Pre-operative KSKS and KSFS were significantly associated with predicting TKA outcomes defined by an OKS under 30 and a PCS score over 50 at 2 years postoperatively.

Multiple logistic regression showed that younger age, worse pre-operative KSKS, and worse pre-operative KSFS were associated with better outcomes at 2 years.

The ROC curve analysis showed that the AUC was highest for the OKS (0.837, 95% CI=0.708–0.967). The OKS difference cut-off value was 12.5, with a sensitivity of 80% and specificity of 77%. This suggests moderate accuracy in predicting patient satisfaction at 2 years.

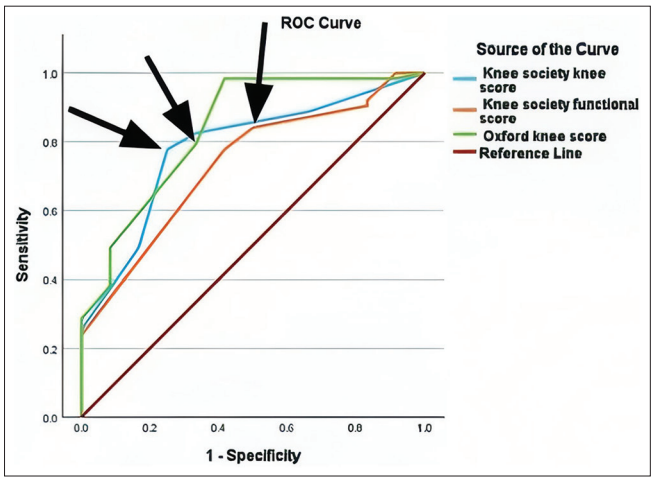

Fig. 1: Receiver-operating characteristic curve

The AUC for KSKS was 0.782 (95% CI=0.649–0.916). The cut-off value for the KSKS difference was determined to be 50.5. At this threshold, the sensitivity and specificity of KSKS in predicting patient satisfaction were found to be 77.8% and 83%, respectively. These results indicate that KSKS demonstrates moderate accuracy, which is lower than that of OKS, in predicting patient satisfaction at the 2-year mark.

The AUC for KSFS was 0.733 (95% CI=0.590–0.877). The cutoff value for the KSFS difference was determined to be 22.5. At this threshold, the sensitivity and specificity of KSKS in predicting patient satisfaction were 77.8% and 58.3%, respectively. This indicates that the accuracy of KSFS in predicting patient satisfaction at 2 years is moderately lower compared to OKS and KSKS.

Our study found a similar proportion of individuals with good TKA outcomes as previous reports; Escobar *et al*. found that 79% of TKA patients had good outcomes, while Callahan *et al*. reported that 89% of patients had good to excellent outcomes after primary TKA. The study had a mean follow-up period of 4.1 years. The average age of the participants was 65.0 years, and 71.7% of the patients were female [14,15].

Our research found age significantly predicts outcomes, with younger patients showing more favorable results after TKA. Lower pre-operative KSS values also predicted better outcomes. While two studies noted a similar trend among subsets of TKA patients, no study reported the predictive value of the KSS from registry data. These studies indicated that patients with lower pre-operative KSS had greater improvement in 2-year outcomes [16,17].

A recent study by D'Apuzzo *et al*. identified morbid obesity as an independent risk factor for poor outcomes following TKA. The prevalence of morbid obesity among patients in our study was significantly lower than that reported by D'Apuzzo *et al*., with our study showing 2.1% compared to their 5.5% [18].

A successful surgery requires pain relief, functional recovery, and patient satisfaction [19]. Our study found that a pre-post-operative OKS difference of 12.5 or more and a pre-post-operative KSKS knee score of 50.5 or more can reliably predict patient satisfaction 2 years after TKA.

Goh *et al*. found that early post-operative scores, particularly the OKS (AUC 0.762, 95% CI 0.736–0.788) and KS knee score (AUC 0.704, 95% CI 0.674–0.734) at 6 months, moderately predict satisfaction at 2 years [20]. In contrast, Clement *et al*. analyzed 2392 TKAs and found the pre-operative OKS poorly predicted satisfaction at 1 year, with an AUC of 0.590 [21].

Kwon *et al*. found that patient satisfaction at 1 year correlated better with absolute post-operative scores than with pre- to post-operative changes [22]. However, it is not known if this applies at 2 years. Our study shows that pre- to post-operative score changes better predict satisfaction at 2 years, contrary to Kwon *et al*.'s findings. It is reasonable to anticipate that patients experiencing significant pain and exhibiting poor functional status before surgery are more likely to achieve post-operative improvements, which would subsequently be reflected in their overall satisfaction [23].

We also recognize the limitations of this study. Firstly, we did not analyze the impact of other factors that could potentially influence patient satisfaction, such as gender, BMI, comorbidities, mental health, and the fulfillment of expectations in relation to the identified threshold values. The exact interaction of these factors remains unclear, and more research is needed to identify the main risks for poor outcomes after TKA. Second, the statistical correlation identified in this study does not necessarily indicate the clinical significance of these thresholds. Therefore, further prospective validation studies are required to confirm that these outcome score thresholds are indeed clinically meaningful.

CONCLUSION

The pre- to post-operative change in OKS (cut-off value: 12.5) more accurately predicts patient satisfaction at 2 years after TKA as compared to KSKS (cut-off value: 50.5) and knee society functional score (cut-off value: 22.5), respectively.

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AUTHOR'S CONTRIBUTION

Mayank Daral: Patient evaluation, data acquisition, literature search. Rishabh Gupta: Data acquisition, literature search, writing introduction, satisfaction survey. Vasu: Patient evaluation, data acquisition, critical review. Rahul Bhargava: Statistical analysis, final drafting of manuscript, discussion. Surendra Kumar: Patient evaluation, literature search, manuscript editing and review. Himanshu Agrawal: Literature search, manuscript editing and review, satisfaction survey.

CONFLICTS OF INTEREST

We do not have any conflicts of interest.

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REFERENCES

1. Vaidya SV, Jogani AD, Pachore JA, Armstrong R, Vaidya CS. India joining the world of hip and knee registries: Present status-a leap forward. Indian J Orthop. 2020;55(Suppl 1):46-55.
2. Patel V, Deshpande SV, Jadawala VH, Bhalsod D, Sawant S. Evaluating short-term patient-reported outcome measures following total hip and knee replacement: A comprehensive review. Cureus. 2024;16:e70468.
3. Goh GS, Liow MH, Bin Abd Razak HR, Tay DK, Lo NN, Yeo SJ. Patient-reported outcomes, quality of life, and satisfaction rates in young patients aged 50 years or younger after total knee arthroplasty. J Arthroplasty. 2017;32:419-25.
4. Bergstein VE, Weinblatt AI, Taylor WL 4th, Long WJ. Total knee arthroplasty survivorship and outcomes in young patients: A review of the literature and 40-year update to a longitudinal study. Arch Orthop Trauma Surg. 2024;144:4077-83.
5. Weldring T, Smith SM. Patient-reported outcomes (PROs) and patient-reported outcome measures (PROMs). Health Serv Insights. 2013;6:61-8.
6. Ethgen O, Bruyère O, Richy F, Dardennes C, Reginster JY. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. J Bone Joint Surg 2004;86:963-74.
7. Janse AJ, Gemke RJ, Uiterwaal CS, Van Der Tweel I, Kimpen JL, Sinnema G. Quality of life: Patients and doctors don't always agree: A meta-analysis. J Clin Epidemiol. 2004;57:653-61.
8. Batailler C, Lording T, De Massari D, Witvoet-Braam S, Bini S, Lustig S. Predictive models for clinical outcomes in total knee arthroplasty: A systematic analysis. Arthroplast Today. 2021;9:1-15.
9. Castro-Dominguez F, Tibesku C, McAlindon T, Freitas R, Ivanavicius S, Kandaswamy P, *et al.* Literature review to understand the burden and current non-surgical management of moderate-severe pain associated with knee osteoarthritis. Rheumatol Ther. 2024;11:1457-99.
10. Goh GS, Liow MH, Pang HN, Tay DK, Lo NN, Yeo SJ. Patients with poor baseline mental health undergoing unicompartmental knee arthroplasty have poorer outcomes. J Arthroplasty. 2018;33:2428-34.
11. Dawson J, Fitzpatrick R, Murray D, Carr A. Questionnaire on the perceptions of patients about total knee replacement. J Bone Joint Surg Br. 1998 Jan;80(1):63-9.
12. Insall JN, Dorr LD, Scott RD, Scott WN. Rationale of the knee society clinical rating system. Clin Orthop Relat Res. 1989;248:13-4.
13. Ware JE Jr., Kosinski M, Bayliss MS, McHorney CA, Rogers WH, Raczek A. Comparison of methods for the scoring and statistical analysis of SF-36 health profile and summary measures: Summary of results from the medical outcomes study. Med Care. 1995;33:AS264-79.
14. Escobar A, Gonzalez M, Quintana JM, Vrotsou K, Bilbao A, Herrera-Espiñeira C, *et al*. Patient acceptable symptom state and OMERACT-OARSI set of responder criteria in joint replacement. Identification of cut-off values. Osteoarthritis Cartilage. 2012;20(2):87-92.
15. Callahan CM, Drake BG, Heck DA, Dittus RS. Patient outcomes following tricompartmental total knee replacement. A meta-analysis. JAMA. 1994;271(17):1349-57. PMID:8158821.
16. McCalden RW, Robert CE, Howard JL, Naudie DD, McAuley JP, MacDonald SJ. Comparison of outcomes and survivorship between patients of different age groups. J Arthroplasty. 2013;8 Suppl:83-6.
17. Jiang L, Bin Abd Razak HR, Chong HC, Tan A. Preoperative patient characteristics and outcomes of total knee arthroplasty in a multiethnic Asian population stratified by ethnicity. J Arthroplasty. 2014;29(2):304-7.
18. D'Apuzzo MR, Novicoff WM, Browne JA. The john insall award: Morbid obesity independently impacts complications, mortality, and resource use after TKA. Clin Orthop Relat Res. 2015;473(1):57-63.
19. Dorr LD, Chao L. The emotional state of the patient after total hip and knee arthroplasty. Clin Orthop Relat Res. 2007;463:7-12.
20. Goh GS, Bin Abd Razak HR, Tay DK, Lo NN, Yeo SJ. Early post-operative Oxford knee score and knee society score predict patient satisfaction 2 years after total knee arthroplasty. Arch Orthop Trauma Surg. 2021;141(1):129-37.
21. Clement ND, Macdonald D, Burnett R. Predicting patient satisfaction using the Oxford knee score: Where do we draw the line? Arch Orthop Trauma Surg. 2013;133(5):689-94.
22. Kwon SK, Kang YG, Kim SJ, Chang CB, Seong SC, Kim TK. Correlations between commonly used clinical outcome scales and patient satisfaction after total knee arthroplasty. J Arthroplasty. 2010;25(7):1125-30.
23. Baker PN, Van Der Meulen JH, Lewsey J, Gregg PJ, National Joint Registry for England and Wales. The role of pain and function in determining patient satisfaction after total knee replacement. Data from the national joint registry for England and wales. J Bone Joint Surg Br. 2007;89(7):893-900.