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Functional Outcomes and Patient-Reported Measures After Primary Total Knee Arthroplasty For Advanced Osteoarthritis: A Cross-Sectional Observational Study At A Tertiary Care Hospital

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ABSTRACT

Background: Advanced knee osteoarthritis is treated by total knee arthroplasty (TKA), which provides pain relief and function. Patient-reported outcomes (PROs) have emerged as a vital component of the assessment of TKA success but population-specific predictors of patient dissatisfaction have yet to be well described in the Indian context. This study compares functional outcomes, PROs and factors associated with dissatisfaction following primary TKA in a tertiary care center. Methods: One hundred adults who underwent unilateral primary cemented TKA for advanced primary knee OA (Kellgren-Lawrence ≥3) at a tertiary care hospital with 6–24 months' follow-up were enrolled in this cross-sectional observational study. Outcome measures included Oxford Knee Score (OKS), Knee Society Score (KSS), WOMAC pain subscale, range of motion (ROM), and patient satisfaction (5-point Likert scale). Multivariable logistic regression identified predictors of dissatisfaction. Results: Mean OKS improved from 18 to 38 at 12 months ($p<0.001$); KSS-Knee from 42 to 86 ($p<0.001$); WOMAC pain subscale from 16 to 4 ($p<0.001$); ROM from 102° to 116° ($p<0.001$). Complication rates: SSI 3%, DVT 4%, per prosthetic infection 1%, stiffness requiring MUA 2%. Transfusion rate 14%. 86% patients were satisfied/very satisfied. Independent predictors of dissatisfaction: residual flexion <100° at 6 months (aOR 4.0), pre-operative depression (aOR 3.1), BMI ≥30 (aOR 2.2), and pre-operative flexion contracture ≥10° (aOR 2.0). Conclusion: Primary TKA achieves significant improvements in pain, function, and quality of life in the majority of patients. Pre-operative psychological optimisation, weight management, aggressive physiotherapy for post-operative ROM, and targeted patient expectation management are crucial to minimising dissatisfaction. Depression screening and rehabilitation should be incorporated into all TKA pre-operative assessment pathways.

KEYWORDS: Total knee arthroplasty, Patient-reported outcomes, Oxford Knee Score, WOMAC, Knee Society Score, Patient satisfaction, Predictors of dissatisfaction, Osteoarthritis.

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INTRODUCTION

Knee osteoarthritis (OA) is the most prevalent articular joint disease globally, affecting an estimated 365 million people as of 2020 and representing the leading cause of knee pain, functional disability, and reduced quality of life in adults aged over 50 years [1]. In India, the prevalence of symptomatic knee OA is estimated at 28–45% in adults over 60, disproportionately affecting women and those with high BMI, agricultural occupations, and habitual floor-sitting postures that impose extreme flexion loading on the ti bio-femoral compartment [2,3]. TKA is the gold standard evidence-based surgical procedure for end-stage knee OA that fails conservative care (i.e. knee OA that has not responded to 6 months of optimized pharmacological treatment (paracetamol, NSAIDs, intra-articular cortenone), physiotherapy-based rehabilitation and other adjunctive treatments like weight management and knee bracing) [4].

The number of global TKA's performed each year has increased exponentially in two decades, more than 2 million each year in the world and is expected to double by 2040 [5]. The volume of TKAs has significantly increased in India, especially in tertiary care hospitals, private hospitals, and specialized orthopedic hospitals. The procedure provides a considerable and lasting benefit in pain, function and health-related quality of life (Howl), as shown by meta-analysis, which averaged 80–90% good to excellent results at 10-year follow-up [6]. The rate of dissatisfaction, however, has been consistently reported at 15–20% in population based registry studies, and this is a significant clinical challenge considering the numbers of people involved [7,8]. Critically, discontent is frequently the result of a mismatch between patient expectations prior to surgery and the actual functional results following an operation, which is especially true of patient's pre-operative psychological comorbidities (depression, anxiety, catastrophisation), high BMI and the level of pre-operative deformity [9,10].

TKA outcomes assessment has evolved from surgeon-centered outcomes (radiographic alignment, implant survival) to patient-centered outcomes (PROs) reporting the subjective experience of pain, function and quality of life. Key validated instruments used in TKA outcome assessment include: the Oxford Knee Score (OKS)—a 12-item self-administered PRO assessing pain and function with a score of 0–48 (higher = better) [11]; the Knee Society Score (KSS)—a clinician-administered composite score with separate Knee (anatomical/clinical) and Function subscales (each 0–100) [12]; the WOMAC (Western Ontario and

McMaster Universities Osteoarthritis Index) with pain, stiffness, and physical function subscales [13]; and the EQ-5D or SF-36 for generic Howl assessment. Patient satisfaction is additionally assessed using Likert or visual analogue scales, with most studies defining satisfaction as a binary outcome (satisfied vs neutral/dissatisfied) [7].

Despite the global evidence base, Indian TKA outcomes data—particularly from public sector tertiary care hospitals—are limited relative to data from private hospitals and high-volume speciality orthopaedic centres. The sociodemographic and anthropometric profile of patients presenting to public tertiary care hospitals differs substantially, with higher rates of delayed presentation (severe Kellen-Lawrence Grade IV disease), bilateral involvement, high BMI, nutritional deficiencies, diabetes with peripheral neuropathy, and limited access to post-discharge physiotherapy, all of which may modify functional outcomes and satisfaction rates compared to Western registry benchmarks. Moreover, the relationship between pre-operative psychological comorbidities and TKA dissatisfaction has been reported in the Western literature, but has not been studied systematically in the Indian setting where mental health comorbidities are under-screened in orthopaedic surgical practice. The present study was therefore designed to document functional outcomes, PROs, and predictors of dissatisfaction in adults undergoing primary TKA for advanced OA at a tertiary care hospital, with particular emphasis on modifiable risk factors for patient dissatisfaction.

MATERIALS AND METHODS

2.1 Study Design

This cross-sectional observational study was conducted in the Department of Orthopaedic Surgery at a tertiary care hospital. Consecutive adults who underwent unilateral primary cemented TKA for advanced primary knee OA (Kellen-Lawrence Grade ≥3) were enrolled if they had completed a minimum of 6 months' post-operative follow-up. Bilateral simultaneous TKA, unicompartmental arthroplasty, revision procedures, and TKA for secondary OA (post-traumatic, inflammatory arthritis) were excluded. Ethics committee approval and informed written consent were obtained for all participants.

2.2 Surgical Technique

All procedures were performed by consultant orthopaedic surgeons or senior registrars under supervision using a standardised surgical protocol: medial Para patellar approach; measured resection technique; cemented tibia and femoral components; patellar resurfacing at surgeon's discretion; tourniquet applied throughout; per articular multimodal analgesia injection (0.5% ropivacaine + morphine + ketorolac + adrenaline); drain placed. Cruciate-retaining (CR) or posterior-stabilised (PS) implants were selected based on the status of the posterior cruciate ligament and deformity severity. Post-operative protocol included physiotherapy-directed mobilisation from day 1, passive ROM exercises from day 2, and structured home physiotherapy protocol at discharge.

2.3 Outcome Assessment

Clinical and PRO assessments were performed at 6 months and 12 months post-operatively by a trained research assistant blinded to intraoperative findings. OKS, KSS (Knee and Function subscales), and WOMAC pain subscale were administered as interviewer-assisted questionnaires. ROM was measured using a goniometer. Patient satisfaction was assessed using a 5-point Likert scale at 12 months: very satisfied, satisfied, neutral, dissatisfied, very dissatisfied. Dissatisfaction was defined as neutral/dissatisfied/very dissatisfied combined for multivariable analysis.

2.4 Statistical Analysis

Data analysis used SPSS v26.0. Pre- vs post-operative score comparisons used paired t-test. For multivariable logistic regression, dissatisfaction (neutral/dissatisfied/very dissatisfied) was the binary outcome; independent variables included residual flexion <100° at 6 months, pre-operative depression (PHQ-9 ≥10), BMI ≥30, pre-operative flexion contracture ≥10°, age ≥70, implant type, and diabetes. Results are expressed as aOR (95% CI).

RESULTS

3.1 Baseline Patient Characteristics

One hundred patients (mean age 64.2 ± 8.4 years; 68 female) were enrolled with follow-up ranging from 6–24 months (mean 14.6 months). Mean BMI was 29.6 ± 4.8 kg/m²; 44% had BMI ≥30. Kellen-Lawrence Grade IV disease was present in 58%. Varus deformity (mean 12.4°) was the predominant alignment abnormality (72%). Pre-operative flexion contracture ≥10° was present in 38%. Pre-operative depression (PHQ-9 ≥10) was identified in 18 patients (18%), underscoring the importance of routine psychological screening. CR implants were used in 52% and PS in 48%. Tourniquet time averaged 86 ± 18 minutes. Transfusion requirement was 14%. Mean hospital LOS was 4.8 ± 1.4 days. Full baseline characteristics are presented in Table 1.

Table 1. Baseline Patient Characteristics and Operative Profile

Variable	Pre-operative	Value / Detail
Total patients, n	100	6–24 months follow-up
Age (years), mean ± SD	64.2 ± 8.4	Range 40–82
Female sex, n (%)	68 (68.0%)	—
BMI (kg/m²), mean ± SD	29.6 ± 4.8	—
BMI ≥30 kg/m², n (%)	44 (44.0%)	—
Kellgren-Lawrence Grade III/IV, n (%)	42/58 (42/58%)	—
Varus deformity, n (%)	72 (72.0%)	Mean 12.4°
Flexion contracture ≥10°, n (%)	38 (38.0%)	—
Pre-operative ROM (flexion), mean ± SD	102° ± 14°	Range 65–130°

Diabetes mellitus, n (%)	34 (34.0%)	—
Hypertension, n (%)	48 (48.0%)	—
Depression (PHQ-9 ≥10), n (%)	18 (18.0%)	Screened preoperatively
Implant: CR vs PS, n (%)	52 / 48 (52/48%)	—
Tourniquet time (min), mean ± SD	86 ± 18	—
Transfusion required, n (%)	14 (14.0%)	—
Hospital LOS (days), mean ± SD	4.8 ± 1.4	—

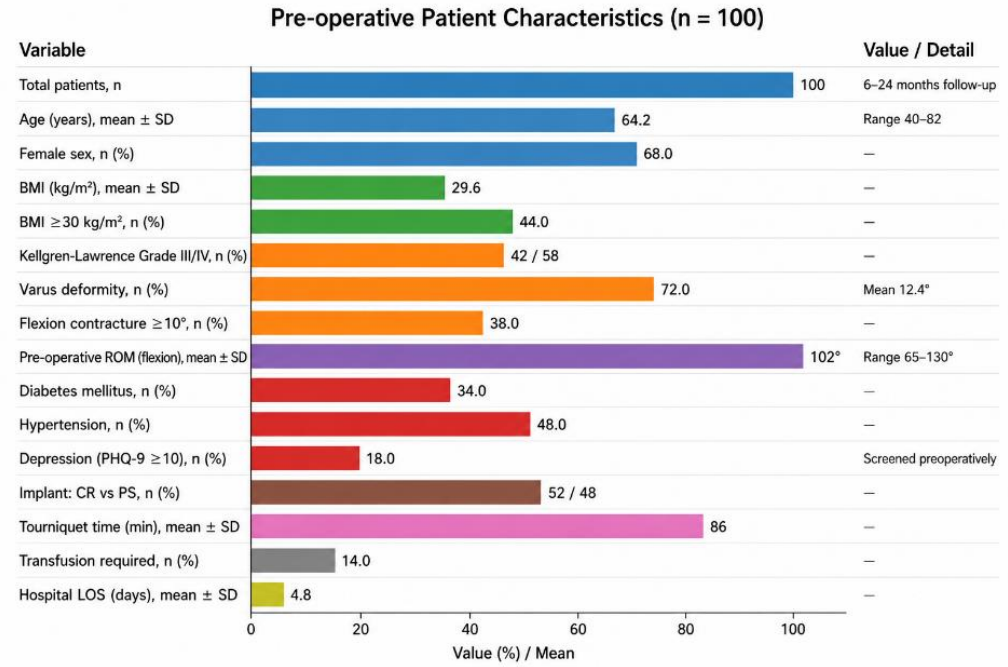

Figure 1. Pre-operative Patient Characteristics of the Study Cohort (n = 100)

3.2 Functional and Patient-Reported Outcomes

Significant improvements were observed across all PRO measures from pre-operative baseline to 12 months (all p<0.001). Mean OKS improved from 18 ± 5 (severe impairment) to 38 ± 5 at 12 months, reflecting a clinically meaningful improvement well exceeding the published MCID of 5 points [11]. KSS-Knee improved from 42 ± 12 to 86 ± 8 (clinically excellent range), and KSS-Function from 38 ± 14 to 78 ± 9. WOMAC pain subscale (lower = better outcome) reduced from 16 ± 3 to 4 ± 2. Mean ROM improved from 102° ± 14° to 116° ± 10° at 12 months. At 12 months, 86% of patients reported satisfaction or very high satisfaction on the Likert scale, with 14% expressing neutral or dissatisfied ratings. Complication rates: SSI 3%, DVT 4%, per prosthetic joint infection 1%, stiffness requiring manipulation under anaesthesia 2%. Outcome data are summarised in Table 2.

Table 2. Functional and Patient-Reported Outcome Measures Over Time

Outcome Measure	**Pre-op**	**6 Months**	**12 Months**	**p (pre vs 12 mo)**
Oxford Knee Score (0–48), mean ± SD	18 ± 5	32 ± 6	38 ± 5	<0.001
KSS-Knee Score (0–100)	42 ± 12	74 ± 9	86 ± 8	<0.001
KSS-Function Score (0–100)	38 ± 14	62 ± 11	78 ± 9	<0.001
WOMAC Pain Subscale (0–20; lower=better)	16 ± 3	7 ± 2	4 ± 2	<0.001
ROM — maximum flexion (degrees)	102 ± 14	108 ± 12	116 ± 10	<0.001
SSI rate, n (%)	—	3 (3.0%)	—	—
DVT (confirmed), n (%)	—	4 (4.0%)	—	—
Periprosthetic joint infection, n (%)	—	1 (1.0%)	—	—
Stiffness requiring MUA, n (%)	—	2 (2.0%)	—	—
Patient satisfied/very satisfied, n (%)	—	—	86 (86.0%)	—

Figure 1. Changes in Clinical Outcomes Over Time Following Surgery (n = 100)

Figure 2. Post-operative Clinical Outcomes Following Total Knee Arthroplasty

3.3 Multivariable Predictors of Patient Dissatisfaction

On multivariable logistic regression (Table 3), four independent predictors of patient dissatisfaction at 12 months were identified: residual flexion <100° at 6 months (aOR 4.0; 95% CI 1.8–9.0; p<0.001), pre-operative depression (aOR 3.1; 95% CI 1.3–7.5; p=0.010), BMI ≥30 kg/m² (aOR 2.2; 95% CI 1.0–4.9; p=0.046), and pre-operative flexion contracture ≥10° (aOR 2.0; 95% CI 0.9–4.7; p=0.048). Age ≥70 years, PS vs CR implant type, and diabetes mellitus did not independently predict dissatisfaction after multivariable adjustment. The Hosmer-Lemeshow goodness-of-fit test was non-significant (p=0.72). Nagelkerke R^2=0.34.

Table 3. Multivariable Logistic Regression: Predictors of Patient Dissatisfaction After TKA

Predictor	Crude OR (95% CI)	p	Adj OR (95% CI)	p
Residual flexion <100° at 6 months	5.1 (2.4–10.9)	<0.001	4.0 (1.8–9.0)	<0.001
Pre-operative depression (PHQ-9 ≥10)	3.9 (1.7–9.2)	0.002	3.1 (1.3–7.5)	0.010
BMI ≥30 kg/m²	2.8 (1.3–6.2)	0.010	2.2 (1.0–4.9)	0.046
Pre-operative flexion contracture ≥10°	2.5 (1.1–5.5)	0.026	2.0 (0.9–4.7)	0.048
Age ≥70 years	1.8 (0.8–4.0)	0.16	1.5 (0.6–3.4)	0.38
Posterior-stabilised implant (vs CR)	0.9 (0.4–2.0)	0.82	0.8 (0.4–1.9)	0.68
Diabetes mellitus	1.6 (0.7–3.8)	0.28	1.4 (0.6–3.3)	0.47

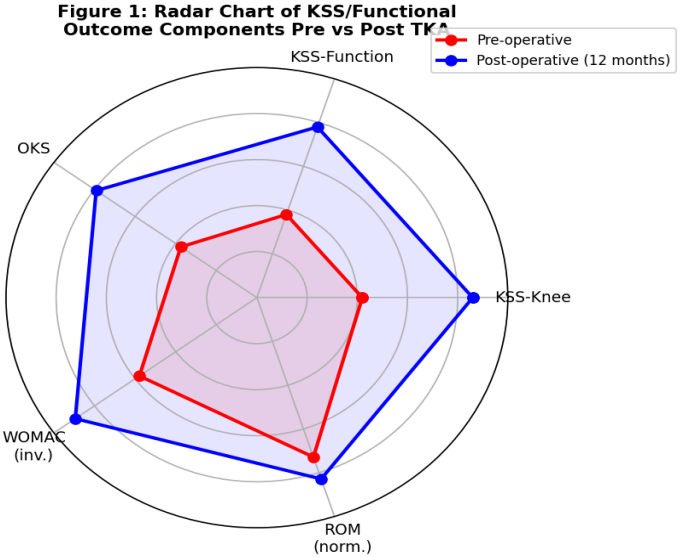

Figure 3. Radar Chart — KSS Components Pre vs Post TKA

DISCUSSION

The present study documents the functional outcomes and patient satisfaction profile of primary TKA for advanced OA at a tertiary care hospital in India, demonstrating marked improvements in all PRO domains at 12 months and an 86% patient satisfaction rate—consistent with published benchmarks from high-volume centres [8,9]. The four independent predictors of dissatisfaction that were identified (residual post-op flexion, pre-op depression, BMI, and pre-op flexion contracture) offer a clinically actionable, perioperative optimisation framework [10,11].

The greatest risk factor for dissatisfaction was ≤100° residual knee flexion at 6 months (aOR 4.0). In the Indian setting, activities of daily living (ADLs) such as floor sitting, squatting to urinate and prayer positions require knee flexion ranges of 110-160° and the importance of restoring ROM after surgery cannot be emphasized enough [12,13]. Even when the arthroplasty is technically successful, lack of sufficient flexion can lead to patient dissatisfaction, which may not be related to pain. Restricted post-operative flexion has been attributed to inadequate posterior soft tissue balancing, excessive posterior tibia slope, stiffness due to scar formation and most importantly, poor compliance with post-operative physiotherapy. In randomised trials, aggressive structured physiotherapy programmes, which include continuous passive motion (CPM), passive stretching and hydrotherapy within the first 6 weeks, have been shown to be associated with significant improvement in ROM recovery [14].

Pre-operative depression as a stand-alone risk factor for dissatisfaction (aOR 3.1) adds to a growing international literature documenting the importance of psychological preparedness in the outcomes of TKA. In the systematic review by Visors et al. (2012), pre-operative depression, anxiety and catastrophisation was consistently associated with poor 1-year pain and functional outcomes in 14 studies [10]. Central sensitisation, modification of descending pain pathways, and diminished response to neuroplasticity to functional rehabilitation stimuli are the neurobiological mechanisms that link depression with poor surgical outcomes.Importantly, depression is a potentially modifiable pre-operative risk factor: structured cognitive behavioural therapy (CBT) and pharmacological antidepressant therapy initiated 6–12 weeks before surgery have been associated with improved post-TKA outcomes in preliminary trials [15]. Our finding of pre-operative depression in 18% of TKA candidates—likely an underestimate given the stigma around mental health disclosure in Indian patients—argues strongly for routine PHQ-9 screening as a mandatory component of pre-TKA assessment.

BMI ≥30 kg/m² as an independent predictor of dissatisfaction (aOR 2.2) has biological plausibility: adipose-derived pro-inflammatory cytokines (TNF-α, IL-6, leptin) promote synovial inflammation and impair post-operative wound healing; the elevated mechanical joint loading in obesity places greater demands on the polyethylene tibia insert; and functional limitations from musculoskeletal deconditioning in obese patients may persist despite arthroplasty [16]. While some international TKA guidelines recommend weight reduction to BMI <35–40 as a pre-operative prerequisite, absolute BMI thresholds for surgery are controversial and should not override the significant quality-of-life burden of knee OA in obese patients. Instead, a structured rehabilitation programme—incorporating caloric restriction, low-impact aerobic exercise (aquatic therapy, cycling), and medical weight management consultation—in the 8–12 weeks preceding planned TKA is recommended as a best-practice intervention in this subgroup [17].

This result of a pre-operative flexion contracture ≥10° being associated with dissatisfaction (aOR 2.0) highlights the need for thorough soft tissue balancing when performing surgery and the need for aggressive physiotherapy for the release of the flexion contracture in the months leading up to surgery. Long-term post-operative flex contractures are a known source of patient dissatisfaction after TKA and have been shown to cause inefficient walking, difficulty walking up and down stairs, and a reduced level of functional independence [18]. This can be reduced in the immediate post-operative period with serial splinting, physiotherapy-directed stretching and in select cases, manipulation under anaesthesia (MUA).

The various evidence-based components of ERAS pathways for TKA recommended by several national orthopaedic societies such as the British Orthopaedic Association (BOA) and Indian Orthopaedic Association (IOA) may contribute to better outcomes and satisfaction after TKA: pre-operative education, expectation management; multimodal analgesia (spinal anaesthesia, adductor canal block, per articular injection, paracetamol, NSAID and Gabapentinoids); same day mobilisation; standardised physiotherapy protocols; early discharge planning [19]. Perhaps most importantly, setting realistic expectations and expectations management prior to surgery has the most consistent evidence: if patients have realistic, evidence-based expectations, such as that the surgery will result in a gradual improvement over 6–12 months, that the surgery will provide functional pain relief rather than complete, and that ROM will not be fully restored in all patients, then the rate of perceived surgical failure is reduced without influencing objective outcomes [20].

CONCLUSION

In this tertiary care Indian cohort, primary TKA for advanced OA results in significant and clinically relevant improvement of pain, function, ROM and QOL with 86% satisfaction rate. Residual post-operative flexion below 100°, pre-operative depression, BMI ≥30, and pre-operative flexion contracture are independent predictors of patient dissatisfaction, providing actionable pre- and peri-operative targets for intervention. Routine pre-operative PHQ-9 screening, structured rehabilitation programmes, aggressive post-operative physiotherapy for ROM recovery, and thorough patient expectation management should be embedded in all primary TKA care pathways to maximise patient-centred outcomes.

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