



Functional outcome of total knee replacement in patients with advanced osteoarthritis: A prospective study

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Abstract

Total knee replacement (TKR) is the standard surgical option for advanced knee osteoarthritis once conservative care stops working, and demand for it in India continues to rise. This paper reviews recent literature (2023–2026) on functional outcomes after TKR, with attention to Indian prospective cohorts. Peer-reviewed systematic reviews, meta-analyses and prospective studies were identified through database and repository searches and synthesised narratively. The evidence shows that patients usually report clear gains in pain and self-reported function within three to six months, whereas performance-based measures such as walking and chair-rise tests improve less consistently. Indian prospective series using the Knee Society Score, Oxford Knee Score and WOMAC report large improvements in scores and range of motion, even among patients with severe deformity and low socioeconomic status. Alignment strategy, robotic assistance and sensor-guided balancing may add modest benefits, but the data are still heterogeneous. Poor rehabilitation adherence, limited access to physiotherapy, out-of-pocket costs and small single-centre samples remain the main barriers. The review concludes that TKR reliably improves function in advanced osteoarthritis and that structured, affordable rehabilitation and multicentre prospective follow-up are the priorities for Indian practice.

Keywords: Total knee replacement, knee osteoarthritis, functional outcome, Knee Society Score, rehabilitation, India

Introduction

Osteoarthritis of the knee is one of the commonest causes of chronic pain and mobility loss in middle-aged and older adults. When pain, stiffness and deformity persist despite exercise, weight control, analgesics and injections, total knee replacement (TKR), also called total knee arthroplasty (TKA), is regarded as the definitive treatment. Recent Indian work describes it as the gold-standard operation for end-stage disease, offering relief from pain and a better quality of life (Clinical and functional outcomes, 2025)^[4]. The George Institute for Global Health (2022)^[14] estimates that more than 100,000 knee replacements are performed in India each year and expects the number to rise.

A successful operation is not defined by a well-aligned implant on an X-ray alone. Patients care about whether they can walk, climb stairs, squat, sit on the floor and return to daily roles. Functional outcome therefore needs to be measured with both clinician-rated scores, such as the Knee Society Score (KSS), and patient-reported measures, such as the Oxford Knee Score (OKS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Even so, a review of alignment strategies noted that as many as one in five patients remain dissatisfied after TKA (Functional outcomes and patient satisfaction, 2025)^[4].

This paper therefore examines functional outcome after TKR for advanced osteoarthritis, drawing on recent systematic reviews, meta-analyses and prospective studies, with special attention to evidence from India. The aims are to summarise how function changes after surgery, to identify factors that modify recovery, and to discuss barriers that affect Indian patients in particular.

Review Approach

A narrative review design was used. Searches were run on PubMed, PubMed Central and open repositories, with Google-based discovery of journal pages, combining terms such as total knee replacement, total knee arthroplasty,

osteoarthritis, functional outcome, Knee Society Score, WOMAC, India, rehabilitation and robotic. Priority was given to papers published between 2023 and 2026. Systematic reviews, meta-analyses and prospective cohort studies were preferred, and Indian studies were deliberately sought. Older sources were used only for background. Findings were summarised in the author's own words, and no primary patient data were collected for this paper.

Major Approaches and Practices

1. Measuring functional outcome after TKR

Functional recovery is usually tracked with three families of tools. Clinician-rated scores such as the KSS combine a knee score (pain, stability, motion) with a function score (walking and stair climbing). Patient-reported measures such as the OKS, WOMAC and the Forgotten Joint Score capture how the knee feels in everyday life. Performance-based tests, including timed walking and chair rises, record what the patient can physically do. An Indian prospective cohort from Karnataka graded KSS results as excellent, good, fair or poor and assessed patients before surgery and at day five, three months and six months (Clinical and functional outcomes, 2025)^[4]. Using all three families together gives a fuller picture than any single score.

2. Surgical technique, implant design and alignment

Conventional TKR aims for a neutral mechanical axis. Newer philosophies, such as kinematic and functional alignment, try to restore the patient's native joint line and soft-tissue balance. A 2025^[12] systematic review comparing kinematic with mechanical alignment treated alignment as a key determinant of outcome and satisfaction (Functional outcomes and patient satisfaction, 2025). A 2026^[3, 4] review of robotic functional alignment, limited to studies with at least two years of follow-up, reported favourable function and few early revisions (Functional alignment in robotic

total knee arthroplasty, 2026) [3]. These results are encouraging, but they come mostly from non-randomised series.

Implant choice has also been studied in India. A multicentre post-marketing study of 408 patients across ten Indian centres found that both unilateral and bilateral TKA with metal-backed components significantly improved range of motion, KSS and quality of life (Machaiah *et al.*, 2025) [7]. In the Karnataka cohort, surgeons used an anteromedial parapatellar approach with a posterior-stabilised design (Prospective study of clinical and functional outcome, 2025) [4].

3. Robotic assistance and intraoperative technology

Robotic platforms have spread quickly. A 2025 [12] meta-analysis of 22 articles covering 3,738 knees found little short-term difference in Forgotten Joint Score between robotic and manual TKA, but a modest advantage at medium-term follow-up (Robotic-assisted total knee arthroplasty with MAKO, 2025). A further 2026 [12, 13] meta-analysis concluded that robotic TKA gives small but consistent gains in function, alignment accuracy and length of stay, without a clear reduction in major complications (Sahoo *et al.*, 2026) [13]. Both reviews call for more randomised trials, so robotics should be seen as a promising refinement rather than a proven necessity.

4. Rehabilitation and the continuum of care

Surgery sets the stage, but rehabilitation largely determines how much function the patient regains. Indian authors report that adherence to home exercise is often poor and that most patients rely on unsupervised home-based physiotherapy (Process evaluation protocol, n.d.; The George Institute for Global Health, 2022) [14]. Interviews with patients, physiotherapists and surgeons in a Delhi hospital highlighted the lack of a system to monitor progress after discharge (Pritwani *et al.*, 2023) [9]. Mobile-application-based telerehabilitation, registered in the Clinical Trial Registry of India, is now being tested as a response.

Evidence on Effectiveness

Large Indian multicentre data add reassurance about durability. In the post-marketing study of 408 patients treated at ten centres between 2016 and 2019, the average age was about 65 years, and outcomes were followed at six weeks, six months, one year and three years using range of motion, KSS, WOMAC and SF-36 alongside implant survivorship (Machaiah *et al.*, 2025) [7]. Studies of this kind show that gains are not limited to the first few months, but they were industry-linked surveillance designs and should be interpreted with that in mind.

Evidence on technology is more mixed. Robotic and alignment-based approaches show small advantages in some patient-reported scores, yet the differences are often within the range of measurement error, and the reviews themselves warn that high-quality randomised evidence is thin (Sahoo *et al.*, 2026 [13]; Robotic-assisted total knee arthroplasty with MAKO, 2025) [12].

The strongest pooled evidence comes from a longitudinal meta-analysis of 72 higher-quality cohort studies including 19,063 patients. It found clinically meaningful improvement in self-reported function by three to six months after TKA, whereas performance-based measures followed variable paths and often showed no clinically meaningful gain

(Orange *et al.*, 2024) [8]. In other words, patients feel better sooner than they measurably move better, which has implications for counselling and rehabilitation goals.

Indian prospective studies point in the same direction. The Karnataka cohort enrolled 33 patients aged over 50 with Kellgren–Lawrence grade 3 or 4 disease, and every patient reached an excellent KSS category at six months (Prospective study of clinical and functional outcome, 2025) [4]. The small sample and short follow-up mean these results should be read cautiously. In rural West Bengal, a prospective study of 54 knees with varus deformity above 30 degrees reported mean range of motion rising from 85.5 to 119.1 degrees and KSS from 37.4 to 81.8, with OKS from 13.7 to 36.8; the deformity was corrected from about 31 degrees of varus to about 4 degrees of valgus (Chakraborty *et al.*, 2026) [1]. A Jordanian prospective cohort of 100 patients further showed that improved knee scores were accompanied by lower depression and anxiety (Haddad & N., 2025) [5], suggesting that function and mental well-being improve together.

Barriers and Challenges to Implementation

Several barriers limit the benefit that Indian patients obtain. First, rehabilitation access and cost are persistent problems. Patients and providers in a Delhi study named access to an affordable, reliable rehabilitation centre as a major obstacle (Pritwani *et al.*, 2023) [9], and out-of-pocket spending on home physiotherapy can be considerable (The George Institute for Global Health, 2022) [14]. Second, adherence to exercise is weak, driven by pain, low motivation and socio-environmental factors.

Third, newer technologies are costly. A recent Indian commentary describes high capital investment, recurring maintenance costs, limited insurance reimbursement and restricted training access as the main obstacles to robotic adoption (Indigenous innovation in orthopedic robotics, 2025) [6]. Fourth, the evidence base itself has gaps: many Indian prospective series are single-centre, have fewer than 100 patients and follow patients for six months or less, and several pooled analyses stress heterogeneity and the shortage of randomised trials. Finally, dissatisfaction affects a meaningful minority of patients worldwide, so expectation management before surgery is essential (Functional outcomes and patient satisfaction, 2025) [4].

Discussion and Implications

Taken together, the literature supports TKR as a dependable way to improve self-reported function in advanced knee osteoarthritis, including in older, rural and socioeconomically disadvantaged Indian patients. An interesting observation from West Bengal is that lower socioeconomic status did not predict worse functional scores in that cohort (Chakraborty *et al.*, 2026) [1], although this single finding needs replication.

For clinical practice, three implications follow. Surgeons should counsel patients that pain and self-reported function improve first, whereas strength and walking performance may need longer and more deliberate rehabilitation. Hospitals should build a continuum of care that includes written or video exercise plans, scheduled follow-up and, where feasible, low-cost tele-monitoring. For research, Indian centres should prefer multicentre prospective designs with standard tools (KSS, OKS, WOMAC), at least one to two years of follow-up, and reporting of socioeconomic

variables, so that results can be pooled. A study titled as a prospective study should also report its own cohort, methods and follow-up schedule clearly.

This review has limitations. It was narrative rather than a registered systematic review, searches were not exhaustive, and several included Indian studies were small, short-term or available only as repository records. Heterogeneity in scoring tools also prevented pooling of Indian data. The conclusions should therefore be treated as a structured summary of current evidence and not as a quantitative estimate of effect.

Conclusion

Total knee replacement produces substantial and early functional gains in patients with advanced osteoarthritis, and Indian prospective data are consistent with international meta-analyses. Technique, alignment strategy and robotic assistance may fine-tune results, but rehabilitation quality, affordability and patient expectations appear to matter at least as much. Strengthening structured, accessible rehabilitation and conducting larger, longer multicentre studies are the most practical steps to improve outcomes for Indian patients.

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