

Original Article

Functional Outcomes After Total Knee Replacement in Kupang: A Retrospective Cohort Study

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ABSTRACT

Background: Total knee replacement (TKR) is effective for advanced knee osteoarthritis, but its access can be limited by implant and perioperative costs. Our tertiary center in Kupang, Indonesia, adopted a single implant system to support service delivery. This study quantified early functional change using the Oxford Knee Score (OKS) three months after TKR.

Methods: We conducted a retrospective single-centre cohort at Siloam Hospital in Kupang, from December 2022 to May 2024. Consecutive adults with Kellgren–Lawrence grade IV knee osteoarthritis who underwent primary TKR with one implant system (Fixamet) were included. The OKS (0–48; higher scores indicate better function) was collected preoperatively and at three months in Bahasa Indonesia using a standardized protocol. Pre–post change was analyzed as paired data.

Results: Forty-seven patients were analyzed (mean age 65.77 ± 7.44 years; 80.9% women). The mean OKS improved from 12.53 ± 3.69 preoperatively to 41.02 ± 2.17 at three months, a mean change of 28.48 points (95% CI 27.24–29.70; $p < 0.001$). One early complication was documented (arthrofibrosis, 2.1%).

Conclusions: In this single-centre cohort, TKR was associated with large early improvements in patient-reported knee function at three months. These findings describe early recovery within our service and do not establish comparative effectiveness versus other implant systems. Future studies should follow patients for a longer period, directly compare Fixamet with other implant systems, and include cost-effectiveness analyses to assess both clinical and economic value.

Keywords: Health services; Osteoarthritis; Oxford knee score; Total knee replacement

INTRODUCTION

Total knee replacement (TKR) reliably improves pain and function in advanced knee osteoarthritis, but access is constrained in many health systems by device price and perioperative logistics. In hospital budgets, the implant is a leading cost driver within the episode of care, so procurement strategy and system standardization directly influence affordability and throughput.^{1–3}

Premium implant families such as Attune (DePuy Synthes) and Persona (Zimmer Biomet) have achieved broad adoption in well-resourced centers for several practical reasons. First, they offer extensive sizing and constraint portfolios to

accommodate varied anatomy and ligament balance strategies. Second, they provide multiple fixation options, including cemented and cementless components with engineered porous surfaces intended to promote osseointegration. Third, bearing options include highly cross-linked or additive-stabilized polyethylene. Finally, these systems are integrated with navigation and robotic workflows that many centers now employ. Collectively, these design and service attributes are valued clinically and logistically, and their long post-market experience further supports use.^{4,6}

Those same attributes increase cost. Manufacturing porous/ 3D-printed cementless components and maintaining multiple constraint



and sizing inventories raise acquisition prices; multi-tray instrumentation increases sterilization throughput; and navigation/ robotic workflows add capital and per-case consumables. Time-driven activity-based costing analyses show that implant purchase and robot-specific supplies are major contributors to total supply cost for TKR. Hospitals therefore deploy price-control programs, vendor standardization, and reference pricing to contain implant expenditures while preserving surgeon choice, underscoring how procurement policy shapes access.¹⁻³

In regions where device budgets are tight, lower-priced systems may expand access if early functional recovery meets accepted benchmarks. Our tertiary hospital in Kupang, Indonesia, adopted the Fixamet system based on local availability and lower acquisition cost relative to premium families used in metropolitan centers. During this early adoption phase, our intent was service evaluation rather than comparative effectiveness.^{1,3,7}

We selected the Oxford Knee Score (OKS) as the primary endpoint because it is a validated, 12-item patient-reported measure of pain and function, widely implemented in arthroplasty services and national Patient-Reported Outcome Measure (PROMs) programs, with clear scoring (0–48, higher is better) and strong responsiveness to postoperative change. We assessed outcomes at three months, which aligns with routine postoperative reviews and represents an early recovery window often used in service monitoring and linked to later patient-reported outcomes.⁸ The aim of this study was to measure the change in Oxford Knee Score from baseline to three months after total knee replacement at a tertiary hospital in Kupang, Indonesia, as an estimate of early functional recovery at the service level.

MATERIAL AND METHODS

Research Design

This was a retrospective cohort study conducted at Siloam Hospital in Kupang, East Nusa Tenggara,

Indonesia. Data collection and analysis were completed in July 2024.

Participants and Sampling

Using a total sampling technique, we identified consecutive adults with radiographically confirmed Kellgren–Lawrence grade IV knee osteoarthritis who underwent primary total knee replacement between December 2022 and May 2024.

Data Collection

The primary endpoint was the Oxford Knee Score, a 12-item patient-reported measure of knee pain and function scored from 0 to 48, with higher scores indicating better status.

The OKS instrument was administered in Bahasa Indonesia following forward–backward translation and cultural adaptation procedures consistent with established guidance and was pilot-tested locally for clarity before routine use. Baseline OKS was collected at the preoperative consultation. The three-month OKS was obtained at the routine postoperative review window.⁸

Patients were contacted for outcome assessment at approximately three months after surgery. Those unable to attend in person completed the assessment by structured telephone interview using an identical script administered by trained staff. Demographic and clinical information was abstracted from the electronic medical record and cross-checked before analysis.

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean $\pm$ standard deviation or median [interquartile range], and categorical variables as counts and percentages. The pre- to postoperative change in OKS was evaluated as paired data; normality of difference scores was examined, and the Wilcoxon signed-rank test was applied when assumptions for parametric testing were not met. Statistical significance was set at $p < 0.05$ (two-sided).



RESULTS

Forty-seven patients met the inclusion criteria and completed the three-month follow-up at RSU Siloam Kupang. The mean age was 65.77 ± 7.44 years, and most were women (80.9%). Baseline characteristics are summarized in Table 1. Laterality of surgery was recorded for 41 cases (right knee 17, left knee 24). Five patients (10.6%) required a wheelchair before surgery.

The mean preoperative OKS was 12.53 ± 3.69 , reflecting severe functional limitation. At three months, the mean OKS increased to 41.02 ± 2.17 , representing a mean improvement of 28.48 points shown in Table 2 (95% CI 27.24–29.70; $p < 0.001$).

These findings demonstrate a substantial early improvement in patient-reported knee function. No comparative analyses with other implant systems

were undertaken, and economic endpoints such as cost or cost-effectiveness were not assessed.

Overall, the demographic profile of this cohort aligns with the known epidemiology of knee osteoarthritis, in which older age and female sex are major risk factors. The marked improvement in OKS within three months supports the effectiveness of TKR in restoring function in this population. Additional information on external reports useful for contextualising early postoperative recovery is provided in Table 3.

DISCUSSION

The three-month follow-up in this study demonstrated marked improvements in patient-reported knee function following total knee replacement, as measured by the Oxford Knee Score.^{1,8} The

Table 1. Demographic and clinical characteristics ($n = 47$)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	9	19.1
	Female	38	80.9
Age	Years	65.77 ± 7.44	-
Side of the knee	Right	17	36.2
	Left	24	51.1
Wheel chair	Yes	5	10.6
	No	42	89.4

Table 2. Comparison of preoperative and postoperative Oxford Knee Scores

Time Point	Mean OKS ($\pm$ SD)	Mean Difference	95% CI	p -value
Preoperative	12.53 ± 3.69	-28.48	(-29.7, -27.2)	< 0.001
Postoperative (3 months)	41.02 ± 2.17	-	-	-

Table 3. Selected external reports useful for contextualising early postoperative recovery after TKR*

Study (year)	Setting	PROM	Follow-up window	Summary of finding as reported
NHS England PROMs (2021–2022)	National programme (England)	OKS	~6 months	>95% of primary knee replacements show improvement on OKS; used for national benchmarking.
NJR linked PROMs	National Joint Registry (UK)	OKS	~6 months	PROMs are collected via linkage to NHS PROMs at ~6 months; widely used for service monitoring.)
NZ Joint Registry	National registry (NZ)	OKS	6 months (sample)	OKS collected on a sampled cohort at 6 months; large numbers enable early-outcome benchmarking.
AJRR 2023	National registry (USA)	KOOS Jr	Early post-op	Reports PROM capture and early outcomes at scale; instrument differs from OKS.

*Provided for orientation only; instruments and time points vary across studies and are not directly comparable to the present cohort.



timing of this assessment is clinically relevant, as early recovery within three to six months is a well-recognized trajectory for postoperative improvement and is often used for service monitoring and audit. Early changes in PROMs such as the OKS are also predictive, to some degree, of later outcomes at one to two years, including patient satisfaction and implant survivorship.⁸⁻¹⁰

The magnitude of functional improvement observed in this cohort is consistent with international benchmarks. National PROMs programs report that the vast majority of patients undergoing primary TKR show measurable gains in OKS at six months.^{1,2,9,11} Similarly, registry data from other countries indicate early functional recovery comparable to that observed in this study, despite differences in patient mix, health systems, and measurement tools. These findings suggest that even in a regional Indonesian center, functional recovery after TKR can reach the standard observed in high-income settings, at least in the early postoperative period.^{10,12}

Beyond clinical outcomes, the results of this study underscore the importance of procurement and service delivery strategies in low- and middle-income countries. Implant costs remain a key barrier to access, as premium systems are associated with higher acquisition prices and additional capital requirements for robotic or navigational workflows.¹⁰⁻¹² By contrast, the Fixamet implant system was adopted locally due to lower cost and availability. The favorable functional outcomes observed here suggest that such systems can expand access while still meeting acceptable recovery benchmarks. This has important implications for policy, as hospitals and governments in resource-constrained settings must balance affordability, procurement strategy, and clinical outcomes.^{12,13}

It is important to acknowledge that this study was not designed to address comparative effectiveness. No direct patient-matched comparisons with premium implant systems were performed, and therefore equivalence or superiority cannot be inferred. In addition, economic outcomes were not collected, limiting the ability to assess cost-effective-

ness or value-based care. Future research should address these gaps by incorporating prospective designs with longer follow-up (12–24 months), randomization where feasible, and integration of economic endpoints. Such studies would align with international registry practice and provide a more comprehensive understanding of durability, complications, and relative value.¹⁴

Finally, the results contribute to the broader evidence base on TKR in underrepresented populations. Most existing studies and registry data originate from high-income countries,^{10,14} whereas regional centers in Indonesia and similar settings face unique challenges related to access, affordability, and perioperative resources. Demonstrating early functional recovery in this context not only validates the use of standardized PROMs like the OKS but also highlights the importance of extending such monitoring to diverse health systems.^{12,13} Building capacity for registry participation and long-term follow-up will be critical for establishing durability and supporting policy decisions on implant procurement and service delivery.^{11,14}

CONCLUSION

In this single-centre retrospective cohort, total knee replacement was associated with large early improvements in patient-reported knee function at three months, as measured by the Oxford Knee Score. These findings describe early recovery for patients treated at our hospital and do not establish equivalence to higher-priced implant systems. Comparative effectiveness should be evaluated in prospective studies, preferably randomized controlled trials, with extended follow-up to assess durability, complications, and implant survivorship. An economic evaluation was not undertaken and will be needed in future work.

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CONFLICT OF INTEREST

There is no conflict of interest found during this study.

ETHICAL APPROVAL

The study received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine and Veterinary Medicine, Nusa Cendana University (Approval Number 29.1/UN15.21/KEPK/2024), on June 12, 2024.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. Due to patient privacy and ethical restrictions, individual-level data cannot be made publicly available.

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