The Philippine Journal of Orthopaedics

SYSTEMATIC REVIEW

Correlation of WOMAC Score with Functional Recovery in Patients with Osteoarthritis Following Total Knee Replacement

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ABSTRACT

Background. Total knee replacement (TKR) is an established procedure for advanced knee osteoarthritis, offering pain relief and improved mobility. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) is widely applied to measure pain, stiffness, and functional limitation.

Objective. This study investigated the relationship between WOMAC scores and overall functional recovery in patients after TKR.

Methodology. A prospective observational study was performed in patients who underwent primary TKR at the Government Medical College and Hospital, Kallakurichi, Tamil Nadu, India, between January 2023 and June 2025. WOMAC scores were documented preoperatively, at six weeks, three months, and six months postoperatively. Recovery was further assessed using the Timed Up-and-Go (TUG) test, range of motion (ROM), and patient satisfaction levels. Statistical analysis included paired t-tests and Pearson correlation.

Results. Eighty patients (52 females, 28 males; mean age 64.2 ± 6.8 years) were enrolled. The average baseline WOMAC score was 72.4 ± 9.6, decreasing to 34.8 ± 7.2 at 3 months and 21.5 ± 5.6 at 6 months ($p < 0.001$). Improvements in TUG and ROM correlated significantly with WOMAC changes ($r = 0.68$ and -0.55, respectively; $p < 0.01$). Patient satisfaction also showed a strong positive association with WOMAC outcomes ($r = 0.72$, $p < 0.001$).

Conclusion. This study concludes that significant WOMAC improvements within six months are correlated with high patient satisfaction and functional gains. Clinicians should consider early interventions if scores plateau. Longer-term studies are needed to confirm sustained benefits. The key take-home message is that WOMAC monitoring after TKR can enhance personalized recovery strategies.

Keywords. osteoarthritis; recovery of function; patient satisfaction; pain measurement; range of motion

INTRODUCTION

Knee osteoarthritis (OA) is among the leading causes of disability globally, affecting over 250 million people and contributing to significant socioeconomic burden through reduced mobility and chronic pain.[1] Total knee replacement (TKR) has become the treatment of choice for patients with end-stage OA, aiming to alleviate pain, restore mobility, improve function, and enhance quality of life.[2,3] Previous research has demonstrated that TKR leads to substantial improvements in pain and function, with success rates exceeding 80% in most cohorts.[4] For instance, studies from Western populations report mean WOMAC score reductions of 40 to 50 points post-TKR, correlating with better daily activities.

However, the trajectory of postoperative recovery depends on surgical precision, physiotherapy, and patient-related factors such as age, BMI, and comorbidities. Evaluating

ISSN 0118-3362 (Print)
eISSN 2012-3264 (Online)
Printed in the Philippines.

Received: January 28, 2026.
Accepted: February 23, 2026
Published Online: March 6, 2026.
https://doi.org/10.69472/poai.2026.16973

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outcomes in TKR requires validated assessment tools. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) is a disease-specific instrument extensively validated for quantifying pain, stiffness, and functional limitation in OA patients. WOMAC consists of 24 items scored from 0 to 96, with higher scores indicating worse symptoms. It includes subscales for pain (0–20), stiffness (0–8), and physical function (0–68), with changes of 12 points or more considered clinically meaningful.

Despite abundant literature on TKR outcomes, gaps remain in understanding WOMAC's correlation with functional metrics in diverse populations, particularly in developing countries like India, with varying access to rehabilitation and limited follow-up data. Most studies focus on short-term pain relief, with few exploring long-term functional recovery or patient satisfaction. This creates a need for localized evidence to guide clinical practice and predict outcomes. This study was designed to assess the correlation between WOMAC score improvements and functional recovery among TKR recipients. This study hypothesized that improvements in WOMAC scores would positively correlate with functional recovery metrics post-TKR.

The novelty of this study lies in its prospective design in a tertiary Indian hospital, assessing WOMAC alongside tests like TUG and ROM to provide actionable insights for rehabilitation tailoring.

METHODOLOGY

This was a prospective observational study conducted in the Department of Orthopaedics, Government Medical College and Hospital, Kallakurichi, Tamil Nadu, India, from January 2023 to June 2025. The study was approved by the Institutional Ethics Committee GMCK/IEC/5/25.

Inclusion criteria

- Age 50–80 years with primary knee OA
- Underwent unilateral or bilateral TKR
- Willingness for follow-up

Exclusion criteria

- Revision TKR
- Inflammatory arthritis (e.g., rheumatoid arthritis)
- Post-traumatic arthritis
- Neurological conditions affecting ambulation

Sample size calculation

Sample size was calculated using the formula for paired t-tests: $n = (Z_{\alpha/2} + Z_{\beta})^2 \times (SD^2) / d^2$, where $Z_{\alpha/2} = 1.96$ ($\alpha = 0.05$), $Z_{\beta} = 1.28$ (power = 90%), SD = 15 (from pilot WOMAC data), $d = 20$ (expected mean difference). This yielded $n = 64$; adding 25% for potential dropouts resulted in a sample size of 80 patients.

All procedures used a standardized surgical technique: cemented posterior-stabilized prosthesis via medial parapatellar approach, performed by a single experienced surgeon (> 10 years experience). Postoperative rehabilitation followed a standardized protocol (daily physiotherapy for six weeks, including range exercises and gait training). Pain management involved multimodal analgesia (NSAIDs, opioids as needed, ice therapy). No surgical complications, infections, or revisions occurred during follow-up. All 80 patients completed the six-month follow-up with no dropouts. Assessors were not blinded but used standardized protocols to minimize bias. For bilateral cases (all simultaneous), both knees were assessed, and scores averaged; subgroup analysis confirmed no trajectory differences ($p > 0.05$).

Outcome measures

1. ***WOMAC score:*** The WOMAC scoring system is a widely used tool for assessing osteoarthritis symptoms, particularly in the hip and knee. It consists of 24 items divided into three subscales: Pain: 5 items, scored from 0 (none) to 4 (extreme), (score range, 0 to 20) Stiffness: 2 items, scored from 0 (none) to 4 (extreme), (score range, 0 to 8) and Physical Function: 17 items, scored from 0 (no difficulty) to 4 (maximum difficulty), (score range, 0 to 68).
   The total WOMAC score is the sum of the scores from all three subscales, with a maximum score of 96. Higher scores indicate worse pain, stiffness, and functional limitation. WOMAC score was assessed at baseline, six weeks, three months, and six months.
2. ***Functional tests:*** The Timed Up and Go (TUG) test[5] is a simple assessment used to evaluate an individual's mobility, balance, and fall risk. The test involves timing how long it takes a person to rise from a seated position, walk three meters, turn around, walk back to the chair, and sit down again. It is commonly used in clinical settings to identify changes in mobility that may require further attention. Knee ROM was assessed using a goniometer; > 110° indicates good recovery.
3. ***Patient satisfaction*** was assessed using a 5-point Likert scale (1 = very dissatisfied, 5 = very satisfied; higher scores better).[6]

Statistical analysis

Paired t-tests compared pre- and postoperative values, while Pearson correlation determined associations between WOMAC and functional parameters (at six-month follow-up). Significance was set at $p < 0.05$.

RESULTS

Eighty patients were included (Table 1). The cohort was predominantly female (65%), with a mean age of 64.2 ± 6.8 years and BMI of 27.5 kg/m^2, typical for OA patients undergoing TKR.[7] Unilateral procedures dominated ($n = 62$, 77.5%), and all bilateral cases were performed simultaneously.

Table 1. Demographic characteristics of patients (n = 80)

Variable	Value
Mean age (years)	64.2 ± 6.8
Gender	52 Female (65%), 28 Male (35%)
Laterality	62 unilateral, 18 bilateral
Mean BMI (kg/m²)	27.5 ± 3.2

Table 2. Changes in WOMAC scores

Time Point	WOMAC scores (Mean ± SD)	*p*-value (vs baseline)
Pre-op	72.4 ± 9.6	-
6 weeks	54.3 ± 8.1	< 0.001
3 months	34.8 ± 7.2	< 0.001
6 months	21.5 ± 5.6	< 0.001

Table 3. Changes in TUG, ROM, and Patient Satisfaction

Parameter	Baseline	6 months	*p*-value
TUG (seconds)	18.2 ± 4.1	9.8 ± 2.3	< 0.001
ROM (degrees)	92.5 ± 10.2	118.4 ± 8.1	< 0.001
Satisfaction (1-5)	-	4.3 ± 0.7	-

Table 4. Correlation of WOMAC with recovery parameters (at 6 months)

Parameter	Correlation (r)	*p*-value
TUG Test	0.68	< 0.01
ROM	-0.55	< 0.01
Patient Satisfaction	0.72	< 0.001

No significant baseline differences existed between unilateral and bilateral cases ($p > 0.05$). Table 1 demonstrates a balanced cohort suitable for assessing TKR outcomes. Bilateral patients showed similar baseline WOMAC scores (73.4 ± 8.9) to unilateral (72.1 ± 9.8, $p = 0.42$), supporting combined analysis.

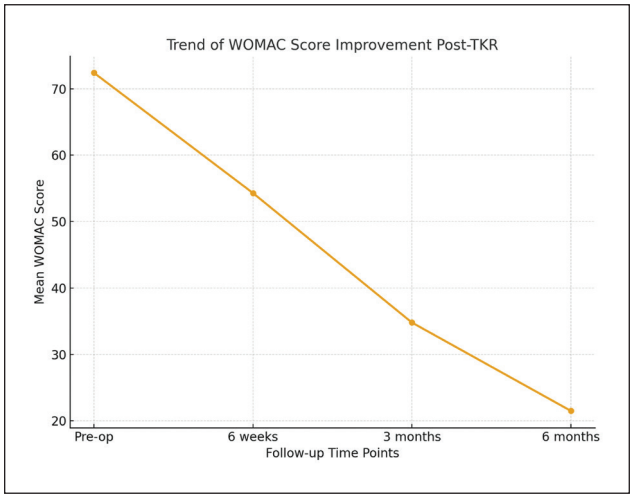

Figure 1. Line chart showing progressive decline in WOMAC score from baseline to six months (demonstrating steady improvement, plateauing after three months).

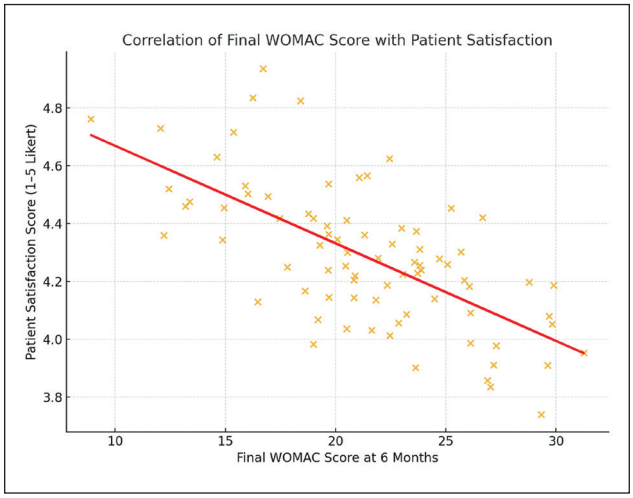

Figure 2. Scatter plot showing correlation between WOMAC and patient satisfaction (strong linear trend, r = 0.72).

DISCUSSION

This study demonstrated significant improvements in WOMAC scores[8] post TKR, with a mean reduction of 50.9 points over six months, reflecting enhanced pain control and functional recovery.[9] Strong correlations were observed between WOMAC changes and TUG (r = 0.68), ROM (r = -0.55), and patient satisfaction (r = 0.72), validating WOMAC's sensitivity as an outcome measure. The strongest relationship with satisfaction highlights that WOMAC reflects not only physical recovery but also patient-perceived well-being. This means improvements in objective functional performance (TUG and ROM) were significantly associated with better WOMAC scores, which reflect pain reduction, improved stiffness, and better physical function.

A large-scale study by Choi et al.[10] echoed these findings, reporting that performance-based physical function tests (TUG, 6-Minute Walk Test, Stair Climb Test) were significantly associated with self-reported WOMAC scores and quality of life at three months after TKA. The correlation between WOMAC pain and physical function was high (r = 0.71, $p < 0.001$, $r = 0.71$, $p < 0.001$), comparable to the current study. Additionally, pre- and postoperative pain control was found to be crucial for functional outcomes, and quadriceps as well as hamstring strength were also significant predictors for postoperative function. Witvrouw et al.[11] found moderate correlations between objective assessment and WOMAC subscales (r = 0.343 for function, r = 0.246 for stiffness, and r = 0.269 for pain), generally lower than the current study's findings, possibly due to differences in patient population or protocols. A more recent review indicated that the magnitude of WOMAC score improvement post-TKR closely predicts better functional daily activity and satisfaction, aligning with the present study's ~50-point reduction. Furthermore, Walker et al.[12] highlighted that worse preoperative WOMAC scores independently predicted greater improvements after surgery.

Postoperative satisfaction was best predicted by improvements in the WOMAC pain and physical function subscales,

supporting the use of WOMAC as a reliable indicator for patient-centered recovery, as seen in previous studies. The correlation between WOMAC pain and physical function was highly comparable to that of the current study.

The study findings imply that WOMAC can guide clinical decisions; for example, scores > 30 at three months may warrant intensified rehabilitation to optimize outcomes. The WOMAC improvement magnitude (50.9 points) in this study aligns with the 40–50 point improvements reported in recent cohorts, though the correlation coefficients (0.55–0.72) were slightly higher in this study than the 0.5–0.6 in obesity-focused research, possibly due to the standardized protocol in this study. Bilateral cases showed similar trajectories, consistent with literature suggesting simultaneous procedures recover similarly to unilateral if rehab is uniform.[13]

Clinical implications include using WOMAC thresholds (e.g., < 25 at six months) to predict satisfaction > 4/5, and treating bilateral TKR[14] patients similarly unless complications arise. These results are consistent with earlier reports identifying WOMAC as a robust tool for monitoring postoperative outcomes and satisfaction.[15]

This study is limited by its single-center design, potentially reducing generalizability. The six-month follow-up is relatively short; a longer evaluation could reveal sustained trends or late complications. There was no control group (e.g., non-surgical OA patients), and assessor non-blinding may introduce bias. The sample, while adequate, was not powered for subgroup analyses beyond bilaterality.

CONCLUSION

The WOMAC score was a reliable and practical tool for assessing functional recovery following TKR. Incorporating routine WOMAC evaluations in postoperative care can assist clinicians in monitoring progress, tailoring rehabilitation, and predicting patient satisfaction. This study confirms strong correlations with objective metrics like TUG and ROM, with implications for early intervention. In Indian settings, where resources vary, WOMAC offers a cost-effective way to enhance outcomes. Future multicenter studies with longer follow-up are recommended. The key take-home message is that WOMAC-driven care personalizes recovery, improving patient-centered results.

ACKNOWLEDGMENTS

We would like to express our sincere appreciation to everyone who contributed to the successful completion of this study. Our deepest thanks go to Prof. Dr. Bhavani - Dean, Govt. Kallakurichi Medical College, for her valuable guidance, insightful feedback, and to my parents for their blessings in this project.

STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

RR: Conceptualization, Methodology, Validation, Writing – original draft preparation; **BP and DS:** Writing – review and editing.

DATA AVAILABILITY STATEMENT

The datasets generated and analyzed in this study are included in the published article.

AUTHOR DISCLOSURE

The authors declared no conflict of interest.

FUNDING SOURCE

None.

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