

Original Article

Comparison of Oxford Knee Score in Knee Osteoarthritis Patients Before and After Total Knee Replacement at Dr. Mohamad Soewandhie Hospital

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ABSTRACT

Background: One of the most common degenerative joint diseases is knee osteoarthritis. This condition leads to pain and reduced functionality of the knee joints, which can negatively impact a patient's quality of life. Total knee replacement (TKR) has become the standard procedure to treat end-stage osteoarthritis. Evaluating the success of TKR procedures is very important. One instrument that can be used for this purpose is the Oxford Knee Score (OKS).

Methods: This observational analytic comparative study involved 40 patients. The data were collected by interviewing patients who had undergone TKR at Dr. Mohamad Soewandhie General Hospital between 2019 and 2024. The data were analyzed using the Wilcoxon signed-ranks test, independent samples t-test, and Kruskal–Wallis test.

Results: The majority of the sample in this study were aged over 60 years (62.5%), female (87.5%), and had an overweight BMI (47.5%). The analysis showed a significant increase in the OKS after surgery, with a p -value of < 0.05 . The independent samples t-test showed a significant difference in the improvement of the OKS between males and females. Meanwhile, the Kruskal–Wallis test showed no significant difference in OKS improvement across BMI categories.

Conclusions: There is a significant difference in the OKS before and after TKR surgery, which indicates an improvement in knee functionality and quality of life after surgery. Differences in patient gender may affect the outcome of the surgery, including post-surgery recovery rate and knee functionality. Meanwhile, BMI showed no significant difference in the outcomes of TKR surgery.

Keywords: Obesity; Osteoarthritis; Oxford knee score; Total knee replacement

INTRODUCTION

Osteoarthritis (OA) is a disorder that involves various anatomical and physiological changes in joint tissues, involving cartilage destruction, osteophyte formation, and alterations in bone structure. This condition triggers clinical symptoms such as pain, swelling, stiffness, and decreased joint function.¹ OA affects approximately 7% of the global population, equivalent to 500 million people worldwide.² The prevalence of knee OA varies widely across Asian populations ranging from 13.8% to 71.1%. This

variation is influenced by demographic shifts and escalating risk factors, particularly the aging population in both developed and developing countries.³ Epidemiological data indicate a significant rise in OA cases in Indonesia, with an increase of 153.12% in males and 143.36% in females between 1990 and 2019. The age-standardized prevalence rate also showed an upward trend, rising by 11.03% in males and 8.42% in females, surpassing the rates observed in China, India, Singapore, and the global average.⁴

In Southeast Asia, cultural and occupational practices involving repetitive knee flexion—such as



squatting, kneeling, and sitting cross-legged—are more prevalent compared to other regions. These movements are commonly performed during household chores, while using the lavatory, and in work-related activities such as dishwashing. Additionally, in countries like Indonesia with a significant Muslim population, the practice of daily prayers involves frequent kneeling, sometimes occurring up to 30 times per day. Furthermore, sitting cross-legged for meals, meditation, and religious activities are widely practiced among Asian populations. The repetitive mechanical stress on the knee joint from these activities contributes to the increased prevalence of knee OA in individuals who engage in them regularly.⁵

OA is most prevalent in older adults and generally develops over time, potentially leading to disability. The severity of clinical symptoms may differ between individuals.⁶ OA can affect many joints in the body; however, the knee joint is the most commonly involved.⁷ Obesity, gender, and aging are major risk factors for OA, affecting nearly 30% of older adults.⁸ As the prevalence of knee OA continues to rise, the demand for total knee replacement (TKR) procedures also increases, as surgical intervention often becomes necessary.⁹

Given the increasing reliance on TKR, research into whether differences in patient characteristics, such as gender and obesity, affect surgical outcomes and recovery is important. In addition to patient-related factors such as gender, obesity, and aging, socioeconomic status and healthcare accessibility have also been reported to influence TKR outcomes. Studies have shown that patients from lower socioeconomic backgrounds often experience delayed access to surgery, limited post-operative rehabilitation, and poorer functional recovery compared to those with higher socioeconomic status. Moreover, disparities in healthcare infrastructure—such as hospital resources, surgeon expertise, and access to rehabilitation services—contribute to variations in post-surgical outcomes.

In Indonesia, where the healthcare system faces challenges such as the uneven distribution of

medical facilities, limited insurance coverage, and financial constraints for many patients, these socioeconomic and systemic factors may significantly impact the success of TKR procedures. Understanding these external factors is crucial for evaluating the effectiveness of TKR and optimizing patient management, particularly in developing countries like Indonesia, where healthcare accessibility remains a significant concern.¹⁰

OA diagnosis can be established based on pathological changes, radiographic findings, and clinical manifestations. The Kellgren–Lawrence radiographic grading system is the gold standard for the radiographic evaluation of OA. This scale classifies the severity of OA into five grades, ranging from 0 to 4. If there are signs of bone growth (osteophytes) at grade 2 or higher, OA is considered present. The more severe the OA, the greater the joint damage, including joint space narrowing, deformity, sclerosis, and cyst formation.¹¹ Conservative therapy, such as nonsteroidal anti-inflammatory drugs (NSAIDs), aims to relieve symptoms such as pain, stiffness, and activity limitation, and is preferred as the first- and second-line treatment for OA.¹² Conservative therapy is recommended for patients with grade 1, 2, or 3 knee OA, while surgery is performed for patients with grade 4, or end-stage, knee osteoarthritis.¹³

TKR is the gold standard for treating end-stage knee OA due to its high effectiveness and ability to improve symptoms and physiological function.¹² The goal of TKR is to replace damaged and inflamed joint surfaces with prosthetic components. The new joint typically consists of metal components combined with high-density polyethylene. Most patients who undergo TKR are over the age of 50, although some patients younger than 50 years are also found.¹⁴ This surgical procedure has achieved significant success with the advancement of medical technology. Today, TKR has become a common option for patients suffering from chronic OA that cannot be managed with conservative treatment.¹⁵

Several studies have reported the occurrence of stiffness and persistent pain after TKR, with approximately 4–16% of patients experiencing



stiffness following surgery.¹⁶ Understanding how patients perceive their knee replacement surgery is essential. The Oxford Knee Score (OKS) helps measure post-surgical pain and knee function. The total score ranges from 0 (poorest function) to 48 (optimal function).¹⁷ To date, no studies have assessed knee mobility and quality-of-life improvement before and after TKR surgery using the OKS in Indonesia. Therefore, further research is needed to evaluate knee condition and function both pre- and post-operatively.

This study aims to compare knee mobility and functionality before and after TKR surgery using the OKS among patients who underwent TKR at Dr. Mohamad Soewandhie General Hospital, Surabaya, between 2019 and 2024, and to determine whether gender and BMI differences affect TKR outcomes. Research comparing OKS scores before and after TKR is important for assessing the effectiveness of the procedure in reducing pain and improving knee function. Such studies help evaluate surgical outcomes and enhance post-operative care. Additionally, identifying the influence of gender and BMI on TKR outcomes is crucial for designing more accurate and personalized care strategies.

MATERIAL AND METHODS

Study Design and Sampling

This study employed an observational analytic design. The research subjects were patients who met the inclusion criteria, namely, grade 4 osteoarthritis patients who had undergone TKR surgery at Dr. Mohamad Soewandhie General Hospital between 2019 and 2024, with a minimum of three months post-surgery. The exclusion criteria for study subjects were patients who had not undergone TKR surgery at Dr. Mohamad Soewandhie General Hospital during 2019–2024 and those who were unavailable or unwilling to sign informed consent. Ethical approval for this study was obtained (No. 125/EC/KEPK- FKUC/VI/2024).

Data Collection

Data were collected by interviews with osteoarthritis

patients who had undergone TKR surgery between 2019 and 2024 and came for follow-up at Dr. Mohamad Soewandhie General Hospital in August to September 2024. The Oxford Knee Score questionnaire was used for data collection. The OKS was originally developed by Dr. Jill Dawson and Professor Ray Fitzpatrick in 1998 and consists of 12 questions. The scoring system uses a Likert scale ranging from 0 to 4, where a score of 4 represents the best outcome and 0 represents the worst outcome.

The sample was obtained using a total sampling method, with n representing the total number of knees that had undergone TKR surgery at Dr. Mohamad Soewandhie General Hospital between 2019 and 2024. The total sample obtained and analyzed in this study comprised 40 knees.

Data Analysis

All collected data were processed and analyzed using IBM SPSS Statistics for Windows, Version 30.0 (IBM Corp., Armonk, NY, USA). A test of normality was first performed to determine whether the dataset followed a normal distribution, which guided the selection of the appropriate statistical tests. Since the total number of samples was 40, the Shapiro–Wilk test was used instead of the Kolmogorov–Smirnov test.

Data were considered normally distributed (parametric) if the p -value was greater than 0.05. In such cases, t -tests or ANOVA were used, depending on the research design and data characteristics. Conversely, if the p -value from the normality test was less than 0.05, the data were considered not normally distributed (non-parametric), and the Mann–Whitney, Wilcoxon, or Kruskal–Wallis tests were applied as appropriate based on the research requirements and data collection method.

RESULTS

Table 1 presents the age, gender, and BMI characteristics of patients who underwent TKR surgery at Dr. Mohamad Soewandhie General Hospital, Surabaya, during the 2019–2024 period. The majority of patients who underwent surgery



were over 60 years old (62.5%). Female patients accounted for 87.5% of the total, which was higher than male patients (12.5%). Patients who had undergone TKR surgery had a range of BMI categories, from normal to obese. Most patients had an overweight BMI (47.5%), followed by those with a normal BMI (25%) and those categorized as obese (27.5%).

The detailed characteristics of patients who had undergone TKR surgery at Dr. Mohamad Soewandhie General Hospital, Surabaya, from 2019 to 2024, are shown in Table 1.

Table 2 shows that among 40 patients who underwent TKR surgery at Dr. Mohamad Soewandhie General Hospital between 2019 and 2024, the lowest preoperative OKS was 1 and the highest was 32, with a mean score of 13.23. After surgery, the lowest OKS was 9 and the highest was 47, with a mean score of 38.80. These results indicate a significant improvement in the OKS following TKR surgery.

The results of the normality tests for each variable are shown in Table 3. Normality was assessed based on the *p*-value: data were considered normally distributed if the *p*-value is >

0.05 and non-normally distributed if the *p*-value is < 0.05. The OKS had a *p*-value of 0.039, indicating a non-normal (non-parametric) distribution. Both gender categories had *p*-values above 0.05, meaning the gender variable was normally distributed.

For the BMI variable, the data were divided into normal, overweight, and obese categories. The normal and overweight categories had *p*-values above 0.05, indicating normal distributions, while the obese category had a *p*-value of 0.008, indicating a non-normal distribution. Since one of the three BMI categories was not normally distributed, the BMI variable as a whole was considered non-normally distributed.

The OKS data were continuous and non-normally distributed based on the normality test. Therefore, the Wilcoxon signed-rank test was used to test the hypothesis. As shown in Table 4, the *p*-value for the OKS variable was < 0.001, indicating a significant difference between pre-operative and postoperative scores. This finding suggests a significant improvement in knee function after TKR surgery. The median OKS increased from 12 before surgery to 41 after surgery.

The gender variable was nominal, con-

Table 1. Characteristics of patients who underwent total knee replacement surgery at Dr. Mohamad Soewandhie General Hospital, Surabaya (2019–2024).

	n	%
Age		
Age <60	15	37.5 %
Age >60	25	62.5%
Sex		
Women	35	87.5%
Men	5	1.5%
BMI		
Normal	10	25%
Overweight	19	47.5%
Obese	11	27.5%

Table 2. Descriptive characteristics of OKS scores

	Min	Max	Median	Mean	Std. Deviation
Pre-op	1	32	12.00	13.23	7.843
Post-op	9	47	41.00	38.80	7.799

Table 3. Test of normality

Variables	Shapiro-Wilk
OKS	0.039
Gender	0.095*
	0.565*
BMI	0.066*
	0.448*
	0.008

*Significant at *p* < 0.05

Table 4. Wilcoxon signed-rank test

	n	Median (min-max)	<i>p</i> -value
Pre-op	40	12(1-32)	< 0.001*
Post-op	40	41(9-47)	

*Significant at *p* < 0.05



Table 5. Independent samples t-test

Gender	n	Median $\pm$ SD	p-value
Women	35	28.2 $\pm$ 10.029	< 0.001*
Men	5	7.2 $\pm$ 11.649	

*Significant at $p < 0.05$ **Table 6.** Kruskal-Wallis test

	n	Median (min-max)	p-value
Normal	10	22.7(19.2-24.9)	0.370
Overweight	19	26.3(25.2-29.7)	
Obese	11	32(30.1-34.2)	

sisting of two categories (female and male) with no hierarchy. The normality test showed that it was normally distributed; therefore, the independent samples t-test was used to test the hypothesis. The results are presented in Table 5. The p -value was < 0.001, indicating a significant difference in OKS improvement between male and female patients. These results suggest that gender may influence postoperative recovery and functional outcomes.

The BMI variable was ordinal, with three categories (normal, overweight, and obese). Because the normality test indicated that the data were not normally distributed, the Kruskal–Wallis test was used. The results, shown in Table 6, revealed a p -value of 0.370, which is greater than 0.05. This indicates that there was no significant difference in OKS improvement across BMI categories, suggesting that BMI was not a major factor influencing recovery and functional outcomes after TKR surgery.

DISCUSSION

This study shows that TKR surgery was more common among women (87.5%), patients over the age of 60 (62.5%), and patients with an overweight BMI (47.5%). These findings suggest that knee osteoarthritis tends to be more severe in women, who also often present with more pronounced symptoms upon diagnosis. Women are three times more likely to undergo TKR at an advanced stage of the disease.¹⁸ Differences in pain perception, knee structure, kinematics, history of knee trauma, and hormonal influences are among the factors that likely contribute to this gender disparity.¹⁹

Hormonal influences on cartilage, reduced

knee cartilage thickness, accelerated articular cartilage loss, and higher preoperative body mass index (> 27 kg/m²) collectively contribute to the faster progression of knee OA in women.¹⁸ Additionally, women are more likely than men to seek medical attention for hip and knee problems.²⁰ TKR is predominantly performed in individuals over 60 years of age, primarily because OA is more prevalent in this age group. As people age, cumulative wear and tear on the knee joints often leads to cartilage degeneration, resulting in pain, reduced mobility, and difficulty performing daily activities.²¹ Therefore, TKR is often chosen to improve quality of life in these patients.

A BMI above 30 kg/m² is significantly associated with knee OA. Studies estimate that approximately 24.6% of knee pain cases are related to overweight or obesity, as excess weight places additional pressure on the joints.²²

This study analyzed 40 knees that had undergone TKR surgery, and the results showed a significant improvement in the Oxford Knee Score after surgery compared to preoperative scores at Dr. Mohamad Soewandhie General Hospital, Surabaya, during 2019–2024 (p -value < 0.05). According to Clement et al., a clinically meaningful difference in OKS is defined as at least five points, which indicates a clinically relevant improvement between patient categories.²³ This aligns with the findings of Sulaiman et al., who reported mean OKS scores of 12.6 before surgery and 42.7 after surgery, demonstrating a significant improvement.²⁴ Similarly, Ingelsrud et al. reported that 85% of patients experienced significant knee function improvement, as indicated by increased OKS scores.²⁵



Currently, TKR is a common surgical procedure for restoring knee functionality in cases of severe osteoarthritis.²⁶ A study by Romanowski et al. also supports this finding, showing significant improvement in OKS before and after TKR surgery, indicating that the procedure has a positive effect on patients with chronic OA.²⁷ Chaudhary et al. noted that several factors influence postoperative OKS improvement, including prosthesis-related factors (implant size and positioning), patient-related factors (activity level, comorbidities, and psychological response), and surgery-related factors (surgeon skill and experience).²⁸

Of the 40 samples analyzed in this study, 35 were female and 5 were male. A significant difference was observed in OKS improvement between genders, as reflected in the median scores for females (28.2) and males (7.2). This may be attributed to anatomical, physiological, and behavioral differences such as pain perception, knee structure, and preoperative activity levels. Brown et al. reported that female patients experienced greater overall improvement in OKS (p -value = 0.03).²⁹ Nandi et al. also found significant differences between male and female patients, with women tending to report higher pain levels and greater sensitivity to pain stimuli. Consequently, they experience greater functional improvement after surgery than men, despite having similar radiographic findings.³⁰

Previous research has identified distinct anatomical differences between male and female knees that may influence surgical outcomes when standard TKR implants are used. These differences include a greater Q-angle, a smaller mediolateral dimension of the distal femur, and a less prominent anterior femoral condyle in women.³¹ Lower pain thresholds and better adherence to postoperative rehabilitation programs are other possible factors contributing to the greater improvements observed in women after surgery.

Although being overweight is a known risk factor for knee OA and can affect surgical outcomes, this study found no significant difference in OKS

improvement across BMI categories. According to Brown et al., preoperative OA severity may be a more critical factor in predicting OKS improvement than BMI, as more severe joint damage is associated with differing recovery patterns. When OA severity is comparable among BMI groups, patients tend to exhibit similar postoperative functional improvements.²⁹ Thus, improvements in OKS are likely influenced more by OA severity than by BMI.

Although there was no significant difference in OKS improvement among BMI categories, excess body weight and high BMI (≥ 35 kg/m²) are associated with increased postoperative pain, higher joint loading, inflammation, and post-surgical complications. These factors can negatively affect physical activity levels and delay functional recovery. Nevertheless, obese patients can still experience meaningful improvements following TKR. Therefore, weight management remains an essential recommendation for optimizing surgical outcomes and recovery. While achieving significant weight loss may be challenging for many patients, maintaining a healthy weight supports better rehabilitation outcomes and enhances postoperative recovery, particularly through physiotherapy.³²

Understanding differences in TKR outcomes between genders and across BMI categories is crucial for evaluating surgical indications, providing effective preoperative counseling, managing patient expectations, and improving postoperative outcomes.

This study has several limitations. First, the research duration was short—only one month—resulting in a relatively small sample size. This limits the ability to assess all TKR surgeries performed at Dr. Mohamad Soewandhie General Hospital. Second, the study location was limited to a single hospital. Expanding future studies to multiple healthcare centers is recommended, given the increasing prevalence of OA in Indonesia.

CONCLUSION

Based on the findings of this study, there was a significant difference in OKS before and after



surgery among patients who underwent TKR at Dr. Mohamad Soewandhie General Hospital, Surabaya, between 2019 and 2024, as shown by the higher mean OKS after surgery. TKR surgery was more frequently performed on women, patients over 60 years of age, and those with an overweight BMI, suggesting that age, gender, and BMI are important risk factors for knee OA and predictors of TKR surgery.

The results of the independent samples t-test showed a p -value < 0.05 , indicating that gender significantly affected TKR outcomes. In contrast, the Kruskal–Wallis test demonstrated that differences among BMI categories did not significantly affect OKS improvement.

Further research considering additional variables—such as comorbidities, activity levels, implant type, and long-term follow-up—is necessary to provide a more comprehensive understanding of the factors influencing TKR outcomes.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

ETHICAL APPROVAL

This study was approved by the Ethical Committee of the School of Medicine, Universitas Ciputra, Surabaya, Indonesia (Approval No. 125/EC/KEPK-FKUC/VI/2024). All procedures performed in studies involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments, or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

DATA AVAILABILITY STATEMENT

Due to privacy restrictions, the raw data cannot be made publicly available. However, aggregated and anonymized data are available from the corresponding author upon reasonable request.

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