

# Preoperative and Postoperative Comparison on Patients with Total Knee Replacement based on the OKS, KOOS-JR, and KOS-ADLS Scoring Systems

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## ABSTRACT

**Background:** Total knee replacement (TKR) is indicated if initial management fails to control symptoms. Clinical and functional assessments in patients who are planned for TKR are essential in order to provide better results. The aim of this study was to assess pre-operative and post-operative clinical and functional comparisons using three assessment systems in patients who had undergone TKR. **Methods:** This was an observational analytical study with a cross-sectional approach on 25 subjects with osteoarthritis who had undergone total knee replacement surgery who attended routine control at the Polyclinic from September to October 2023 at the Orthopedics and Traumatology Polyclinic at Siti Khodijah Hospital, Sidoarjo, Indonesia. **Results:** This study showed that postoperative clinical and functional results provided good results. The results of the three scoring systems showed postoperative clinical and functional improvement evaluated by KOOS-JR ( $-11,720 \pm 7,357$ ), KOS-ADLS ( $16,840 \pm 10,371$ ), with the most significant improvement assessed by the OKS scoring system ( $18,520 \pm 9,175$ ). The patient's clinical and functional outcomes are better after TKR surgery based on three scoring systems, namely OKS, KOOS-JR, and KOS-ADLS. **Conclusion:** In this study, treatment with TKR provides better clinical outcomes and functional improvements such as the disappearance of pain, being able to walk long distances, full knee extension, and gradual knee flexion as seen from the improvements in clinical scores and postoperative knee functional scores using the OKS, KOOS-JR, and KOS-ADLS scoring systems. The assessment system that provides the greatest improvement is the OKS assessment system.

**Keywords:** OKS; KOOS-JR; KOS-ADLS

## INTRODUCTION

Knee osteoarthritis is a degenerative disease that causes pain, functional limitations, and disability throughout the world. [1, 2] Osteoarthritis also causes other symptoms such as angular deformity, recurrent swelling and stiffness. [3] This disease is progressive and its prevalence increases among the elderly as they get older. Other risk factors that can increase the incidence of osteoarthritis are gender, genetics, obesity, and trauma. [4, 5]

Considering the increasing number of osteoarthritis in older people in the world, this has led to an increase in demand for total knee replacement (TKR). TKR is the best therapeutic option if the response to medical treatment or medical rehabilitation does not provide good results in elderly osteoarthritis patients. This action is also indicated when initial management such as education, exercise, weight loss, and analgesics fail to control the symptoms of osteoarthritis. [1, 2, 6] This treatment is expected to improve functional limitations, and disability and reduce the burden experienced by patients, family members, and society for daily activities. [3, 7]

The level of patient satisfaction after TKR depends greatly on pre-operative expectations. Satisfaction after the TKR procedure increases by 81-89% with functional improvements such as increased knee stability, reduced pain and increased ability to carry out daily activities. Patient satisfaction is assessed by many other factors including surgical factors (type of surgery, type of anesthesia, operating time, complications, type of implant, etc.), post-operative factors (post-operative care, analgesics and pain management, hospital quality, etc.) and pre-operative factors. Thus, it is important to educate patients before carrying out TKR. [1, 6, 8]

Clinical and functional assessment in osteoarthritis patients who are planned for TKR is vital. Assessments can be carried out pre-operatively and post-operatively to improve the patient's quality of life and manage patient expectations. Clinical and functional measurements can be assessed using various types of scoring systems such as the Oxford Knee Score (OKS), Knee Injury and Osteoarthritis Outcome Score (KOOS-JR), Knee Outcome Survey-Activity Daily Living Scale (KOS-ADLS), SF-36, Knee

Society Score, and many other types of scoring systems. [3, 8–10].

The aim of this study was to assess pre-operative and post-operative clinical and functional comparisons using the Oxford Knee Score (OKS), Knee Injury and Osteoarthritis Outcome Score (KOOS-JR), and Knee Outcome Survey-Activity Daily Living Scale (KOS-ADLS) in osteoarthritis patients who have undergone total knee replacement (TKR) at Siti Khodijah Hospital, Sidoarjo, Indonesia.

## METHODS

This research is an observational analytical study with a cross-sectional design. A total of 25 subjects were included in this study. The subjects were patients with knee osteoarthritis who had undergone unilateral or bilateral total knee replacement surgery who attended routine control at the Polyclinic from September 2023 to October 2023 in Orthopedic and Traumatology Polyclinic at Siti Khodijah Hospital, Sidoarjo, Indonesia.

The inclusion criteria were male and female patients aged 50 to 75 years who were diagnosed with osteoarthritis of the knee joint who underwent TKR at least 1 month after the procedure, and who were willing to be respondents. The exclusion criteria were patients with TKR repairs, patients with a history of septic arthritis, patients with dislocation of the prosthesis after total knee replacement due to infection, problematic implants, patients with neurovascular problems, and patients who were unwilling to be respondents. Respondents who met the inclusion criteria and exclusion criteria were evaluated clinically and functionally pre-operatively and post-operatively using the OKS, KOOS-JR, and KOS-ADLS scoring systems.

Data regarding age, gender, occupation, part operated on, and scoring system were recorded and analyzed using SPSS. The data was tested for normality using Shapiro-Wilk to determine whether the data distribution was normal or not. Data distribution is said to be normal if  $p > 0.05$ . If the results are normally distributed, then use the Paired T-Test, whereas if the data is not normally distributed then use the Wilcoxon Test.

## RESULTS

This research was conducted at the Orthopedic and Traumatology Polyclinic of Siti Khodijah Hospital, Sidoarjo, East Java on 25 knee osteoarthritis patients who had undergone unilateral or bilateral total knee replacement surgery who attended for routine control at the Polyclinic in September 2023 to October 2023 who meet the inclusion and exclusion criteria.

The characteristics of the respondents in this study were grouped based on gender, age, occupation, and the extremity on which the operative procedure was performed, which are presented in Table 1.

**TABLE 1:** Demographic Data.

	N	Percentage (%)
<b>Gender</b>		
Male	5	20%
Female	20	80%
<b>Age</b>		
45 -54 y.o	0	0 %
55-65 y.o	19	76%
66-74 y.o	6	24%
75-90 y.o	0	0 %
<b>Occupation</b>		
Housewife	17	68 %
Self-employed	4	16 %
Private sector Employee	2	8 %
Farmer	1	4 %
Teacher	1	4 %
<b>Extremities</b>		
Dextra	9	36 %
Sinistra	12	48 %
Bilateral	4	16 %
<b>Total</b>	<b>25</b>	<b>100 %</b>

The results of this research show that the highest number of respondents were female, 20 people (80%), while men were 5 people (20%). Based on age, the highest vulnerable age group was between 55-65 years old, namely 19 patients (76%), and the second highest vulnerable age group was 66-75 years old (24%). Age assessment was based on the WHO classification. As for occupation, the highest results were housewives, 17 people (68%). Based on the extremities that underwent operative procedures, the highest results were found in the left extremities with 12 people (48%), followed by the right extremities with 9 people (36%) and bilateral with 4 people (16%).

In the pre-operative clinical and functional assessment using the OKS, KOOS, and KOS-ADLS scoring systems, it was found that 23 patients (92%) complained of pain with severe intensity. Patients also experienced several other symptoms such as walking with a limp, 17 people (68%). In the preoperative functional assessment, there were limitations when squatting for 23 people (92%), kneeling for 22 people (88%), going up or down stairs for 21 people (84%), and standing upright for 19 people (76%). We also found that 19 people (76%) had problems standing up and sitting down, 18 people (72%) had problems entering and getting out of a car, 18 people (72%) had problems turning their knees, and 16 people (64%) had difficulty to fully straightening their knees.

Postoperative clinical and functional results provided good results such as relief of pain in 17 people (68%), being able to walk 15-≥60 minutes in 24 people (96%), being able to straighten the knee completely in 16 people (64%), sitting in chairs with an angle of 90° there are 16 people (64%) and several other functions such as reduced difficulty when going up and down stairs, shopping for daily

necessities, getting in and out of the car, showering, standing up straight, picking up objects from the floor from a standing position. However, there were several functional limitations that still occurred in patients, namely squatting in 22 people (88%) and kneeling in 21 people (84%).

In this study, to determine the significance of the difference between pre-operative and post-operative TKR, a related sample bivariate test was carried out, namely the Paired T-Test (parametric) or Wilcoxon Test. Before testing with the Paired T-Test, a normality test was carried out using the Shapiro-Wilk test to determine whether the data distribution was normal or not. Data distribution is said to be normal if  $p > 0.05$ .

The results of the normality test using Shapiro-Wilk only KOOS-JR and KOS-ADLS were normally distributed with  $p > 0.05$ . Therefore, the paired difference test used for KOOS-JR and KOS-ADLS is the Paired T-Test. In the OKS instrument, because the Shapiro-Wilk test results were  $p < 0.05$ , the distribution was not normal, therefore the Wilcoxon test was used for the difference test (Table 2).

**TABLE 2:** Normality Test Result.

		Sig.	Interpretation
OKS	Pre	0.008	Abnormal Distribution
	Post	0.010	Abnormal Distribution
KOOS-JR	Pre	0.585	Normally distributed
	Post	0.024	Normally distributed
KOS-ADLS	Pre	0.462	Normally distributed
	Post	0.442	Normally distributed

Analysis using the paired T-test showed that there was a significant difference between the pre-operative KOSS-JR and KOS-ADLS values and post-operative Total Knee Replacement, with a p-value of 0.000 ( $< 0.05$ ). The Wilcoxon test results showed that there was a significant difference between the pre-operative and post-operative Total Knee Replacement OKS values, with a p-value of 0.000 ( $< 0.05$ ) (Table 3).

**TABLE 3:** Differential Test Result.

	Differential Test	Mean ± SD	Sig.
OKS	Wilcoxon	18.520 ± 9.175	0.000
KOOS-JR	Paired T-Test	-11.720 ± 7.357	0.000
KOS-ADLS	Paired T-Test	16.840 ± 10.371	0.000

This study showed that the patient's clinical and functional outcomes were better after Total Knee Replacement surgery which were assessed using three scoring systems, namely OKS, KOOS-JR, and KOS-ADLS. Although all three scoring systems resulted in a good improvement, KOOS-JR scoring system (-11,720 ± 7,357) and KOS-ADLS (16,840 ± 10,371), but OKS scoring system showed the most significant change was showed by OKS (18.520 ± 9.175) (Table 3).

**DISCUSSION**

Total knee replacement is a very effective procedure for reducing symptoms and improving function in patients with osteoarthritis. Over the last few years, there has been an increase in demand for TKR procedures throughout the world due to the increasing level of patient satisfaction as a priority for treating osteoarthritis. Our study also proves that TKR can improve the patient's quality of life, namely reducing the perceived clinical symptoms and improving function in patients with osteoarthritis. [3, 6, 11]

In our study, the final results showed a better clinical and functional outcome for patients after TKR surgery assessed by three assessment tools. This is in accordance with research in Nottingham, UK, which stated that after undergoing total knee replacement surgery, the OKS rate increased by more than 70% after surgery. [1]

A study in 2017 by Calattayud et al illustrates that high-intensity training prior to surgery can reduce pain, and increase leg muscle strength, ROM, and function in the pre-operative period thereby reducing the length of treatment and faster physical, mental, and functional improvements. after TKR. [12] After TKR there was a significant increase in one basic aspect of self-care (bathing), three other aspects of difficult tasks (light housework, heavy housework, and shopping), and two advanced activities in daily life (walking 2-3 blocks and weight lifting ≤5 kg).<sup>16</sup> Improvement after TKR surgery can be evaluated at 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> months after the procedure. In Leigh White's research, there was an increase in evaluation results in the 6<sup>th</sup> month (88%) and in the 12th month (83.7%). This improvement is followed by rehabilitation and regular patient education. Clinical and functional improvements include the ability to walk, bend the knee, straighten the leg, climb stairs, and stand up. [1, 7, 12, 13]

Several factors underlie the assessment of clinical and functional outcomes after TKR surgery, namely age, gender, BMI, socio-economic status, family support, mental health, pre-operative pain and functional scores, comorbidities, implants used, and quality of the treatment from the hospital. [4, 13]

A study conducted by M.T. Sanchez-Santos reported that patients with pre-operative conditions such as poor pain and function, socio-economic problems, patients experiencing anxiety/depression, comorbidities, and high BMI were associated with worse postoperative outcomes. [13]

The potential influencing factor of the type of implant used is associated with good outcomes. However, there are several factors that play an important role in functional outcomes after total knee replacement, such as age, gender, and obesity. [4, 5]

Postoperative clinical and functional results provided good results such as relief of pain in 17 people (68%), being able to walk 15-≥60 minutes in 24 people (96%), being able to straighten the knee completely in 16 people (64%), sitting in chairs with an angle of 90° there are 16 people (64%) and several other functions such as reduced difficulty when going up and down stairs, shopping for daily necessities, getting in and out of the car, showering, standing up straight, picking up objects from the floor from a standing position. This is in accordance with the results of previous research where as time goes by the patient's pain decreases, followed by improvements in the patient's ROM such as knee flexion and extension. Improvements in the flexion range start from the 3rd month to the 12th month while the extension range starts from the 6th month to the 12th month.[13, 14] Improvements in flexion between 70 and 90 degrees can be achieved immediately after surgery, while flexion at an angle of 95-115 degrees is achieved 1 month after surgery, and an angle of 109-122 degrees is achieved 3 months after surgery.[15] Improved extension with an angle of 0 degrees and 5 degrees can be achieved immediately after total knee replacement surgery for up to 5 years of follow-up.[16] Several factors determine the improvement of the patient's ROM, namely age, gender, diagnosis, preoperative ROM, surgeon skill, prosthesis design, and postoperative rehabilitation.[14]

In this study, there were several functional limitations that still occurred in patients, namely problems in squatting in 22 people (88%) and kneeling in 21 people (84%). Some literature states that a small number of patients who have undergone TKR procedures still experience complaints of pain with mild intensity and slight functional limitations after surgery. However, there are also those who experience moderate-intensity pain and still experience functional limitations. For example, patients still feel stiffness, and pain when standing from a chair, and have difficulty kneeling and standing again. Patients were educated that although kneeling will be uncomfortable or painful, it will not damage the new joint. Research by Leigh White shows an improvement in kneeling 6-12 months after surgery with a percentage of 63-72%.[6] Other studies also stated that there was an increase of 20% and 40%. However, the percentage who are still unable to kneel is 15-39%. [1, 7, 13] Stiffness assessment also has an important role as a predictor of patient satisfaction. Research by Mohammed shows that the level of satisfaction after total knee replacement can be predicted pre-operatively through the perception of stiffness. The stiffness assessment is more specific using the KOOS-JR score rather than using the OKS or KOS-ADLS score because the KOOS-JR score discusses stiffness in more detail.

Less frequent occurrences of stiffness and less limited range of motion (ROM) provide better postoperative outcomes. [8]

Monitoring or evaluating discomfort after TKR surgery is vital so that the patient's function becomes better and the level of patient satisfaction increases. Evaluation of patient satisfaction can be assessed from two categories, namely the intrinsic category (age, gender, comorbidities, and patient expectations) and the extrinsic category (surgeon, anesthesia, and rehabilitation factors). Clinical and functional evaluation of patients after TKR surgery sometimes has several obstacles so repairs take slightly more time. Some of the obstacles are that patients think that kneeling will be painful, afraid to try some functional movements, are told not to do any normal movements, afraid of damaging the implant, and experience numbness and stiffness. This can be prevented by providing education and rehabilitation during the healing process. [6, 17, 18]

The education and rehabilitation that we can provide to patients after TKR surgery is to conduct mobilization and physiotherapy in stages. Mobilization can begin 4-8 hours after TKR surgery. Early mobilization provides beneficial results for patients, such as improving patient outcomes, minimizing length of stay, and preventing complications. A physiotherapy program is also recommended during the recovery period with safe exercise movements that focus on increasing the range of motion of the knee joint, such as pedaling a bicycle. Research published in the Journal of Bone and Joint Surgery shows that bicycle pedaling, knee extension, and heel-toe walking provide good functional results. Based on the results of this trial, post-operative patients can complete some simple homework. [19]

There for, assessment using a pre-operative scoring system is very important to provide education and manage patient expectations regarding clinical and functional results after this procedure. Post-operative evaluation using a scoring system also has a role in analyzing better clinical and functional improvements. [1, 13]

## CONCLUSION

Total knee replacement is an operative procedure that has been proven to be reliable and feasible for elderly osteoarthritis patients who have not responded well to medical treatment or medical rehabilitation. Treatment with TKR provides better clinical outcomes and functional improvements as reflected by improvements in clinical scores and postoperative knee functional scores using the OKS, KOOS-JR, and KOS-ADLS scoring systems. The assessment system that provides the greatest improvement is the OKS assessment system. It is hoped that the results of this research will help provide education to patients about undergoing total knee replacement in elderly osteoarthritis patients in order to improve patient's quality of life.



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