

## Quality of Life After Simultaneous Bilateral Total Knee Arthroplasty: A Pilot Study

Mohammad Mohammadaly Abbas<sup>1\*</sup>, Mohammed Hussein Alkaff<sup>2</sup>, Kamel Fouad Azhar<sup>3</sup>, Mohammed Abdulrahman Alhamdan<sup>4</sup>, Sarah Maher Moshref<sup>5</sup>

<sup>1\*</sup>Assistant Professor and Orthopedic Consultant,  
Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia.

<sup>2</sup>Orthopedic Consultant, Orthopedic Department,  
King Abdulaziz University Hospital, Jeddah, Kingdom of Saudi Arabia.

<sup>3</sup>Teaching Assistant at University of Jeddah, Family Medicine Resident at Texas Tech University.

<sup>4</sup>Orthopedic Surgery Demonstrator,  
King Abdulaziz University, Orthopedic Department, Jeddah, Kingdom of Saudi Arabia.

<sup>5</sup>Resident at Rehabilitation Center,  
King Abdulaziz Hospital and Oncology Center, Jeddah, Kingdom of Saudi Arabia.

### ABSTRACT

**Objectives:** To assess quality of life (QOL) of patients who underwent simultaneous bilateral total knee arthroplasty (SB-TKA).

**Methods:** We retrospectively analyzed the files of all patients who underwent SB-TKA in 2005-2011. Patients were interviewed regarding preoperative and 1-year postoperative parameters for QOL using Nottingham Health Profile (NHP) questionnaire, as well as other parameters.

**Results:** Twenty patients (nine men and 11 women) were included. NHP scores showed significant improvement in all dimensions. From preoperative to postoperative assessments, mean (standard deviation) scores improved significantly especially for sleep, social isolation, energy and pain. We observed significant improvement in achievement of daily living activities, performing Omra (pilgrimage) in standing position, ability to climb stairs, and knee satisfaction.

**Conclusion:** After SB-TKA, there were significant improvement in QOL parameters including pain and sleep. Further prospective controlled investigations are warranted to

address the added value of SB-TKA compared to staged bilateral TKA in terms of QOL.

**Key words:** Bilateral Total Knee Arthroplasty, Simultaneous, Quality of Life, Daily Living Activities.

### \*Correspondence to:

**Mohammad Mohammadaly Abbas,**  
Assistant Professor and Orthopedic Consultant,  
Faculty of Medicine,  
King Abdulaziz University, Jeddah, Saudi Arabia.

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### INTRODUCTION

Total knee arthroplasty (TKA) is an efficient and cost-effective procedure to treat advanced stages of primary knee osteoarthritis (OA).<sup>1-6</sup> Because of the growing prevalence of knee OA, the demand for TKA is increasing.<sup>6,7</sup> In the United States alone, the yearly number of TKA procedures is expected to increase 7-fold between 2005 and 2030.<sup>8</sup>

Patients who require replacement of both knees because of bilateral degenerative disease can benefit from either staged or simultaneous procedures. With simultaneous bilateral TKA (SB-TKA), patients have the opportunity to be treated for both knees in a single anesthesia session and to benefit from bilateral knee rehabilitation. Economically, SB-TKA has the advantage of reducing hospital stay time and hospitalization costs.<sup>9</sup> In addition

to these early post-operative advantages, patient quality of life remains a crucial issue in judging the real effectiveness of SB-TKA.

In both unilateral and bilateral end-stage knee OA, TKA is indicated to improve knee function and eradicate articular pain;<sup>1,4</sup> however, surgical success, as judged by objective orthopedic assessment, cannot predict patient satisfaction regarding pain control or achieving activities of daily life (ADL), the two major determinants of quality of life. Highly successful surgical procedures that are achieved by improved implant designs and techniques<sup>10,11</sup> are still associated with a non-negligible proportion (5-20%) of patients who suffer from residual knee pain that often significantly disables ADLs such as walking, climbing stairs, and

standing up from a chair.<sup>4,6,10,11</sup> Therefore, patient-reported outcomes are becoming an essential criterion of success and tend to be systematically included in clinical assessments.

Several questionnaires investigating generic health status have been used for the assessment of patient-reported outcomes, such as the Nottingham Health Profile (NHP), Short Form 36 (SF-36), and Health Assessment Questionnaire (HAQ). In addition, other disease- and joint-specific questionnaires have been developed, such as the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index, Knee Society Score (KSS), International Knee Documentation Committee (IKDC) Subjective Knee Form, Knee Injury and Osteoarthritis Outcome Score (KOOS), Oxford Knee Score, and Arthritis Impact Measurement Scale 2 (AIMS2).<sup>12-19</sup> Despite variations in the responsiveness and size effects of these specific and generic instruments, there is no consensual practice regarding the superiority of one versus the others.<sup>16,17,20</sup> Many researchers, however, tend to use a combination of one disease- or joint-specific questionnaire with one generic questionnaire and to repeat assessments at different timepoints.<sup>14-16</sup>

Patient-reported outcomes may involve misconceptions about successful therapy, which is regarded by patients as full recovery from the disease or a return to the baseline state. This means that the surgeon's role in explaining the objectives of surgical procedures is of critical importance, in order to guide patients' expectations toward more realistic expectations, such as a "less-disabled lifestyle," with regard to the preoperative state and the underlying diagnosis.<sup>5,21,22</sup>

In Saudi Arabia, although the incidence of OA is remarkably high (up to 60%) in some regions, only a few authors have shared their experience regarding TKA outcomes and quality of life.<sup>23,24</sup> SB-TKA is even less documented. However, for modern standards of practice, such information is necessary to help patients and surgeons make a clear choice between staged TKA and SB-TKA. To share our experience, we conducted a pilot study. Our aim was to investigate patient-reported outcomes and quality of life following SB-TKA for OA.

## MATERIAL AND METHODS

This retrospective study was conducted at the Orthopedics Department of a University Hospital in Saudi Arabia. We analyzed the clinical data of all patients who underwent SB-TKA between 2005 and 2011.

Only patients with a diagnosis of bilateral end-stage primary OA were included, while patients with unilateral OA or rheumatoid arthritis were excluded. Eligible patients were contacted for an interview and were assessed regarding the outcomes of TKA and their quality of life before and 1 year after the surgery. We principally used the NHP questionnaire to assess pre- and postoperative outcomes, while the WOMAC and IKDC questionnaires were used in postoperative assessments only to assess function of the knee. The study was reviewed and approved by the ethical review board of our institution.

### Surgical Procedure

The prosthesis used was the cemented PFC SIGMA (Johnson & Johnson, New Brunswick, NJ, USA), with posterior cruciate ligament sacrifice and patelloplasty. No patellar replacement was performed. Decision to undergo simultaneous bilateral

replacement was made after an agreement between the patient and surgeon and was primarily based on the severity of bilateral knee symptoms prior to surgery.

### Questionnaires

In this study, we used the Arabic version of the WOMAC, which is a valid tool for assessing the severity of knee OA and is in agreement with the original version.<sup>25,26</sup> The WOMAC OA index is one of the most widely used knee- and disease-specific measures. It assesses three important dimensions for the patients: pain, stiffness, and functional disability. Of the different versions of the WOMAC OA index, we used the visual analog scale (VAS) version.<sup>14,27,28</sup> The WOMAC consists of 24 items clustered in three domains: pain (five items), stiffness (two items), and physical function (17 items). Scores for each item range between 0 and 100, and the total score for each domain is obtained by summing the scores of the related items. A total WOMAC score is calculated by summing the items for all three domains. Higher scores indicate worse pain, stiffness, and functional limitations.

The NHP is a two-part generic health measure that was primarily developed to assess the health-related quality of life (HRQoL) of patients with chronic disease conditions. It is composed of 38 items clustered in six domains: energy level (three items), pain (eight items), emotional reactions (nine items), social isolation (five items), physical mobility (eight items), and sleep (five items). Each item is a dichotomous question answered by "yes" or "no" and scored as 1 or 0, respectively. Final scores for each dimension are obtained by dividing the sum of the related items' scores by the number of items, yielding a score between 0 and 100%, where higher scores correspond to worse HRQoL. The NHP is a valid and reliable tool with good sensitivity for detecting changes in health status when used at different timepoints.<sup>14,18,29,30</sup> The IKDC is a general knee instrument,<sup>27,28</sup> and we used the IKDC subjective evaluation form for this study.

The NHP questionnaire was administered for preoperative and 1-year postoperative assessments, while the WOMAC and IKDC questionnaires were administered for the 1-year postoperative assessment only.

### Other Assessments of Activities of Daily Life

In addition to the questionnaires described above, patients were assessed regarding their general achievement of daily life activities, prayer in standing position, Omra (pilgrimage) in standing position, stair climbing, compliance with physical therapy, and amount of exercise.

### Statistical Methods

Statistical analysis was performed with the Statistical Package for Social Sciences version 16.0 for Windows (SPSS Inc., Chicago, IL, USA). Categorical variables are presented as frequency and percentage, while continuous variables are presented as mean ± standard deviation (SD). Paired *t*-test was used to analyze paired continuous data with normal distribution, while the Wilcoxon signed-rank test was used to analyze paired continuous data that did not verify a normal distribution, as well as paired ordinal data such as 0 to 10 scores. Effect size was calculated for within-subjects comparison of means, using Cohen's *d*. Variables with dichotomous values ("yes" or "no") were analyzed using McNemar test. A *p* value of <0.05 was considered to reject the null hypothesis.

**Table 1: Characteristics of the population**

Parameters		Frequency	%
Gender	Male	9	45.0
	Female	11	55.0
Activity	Going to mosque	10	50.0
	Housekeeping	5	25.0
	Regular daily activity	5	25.0
Post-op use of walk-aids		20	100%
Post-op physical therapy		20	100%

**Table 2: Parameters associated with knee replacement.**

Parameters	Min	Max	Mean	SD
Duration of knee symptoms before SB-TKA (months)	6.00	108.00	18.35	23.14
Time from decision to surgery (months)	1.00	6.00	3.25	1.55
Duration of post-op use of walk-aids (weeks)	4.00	14.00	7.15	2.43
IKDC post-op score	27.60	63.22	39.24	8.69
WOMAC post-op score	50.00	88.00	63.85	10.97

Min: minimum; max: maximum; SD: standard deviation; SB-TKA: simultaneous bilateral total knee arthroplasty; IKDC: International Knee Documentation Committee questionnaire; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index questionnaire

**Table 3: Nottingham Health Profile (NHP) scores before and 12 months after simultaneous bilateral total knee arthroplasty**

Score	Before TKR		After TKR		p value	Effect size (Cohen's d)
	Mean	SD	Mean	SD		
NHP: Physical activity	59.01	13.70	26.11	25.05	0.001*†	0.895
NHP: Pain	82.91	22.94	28.30	30.05	<0.001*†	1.110
NHP: Sleep	76.70	22.12	25.64	25.17	0.001*‡	1.249
NHP: Social isolation	39.39	17.49	7.76	20.04	0.002*‡	1.180
NHP: Energy level	77.52	25.57	19.48	28.89	0.001*‡	1.121
NHP: Emotion reaction	67.13	18.37	31.28	24.24	<0.001*†	0.998
Knee pain (VAS)	8.85	0.74	2.60	1.14	<0.001*‡	-
Physical therapy visits per week	5.95	2.35	10.55	3.76	<0.001*†	-
Knee satisfaction	2.80	1.15	8.60	0.82	<0.001*‡	-

\*Significant result ( $p < 0.05$ ); †Significance calculated using paired *t*-test; ‡Significance calculated using Wilcoxon signed-rank test; Cohen's *d* = 0.02, small effect; *d* = 0.05, medium effect; *d* = 0.08, large effect; TKR: total knee replacement; VAS: visual analog scale.

**RESULTS**

The study included 20 patients (nine men and 11 women), all of whom underwent SB-TKA for bilateral end-stage primary OA. The mean (SD) time from therapeutic decision to surgical procedure was 3.25(±1.55) months. On an average, the patients had suffered from knee symptoms for 18 months prior to TKA (range 6 months to 9 years). Postoperatively, all patients benefited from physical therapy and used walk-aids after SB-TKA for a mean (SD) duration of 7.15(±4.0) weeks. (Tables 1 and 2) Early postoperative assessments (8 weeks after SB-TKA) showed a significant decrease in the mean VAS pain score from 8.85 (±0.74) to 7.00 (±1.55), ( $p < 0.001$ ) (results are not reported in tables). One-year postoperative assessment revealed mean (SD)

IKDC and WOMAC scores of 39.24 (±8.69) and 63.85 (±10.97), respectively. (Table 2) Quality of life assessments showed significant improvements in all NHP dimensions, with mean (SD) scores from preoperative to postoperative assessments improving from 59.01 (13.70) to 26.11 (25.05) for physical activity ( $p=0.001$ ), from 82.91 (22.94) to 28.30 (30.05) for pain ( $p<0.001$ ), from 76.60 (22.12) to 25.64 (25.17) for sleep ( $p=0.001$ ), from 39.39 (17.49) to 7.76 (20.04) for social isolation ( $p=0.002$ ), from 77.52 (25.57) to 19.48 (28.89) for energy ( $p=0.001$ ), and from 67.13 (18.37) to 31.28 (24.24) for emotional reaction ( $p<0.001$ ). Effect size calculated with Cohen's showed the largest effects on sleep ( $d=1.249$ ), followed by social isolation

( $d=1.180$ ), energy ( $d=1.121$ ), and pain ( $d=1.110$ ) (Table 3). Mean VAS scores revealed significant improvements in pain, from 8.85 ( $\pm 0.74$ ) to 2.60 ( $\pm 1.14$ ) ( $p < 0.001$ ), and knee satisfaction, from 2.80 (1.15) to 8.60 (0.82), ( $p < 0.001$ ). (Table 3)

We also observed significant improvements in most of the additional parameters for preoperative compared to postoperative assessments: difficulty performing daily living activities, 18 (90.0%) vs. 3 (15.0%) ( $p < 0.001$ ); ability to perform Omra, 2 (10.0%) vs. 16 (80.0%) ( $p < 0.001$ ); ability to climb stairs,

3 (15.0%) vs. 16 (80.0%) ( $p = 0.002$ ); and severe pain considered as an NHP pain score of  $> 50$  points, 17 (85.0%) vs. 4 (20.0%) ( $p = 0.004$ ). There were no significant improvements in the following parameters: ability to pray in standing position, painful prolonged sitting, compliance with physical therapy, and performance of regular exercise. (Table 4) No significant differences were observed between genders with respect to preoperative and postoperative pain scores for either VAS or NHP assessments. (Table 5)

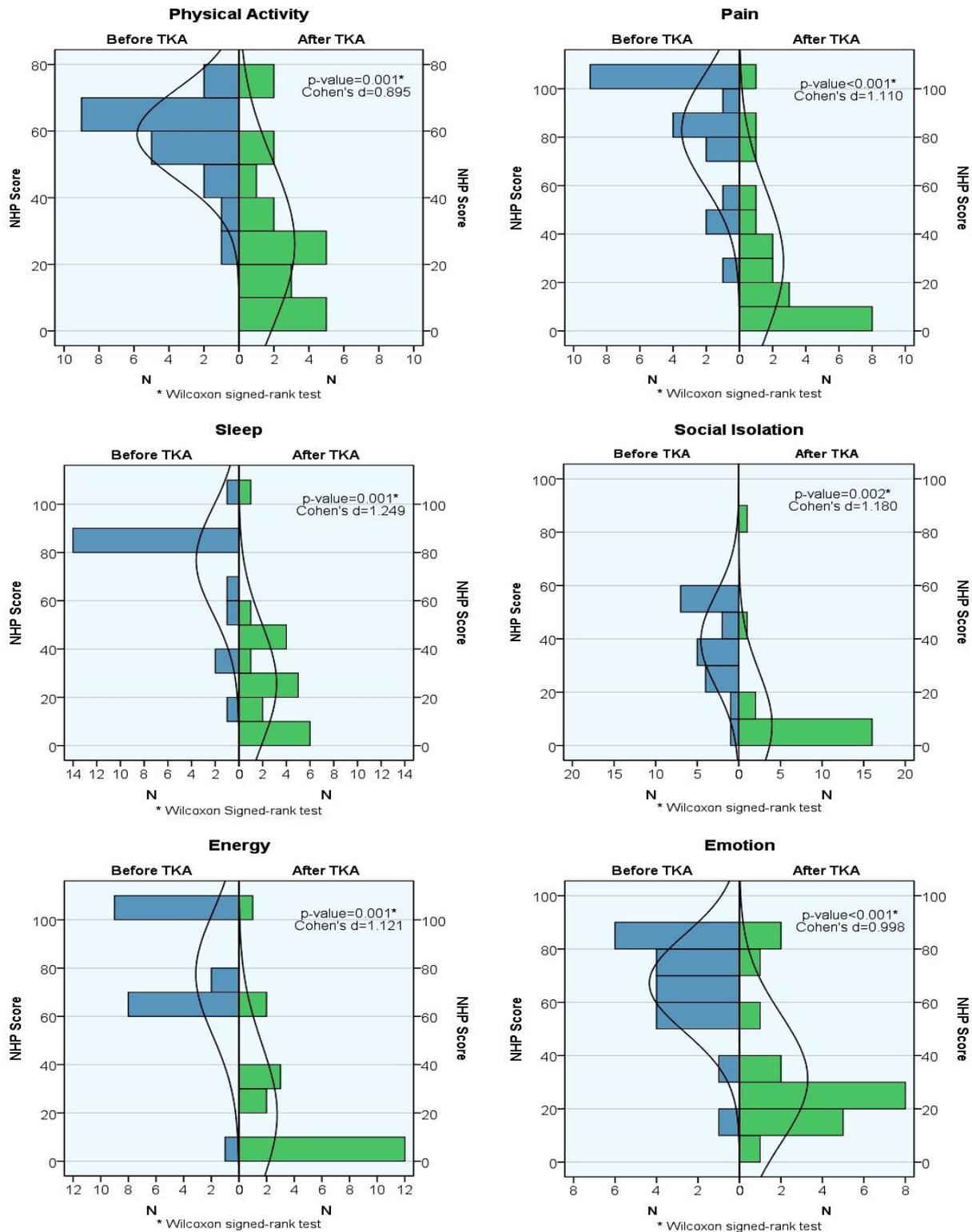


Fig 1: Comparative analysis of before and After TKA findings of present study

**Table 4: Disabilities and other knee symptoms before and after simultaneous bilateral total knee arthroplasty**

Parameter	Before TKR		After TKR		p-value
	Freq.	%	Freq.	%	
Trouble with ADL	18	90.0	3	15.0	<.001*
Prayer in standing position	1	5.0	2	10.0	1.00
Perform Omra standing	2	10.0	16	80.0	<.001*
Stair climbing	3	15.0	16	80.0	<.001*
Prolonged sitting painful	18	90.0	14	70.0	.125
Physical therapy compliance	17	85.0	20	100.0	.250
Regular exercise (walking)	1†	5.0	5	25.0	.219
Severe pain (NHP pain score>50)	17	85.0	4	20.0	.004*

\*Significant if <0.05 (significance calculated using McNemar test); †Warm-up; ADL: activities of daily living; NHP: Nottingham Health Profile; TKR: total knee replacement;

**Table 5: Pain scores in men vs. women before and after total knee replacement (TKA)**

Pain Score	Men		Women		P value	
	Mean	SD	Mean	SD		
VAS	Pre-TKA	8.78	0.83	8.91	0.70	0.706
	8 weeks post-TKA	7.22	1.72	6.82	1.47	0.577
	1 year post-TKA	2.44	1.01	2.73	1.27	0.596
NHP	Pre-TKA	82.36	27.53	83.36	19.82	0.926
	1 year post-TKA	22.08	34.03	33.39	26.94	0.417

VAS: visual analog scale; NHP: Nottingham Health Profile

## DISCUSSION

Knee OA is associated with irreversible structural changes that affect not only the cartilage but also the entire joint system. Therefore, ameliorating the resulting pain and functional disabilities are the main targets of corrective therapies including TKA.<sup>31</sup> However, treated patients often have residual pain even after successful articular replacement to address movement disabilities. From the patient's perspective, this might be considered a failure of surgery and a continuation of underlying disease, which can impact psychological health and quality of life.<sup>18</sup>

In this study, we focused on the postoperative results of SB-TKA and effects on the daily activities of patients and their quality of life. To assess these results, we used the NHP questionnaire, which has been shown to have high sensitivity in assessing changes over time in pain, physical mobility, quality of sleep, and other parameters in patients with arthritis.<sup>12,13</sup>

The findings from this study are generally comparable with those reported for the frequently used WOMAC score; there was a larger size effect for pain and mobility in long-term postoperative assessments ( $\geq 1$  year time period). In addition, we observed no significant change in the proportion of patients who had knee stiffness pre- and postoperatively. This is consistent with literature reporting a smaller size effect for this parameter as measured by WOMAC score,<sup>20,34</sup> although the WOMAC uses two questions to evaluate this dimension whereas we used only one.

In the studied population, the mean waiting time between the therapeutic decision and surgery was 3.25 months, with a maximum waiting period of about 6 months. A previously published study showed that patients reported no deterioration in pain or functional disability during a period of  $\leq 180$  days

(6 months) waiting for surgical intervention.<sup>32</sup> Similar results were observed by Hirvonen et al., who reported that the waiting time before TKA did not significantly affect patient HRQoL.<sup>33</sup>

The significant improvement in the pain VAS score after SB-TKA that we observed is consistent with what has been reported previously for unilateral or staged TKA,<sup>23,34,35</sup> including a study from Saudi Arabia by Al Omran,<sup>24</sup> Papakostidou<sup>34</sup> and O'Connor<sup>36</sup> reported higher preoperative pain scores and greater postoperative improvement in pain scores in women compared to men; however, we did not observe any significant difference between genders in pain scores before and after SB-TKA. Of improvements noted in many dimensions, the increasing proportion of patients who attended physical therapy after TKA reflects the reduction in pain after the surgery.

In contrast with the significant improvement in ADL generally reported by our patients, no significant improvements were reported for exercise, painful prolonged sitting or prayer in standing position. These observations suggest that relief of permanent pain is a crucial parameter of patient satisfaction, while for activity-associated pain; patients are likely to adopt palliative attitudes, such as praying in sitting position, avoiding painful postures, and giving up physical exercise. However, patients may exhibit dissatisfaction when the outcomes of the surgery do not match with their preoperative expectations. It was reported that frequent severe pain occurring during some activities, such as physical exercise,<sup>37</sup> may considerably affect patient quality of life and induce a vicious cycle of anxiety/depression and pain.<sup>38</sup> Therefore, it is important for surgeons to detect and correct such misconceptions prior to SB-TKA by clearly discussing preoperative expectations with patients with regard to their

priorities, lifestyle, and preoperative condition.<sup>5,21,22</sup> On the other hand, surgeons should also screen for the specific needs of each patient in order to implement all available means, including postoperative measures, to rehabilitate their central ADLs.

The present study was limited by its small sample size and the likelihood of recall bias associated with its retrospective design. In addition, no generic HRQoL questionnaire was used to measure patients' overall quality of life.

To determine the added value of SB-TKA in terms of quality of life compared to staged bilateral TKA, a multicenter prospective controlled study is warranted, using both generic and disease-specific assessment tools, with a sufficiently long follow-up to assess both long- and short-term outcomes in Saudi Arabia.

## CONCLUSION

Patients reported a significant improvement after SB-TKA in various aspects of their quality of life, including permanent pain. Residual knee stiffness, leg numbness, and posture- or exercise-related pain did not have a large effect on overall satisfaction. Assessments of patient-related outcomes and quality of life should be integrated into routine practice, as they can highlight the daily life priorities of each patient and increase patients' comprehension of their expectations and satisfaction criteria. To support the added value of SB-TKA in terms of quality of life versus staged bilateral TKA, further controlled studies are warranted.

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