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Investigation of mid-term functional skills and psychological factors in female patients undergoing total knee arthroplasty

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Ethics Committee Approval
The study was approved by the Samsun University Clinical Research Ethics Committee (no: SÜKAEK 2022/5/14).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

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Abstract

Background/Aim: Previous studies have yielded conflicting clinical, psychological, and functional outcomes in patients undergoing total knee arthroplasty (TKA). This study aimed to more precisely evaluate the clinical outcomes, mid-term general physical and psychological health status, functional abilities, and improvements in patients' quality-of-life undergoing TKA.
Methods: This cross-sectional study included 25 female patients older than 55 years who underwent unilateral TKA due to osteoarthritis (OA). The Five Repetition Sit-to-Stand Test (5STS), Stair-Climbing Test (SCT), 6-Minute Walking Test (6MWT), Berg Balance Scale (BBS), Tampa Scale for Kinesiophobia (TSK), and Short Form Health Survey (SF-12) scores of the patients were evaluated using means. Meanwhile, the Lower Limb Length (LLL), Navicular Drop Test (NDT), Proprioception Assessment, Foot Posture Index (FPI-6), Foot Function Index (FFI), Lower Extremity Functional Scale (LEFS), Knee Injury and Osteoarthritis Outcome Score (KOOS), and Oxford Knee Score (OKS) were evaluated by comparing the operated (OP) sides that underwent TKA with the non-operated (NONOP) sides diagnosed with OA.
Results: The study found that LLL (P=0.001), abduction/adduction forefoot on rearfoot (ABD) (P=0.017), and T.FPI-6 (P=0.014) in the FPI-6 parameters, as well as KOOS (P<0.001), OKS (P<0.001), LEFS (P<0.001), and FFI (P<0.001) results, were significantly in favor of the OP limb. Besides some parameters in FPI-6, no significant difference was found between the OP and NONOP extremities in terms of prone and supine proprioception values (P>0.05).
Conclusion: Overall, it was found that TKA plays a crucial role in recovery and regaining functional skills. Including preoperative evaluations with a control group and patients of both sexes in future studies and examining the relationships between the conducted tests and scales may contribute to better evaluating the results.

Keywords: total knee arthroplasty, functional skills, psychological factors, osteoarthritis

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Introduction

The knee joint is a polycentric joint that enables varus and valgus movements and flexion, extension, and rotational movements. Due to its inherent structural vulnerabilities, the knee joint is susceptible to instability. This instability is countered by the joint capsule, internal and external lateral ligaments, cruciate ligaments, and the surrounding muscle tissue [1].

Osteoarthritis (OA) is a degenerative disease that leads to imbalances and functional limitations. It manifests through pain, physical disabilities, restricted movement, bone misalignment, and impaired muscle performance in weight-bearing joints like the hips and knees. This condition significantly diminishes the quality-of-life, particularly among middle-aged and older individuals [2,3].

In cases where conservative treatments fall short, arthroplasty operations come into play. These surgeries aim to alleviate the persistent pain from chronic arthropathy and enhance the knee joint's functionality. The procedure involves the removal of diseased bone and cartilage tissues, replacing the diseased bone and cartilage with components that cover the joint surface [4].

The foot, positioned distally, serves several crucial roles. It provides a supportive surface against perturbations, absorbs and adjusts to abrupt body movements, and offers stabilization when needed to mitigate the adverse impacts of excessive mobility on the lower extremities and the body as a whole [5].

Research within the literature has demonstrated that excessive pronation and variations in foot posture contribute to issues such as postural instability, recurring injuries, lower extremity discomfort, Achilles tendinopathies, and patella-femoral joint pain [6,7]. The structural aberrations of the foot, such as pronation or supination misalignment, along with high or low arches, are believed to heighten the risk of biomechanical irregularities and subsequent injuries [8]. Although the association between foot morphology and lower extremity injuries remains somewhat elusive, existing studies reveal varying degrees of correlation between arch structure and biomechanical characteristics of the lower extremities [9].

Proprioception refers to the perception of joint and extremity positions facilitated by neural inputs generated through receptors found in the joints and surrounding tissues [10]. This proprioceptive sense holds significant importance in joint stabilization and its upkeep [11]. Proprioception is categorized into two types: static proprioception (pertaining to sensing position) and dynamic proprioception (related to perceiving movement) [12]. When proprioceptive deficits are present, it leads to a reduction in the dynamic activity of the muscles encompassing the knee joint and responsible for its movement [13,14].

Deformities in the joint capsule and ligament structures can lead to positioning, coordination, and balance issues in the extremities of individuals who have undergone total knee arthroplasty (TKA) surgery. Changes in muscle strength and gait patterns resulting from TKA and the loss of proprioception contribute to an amplified postural sway [15]. This situation not only hinders the performance of daily activities, particularly among elderly patients who have undergone TKA but also elevates the risk of falls. The alteration in physical function and quality-of-life underscores the significant psychological impact [16].

Knee arthroplasty surgeries, when executed with meticulous patient selection and appropriate surgical techniques, have demonstrated enhancements in joint mechanics, pain reduction, and an expanded range of motion. This improvement fosters patient contentment by enabling them to comfortably engage in functional activities [17]. Compared to the pre-surgery state, patients undergoing TKA experience improved functional performance and balance [18]. The traditional presentation of clinical outcomes in TKA relies on objective criteria encompassing implant survival, joint range of motion, joint balance, and radiological findings [19].

Considering this breadth of information, the present study aims to assess the clinical outcomes, medium-term overall physical and psychological health status, functional capabilities, and the augmented quality-of-life in patients who have undergone TKA.

Materials and methods

Twenty-five female patients, ranging in age from 56 to 75 years with a mean age of 65 years, who were admitted to the Samsun Training and Research Hospital Orthopaedics and Traumatology Outpatient Clinic with a diagnosis of osteoarthritis (OA) between January 2019 and March 2021, were assessed in this cross-sectional study. The study included female patients over 55 who underwent TKA using Pacific Medical Group (PMG) fix-mobile cruciate retaining femoral components for the first time due to OA and who underwent a single joint operation. The average follow-up period was 18.3 months, ranging from 12 to 36 months.

The study was conducted using a single-blind method; patients were not informed about the nature of the study. A priori test with the G*Power 3.1 program determined the required number of participants. Based on the sample study conducted for power analysis, it was determined that the study could be successfully carried out with 18 patients (Effect size: 0.80, Actual Power: 0.89).

This research received approval from the Samsun University Clinical Research Ethics Committee (Approval No: SÜKAEK 2022/5/14).

In the current study, the functional and clinical outcomes of patients who underwent TKA were compared between their operated (OP) extremities and their non-operated (NONOP) extremities. Both the OP and NONOP extremities were diagnosed with stage 3 or stage 4 osteoarthritis (OA). Patients attended the clinic for a total of three evaluation sessions. During the initial visit, patients were briefed about the testing protocols, underwent anthropometric measurements, and participated in preliminary assessments. In the subsequent visit, patients performed a battery of tests, including The Five Repetition Sit-to-Stand Test (5STS), Stair-Climbing Test (SCT), 6-Minute Walking Test (6MWT), Berg Balance Scale (BBS), Proprioception Assessment, Navicular Drop Test (NDT), and Foot Posture Index (FPI-6). The third visit encompassed

evaluations using the Foot Function Index (FFI), Lower Extremity Functional Scale (LEFS), Tampa Scale for Kinesiophobia (TSK), Knee Injury and Osteoarthritis Outcome Score (KOOS), Oxford Knee Score (OKS), and Short Form Health Survey (SF-12).

The Five Repetition Sit-to-Stand Test (5STS)

Patients were instructed to cross their arms over their chest and to execute a single practice iteration of sitting and rising from a chair. Following the trial run, they were directed to sit on the chair and rise swiftly and continuously without pauses. The elapsed time from completing the fifth repetition was then documented [20].

Stair-Climbing Test (SCT)

The SCT is an assessment tool for gauging functional performance following TKA [21]. Participants were tasked with ascending and descending ten steps as swiftly as possible while ensuring their safety (step height: 20 cm) [22]. Patients were permitted to grasp the handrails beside the staircase throughout the test. The duration taken to execute the maneuver was subsequently measured in seconds.

6-Minute Walking Test (6MWT)

The 6MWT is a dependable approach for assessing the functional capacity of patients post-knee arthroplasty surgery. Individuals were instructed to ambulate at their maximal pace while maintaining their safety along a 30-meter linear corridor for 6 min; they were permitted to halt and rest as needed but were prohibited from running [23]. Assistive devices commonly used by patients, such as walking sticks, were permissible during the test. Regular updates on the remaining time were provided at 60-s intervals, accompanied by verbal encouragement [24]. Upon completing the 6 min, the distance covered during walking was documented in meters.

Berg Balance Scale (BBS)

The BBS, designed to assess the susceptibility to falls and balance impairment in older patients, has been validated in clinical settings and research studies [25,26]. Each item is assigned a score ranging from 0 to 4 points, culminating in a maximum total score of 56. The point distribution is as follows: 0 to 20 points indicate a high risk of falling, 21 to 40 points denote a moderate risk of falling, and 41 to 56 points indicate a low risk of falling. The evaluation used standard equipment, including a chair, a step, a 15-meter-long corridor, and a stopwatch. The resultant total score was duly recorded.

Evaluation of proprioception

In the study, knee joint proprioception measurements were acquired from the participants using a digital goniometer (2176-300 Insize Digital Protractor) with a precision of one degree. The goniometer was affixed to the patients' knee joint utilizing electromyography (EMG) bandages. Three distinct target angles (15°, 30°, and 45°) were established for subsequent measurements. Initially, the procedure was conducted with patients lying face-down and their eyes closed. During this process, the patients' hips were maintained in a neutral position, the goniometer was calibrated to zero at the complete extension of both knees, and the intended target angle was communicated verbally to the patients. Participants were instructed to concentrate on this angle, maintaining the knee in that position for 5 s, ensuring a comprehensive perception of the target angle. Subsequently, patients were prompted to align their knees with the designated target angle. The measurements were repeated three times for each target angle, and the average angular deviation from each measurement was computed. The entire sequence of steps was replicated with patients lying on their backs, and the assessment was conducted for both knees.

Navicular Drop Test (NDT)

This assessment was employed to evaluate the medial longitudinal arch heights of the participants. For the measurement of navicular height, each patient was instructed to place full weight on their bare feet, and the measurement was taken as the distance between the tubercle of the navicular – the insertion point of the tibialis posterior muscle – and the ground in this stance [27]. Subsequently, participants were requested to sit, and the distance from the navicular tubercle to the ground was gauged in the subtalar neutral position without any weight on their feet [28]. The disparity between this latter measurement and the initial navicular height yielded the recorded value for navicular drop (mm).

Foot Posture Index (FPI-6)

The FPI-6 assesses the stance of both the rearfoot and forefoot across multiple planes. Its validity and reliability for assessing foot posture under consistent load have been substantiated in existing literature on adult and pediatric populations [29]. During the assessment, palpation and visual observations were conducted while maintaining a shoulder-width stance with an even distribution of weight on both feet. Six parameters were evaluated, encompassing the position of the talus's head, the supra/infra malleolar inclination, the frontal plane orientation of the calcaneus, the configuration of the medial folds of the talonavicular joint, the appearance of the medial arch, and the forefoot's adduction/abduction about the rearfoot. Each parameter was assigned a score ranging from -2 to +2, with a score of zero denoting a neutral foot posture.

Foot Function Index (FFI)

The FFI was employed to quantify the impact of foot pathology on functional aspects such as pain, disability, and limitations in activity. Comprising 23 items grouped into three subcategories – pain, disability, and activity limitation – the scale generates higher scores indicative of greater pain, disability, and activity constraints [30]. The Turkish version's validity and reliability were established by [31]. The aggregated score derived from summing the patients' scores is divided by the maximum possible cumulative score attainable from these questions. This yields an index total score, multiplying the resultant fraction by 100.

Tampa Scale for Kinesiophobia (TKS)

Seventeen questions about falling and movement apprehension were appraised using a scoring system ranging from 1 to 4. Questions 4, 8, 12, and 16 were reverse-scored. A heightened score (with a maximum potential of 68) signifies a notable fear of falling and movement within the patient [32].

Knee Injury and Osteoarthritis Outcome Score (KOOS)

The KOOS assessment has been established as reliable and valid for evaluating knee-related functional status, pain, daily activities, and quality-of-life [33]. The patients were presented with questions and instructed to select the response

that best aligned with their experiences over the preceding week. In total, 42 questions were posed to the patients, each offering five response choices. Responses to each question were scored on a scale of 0 to 4. A score of 0 signifies a considerable knee issue, while a score of 100 indicates an absence of problems concerning the knee [34].

Oxford Knee Score (OKS)

Within the OKS form, individual questions hold point values ranging from 0 to 4. Based on the responses provided by patients using a 5-point Likert-type scale across 12 questions, a score within the range of 0 to 48 was computed. Because of knee pain and the impact of osteoarthritis, a score of 0 reflects the poorest outcome, while 48 points correspond to the most favorable result [35].

Short Form Health Survey (SF-12)

The SF-12, condensed from the SF-36 by selecting 12 distinct items spanning eight subcategories, comprises two distinct dimensions: the Physical Component Score (PCS) and the Mental Component Score (MCS). Scores for SF-12 PCS and SF-12 MCS encompass a spectrum of 0 to 100, with higher scores indicative of enhanced health status [36].

Statistical analysis

The study's statistical analysis was performed using the SPSS 22.0 software package. The data's normal distribution was assessed through the Shapiro-Wilk test, while the Levene test was employed to verify homogeneity assumptions. Descriptive statistics were presented as means and standard deviations. Paired sample t-tests were conducted to compare the OP and NONOP sides. Furthermore, effect sizes were computed using Cohen's d effect size formula ((M2 − M1) / SDpooled) for paired group comparisons. Following this formula, a d value of 0.8 was considered indicative of a substantial effect size. *P*-value less than 0.05 were considered significant.

Results

The mean values of patients in our study were as follows: age, 65 years; height, 154.52 cm; weight, 87.92 kg; BMI, 36.96 kg/m²; and follow-up duration, 18.3 months. A statistically significant difference was observed between the OP and NONOP sides (*P*=0.001, 95% CI: 0.39–1.25) during the evaluation of LLL. Among the patients in the study, 52% had their OP knee on the right side, while 48% had it on the left (Table 1).

Table 1: Descriptive data (n=25).

	Mean	SD	Min	Max
Age (year)	65.00	5.431	56	75
Height (cm)	154.52	7.506	145	170
Weight (kg)	87.92	15.319	61	127
BMI (kg/m²)	36.96	6.83	27.11	52.18
Follow-up (month)	18.3	7.62	12	36

	OP	NONOP	t	*P*-value	ES	95% CI	
	Mean (SD)	Mean (SD)				LB	UB
LLL (cm)	86.60 (3.76)	85.78 (3.77)	-3.94	0.001*	21.78	0.39	1.25

	R	L
Operated knee	52%	48%

SD: Standard deviation, Min: Minimum, Max: Maximum, BMI: Body mass index, R: Right, L: Left, OP: Operated, NONOP: Non-operated, CI: Confidence interval, LB: Lower bound, UB: Upper bound, ES: Effect size, LLL: Lower limb length

The mean time for the 5STS test was 22.43 s, while the mean SCT time was 16.87 s. The mean distance covered in the 6MWT was 319.36 meters (Table 2).

Regarding the assessment scores, the mean BBS score of our patients was 48.76, whereas the mean TKS score was 46.36. In our SF-12 evaluation, the mean scores were 42.74 for SF-12 PCS, 42.85 for SF-12 MCS, and 85.59 for SF-12 T (Table 3).

Table 2: Mean values of 5STS, SCT, and 6MWT.

	Mean	SD	Min	Max
5STS (sec)	22.43	6.24	11.04	38.23
SCT (sec)	16.87	8.93	7.29	44.03
6MWT (m)	319.36	90.15	139	449

SD: Standard deviation, Min: Minimum, Max: Maximum, 5STS: The five repetition sit-to-stand test, SCT: Stair-climbing test, 6MWT: 6-Minute walking test

Table 3: Mean scores of BBS, TKS, and SF-12.

	Mean	SD	Min	Max
BBS	48.76	6.57	36	55
TKS	46.36	7.68	26	59
SF-12 PCS	42.74	11.82	22.60	62.94
SF-12 MCS	42.85	11.92	24.29	63.18
SF-12 T	85.59	18.60	58.12	114.34

SD: Standard deviation, Min: Minimum, Max: Maximum, BBS: Berg balance scale, TKS: Tampa scale for kinesiophobia, PCS: Physical, MCS: Mental, T: Total

When comparing proprioception values on the OP and NONOP sides at 15, 30, 45, and 60 degrees in the prone position, no statistically significant differences were observed for any of the angles: 15º (*P*=0.203, 95% CI: -3.98–0.89), 30º (*P*=0.361, 95% CI: 3.47–1.31), 45º (*P*=0.609, 95% CI: -3.72–2.22), and 60º (*P*=-10.096, 95% CI: -2.65–0.81) (Table 4).

Similarly, when evaluating OP and NONOP side proprioception values at 15, 30, 45, and 60 degrees in the supine position, no statistically significant differences were found for the following angles: 15º (*P*=0.979, 95% CI: -3.10–3.18), 30º (*P*=0.600, 95% CI: -2.69–4.55), 45º (*P*=0.511, 95% CI: -2.09–4.09), and 60º (*P*=0.356, 95% CI: -0.97–2.60) (Table 4).

Table 4: Comparison of OP and NONOP proprioception values in prone and supine positions.

Variables	OP	NONOP	t	*P*-value	ES	95% CI	
	Mean (SD)	Mean (SD)				LB	UB
P 15º S	6.14 (3.78)	7.69 (4.80)	-1.308	0.203	0.36	-3.98	0.89
P 30º S	4.75 (2.50)	5.82 (4.91)	-0.931	0.361	0.27	-3.47	1.31
P 45º S	4.70 (3.14)	5.45 (6.17)	-0.518	0.609	0.15	-3.72	2.22
P 60º S	3.19 (3.51)	4.10 (2.75)	-1.096	0.284	0.28	-2.65	0.81
S 15º S	7.71 (6.98)	7.68 (5.19)	0.026	0.979	0.00	-3.10	3.18
S 30º S	7.70 (5.89)	6.77 (6.90)	0.531	0.600	0.14	-2.69	4.55
S 45º S	7.77 (6.28)	6.77 (6.25)	0.667	0.511	0.16	-2.09	4.09
S 60º S	6.69 (4.74)	5.88 (4.90)	0.941	0.356	0.17	-0.97	2.60

SD: Standard deviation, OP: Operated, NONOP: Non-operated, CI: Confidence interval, LB: Lower bound, UB: Upper bound, ES: Effect size, P: Prone, S: Supine

In assessing the foot posture index on the OP and NONOP sides, no significant differences were observed between T.H. (*P*=1.00, 95% CI: -0.12–0.12) and LAT. M. (*P*=0.504, 95% CI: -0.65–0.33), CALC. (*P*=0.382, 95% CI: -0.21–0.53), TNJ (*P*=0.574, 95% CI: -0.21–0.37), and MA (*P*=0.056, 95% CI: -0.01–0.49) values. However, statistically significant differences were found in ABD (*P*=0.017, 95% CI: 0.07–0.65) and T.FPI-6 (*P*=0.014, 95% CI: 0.25–1.99) values (Table 5).

Table 5: Comparison of OP and NONOP side values of FPI-6 parameters.

Variables	OP	NONOP	t	*P*-value	ES	95% CI	
	Mean (SD)	Mean (SD)				LB	UB
T.H.	1.24 (10.09)	1.24 (10.09)	0.000	1.00	0.00	-0.12	0.12
LAT. M.	0.44 (1.45)	0.60 (1.29)	-0.679	0.504	0.12	-0.65	0.33
CALC.	0.72 (1.17)	0.56 (1.12)	0.891	0.382	0.14	-0.21	0.53
TNJ	0.32 (1.38)	0.24 (1.33)	0.569	0.574	0.06	-0.21	0.37
MA.	0.64 (10.04)	0.40 (0.87)	2.01	0.056	0.25	-0.01	0.49
ABD	1.68 (0.56)	1.32 (0.69)	2.57	0.017*	0.57	0.07	0.65
T.FPI-6	5.08 (3.70)	3.96 (3.94)	2.66	0.014*	0.29	0.25	1.99

SD: Standard deviation, OP: Operated, NONOP: Non-operated, CI: Confidence interval, LB: Lower bound, UB: Upper bound, ES: Effect size, T.H.: Talar head palpation, LAT. M.: Curves above and below the lateral malleolus, CALC.: Inversion/eversion of the calcaneus, TNJ: Prominence in the region of the TNJ, MA: Congruence of the medial longitudinal arch, ABD: Abduction/adduction forefoot on rearfoot, T.FPI-6: Total foot posture index

Statistical significance was observed in the following parameters: KOOS (P<0.001, 95% CI: -38.20–28.60), OKS (P<0.001, 95% CI: 9.85–12.55), LEFS (P<0.001, 95% CI: 14.74–21.82), FFI P. (P<0.001, 95% CI: -17.02–12.62), FFI I. (P<0.001, 95% CI: -25.02–16.58), FFI L. (P<0.001, 95% CI: -11.17–7.95), and FFI T. (P<0.001, 95% CI: -51.39–39.97). However, no significance was observed in the NDT parameter (P=0.307, 95% CI: -0.26–0.09) (Table 6).

Table 6: Comparison of OP and NONOP side values of KOOS, OKS, LEFS, FFI and NDT.

Variables	OP	NONOP	t	*P*-value	ES	95% CI	
	Mean (SD)	Mean (SD)				LB	UB
KOOS	41.26 (19.04)	74.66 (19.07)	-14.35	<0.001*	1.75	-38.20	-28.60
OKS	30.80 (11.33)	19.60 (9.14)	17.08	<0.001*	1.09	9.85	12.55
LEFS	45.08 (20.42)	26.80 (14.80)	10.65	<0.001*	1.03	14.74	21.82
FFI P.	23.88 (17.60)	39.20 (15.80)	-18.59	<0.001*	0.92	-17.02	-13.62
FFI I.	33.52 (25.25)	54.32 (20.45)	-10.17	<0.001*	0.90	-25.02	-16.58
FFI L.	11.96 (12.60)	21.52 (14.57)	-12.24	<0.001*	0.70	-11.17	-7.95
FFI T.	69.36 (47.43)	115.04 (43.30)	-16.51	<0.001*	1.01	-51.39	-39.97
NDT (mm)	0.86 (0.42)	0.95 (0.45)	-1.04	0.307	0.20	-0.26	0.09

SD: Standard deviation, OP: Operated, NONOP: Non-operated, CI: Confidence interval, LB: Lower bound, UB: Upper bound, ES: Effect size, KOOS: Knee Injury and Osteoarthritis Outcome Score, OKS: Oxford Knee Score, LEFS: Lower extremity functional scale, FFI P.: Foot function index pain, FFI I.: Foot function index insufficiency, FFI L.: Foot function index activity limitation, FFI T.: Foot function index total, NDT: Navicular drop test

Discussion

The study aimed to compare the clinical and functional outcomes of patients who underwent unilateral TKA for stage 3 or stage 4 osteoarthritis (OA) between the operated (OP) extremity and the non-operated (NONOP) extremity. The study's results demonstrated significant differences favoring the OP limb in various parameters.

Among the parameters analyzed, including LLL, ABD, and T.FPI-6 in the FPI-6 assessment and KOOS, OKS, LEFS, and FFI scores, the OP limb consistently showed superior outcomes compared to the NONOP limb. While some parameters within the FPI-6 assessment indicated differences, no significant distinction was observed between the OP and NONOP limbs in terms of proprioception values measured in both prone and supine positions.

Numerous conducted studies have consistently reported an increase in leg length discrepancy (LLL) following TKA [37-39]. Our study's findings align with this prevailing perspective. However, it's noteworthy that differing threshold values, such as 10 mm and 15 mm, have been employed in other investigations examining LLL [37,40]. In contrast, our study did not rely on radiological outcomes for LLL assessment; measurements were taken in centimeters using a simple measuring tape.

In our study, the measurement of LLL revealed an 8.2 mm disparity between the OP and NONOP sides when mean values were compared. Although these outcomes may not yield a definitive radiological conclusion, they do distinctly indicate that a 10-15 mm variation exists when assessed with standard deviations. This observation implies that the outcomes for both the OP side after TKA application and the sides diagnosed with OA fall within the ranges stipulated in the existing literature.

The impact of foot stance on mechanical alignment and dynamic function of the lower extremities has long been acknowledged [41]. The medial section of the lower extremity bears a greater force during weight-bearing than the lateral section. This imbalance may lead to excessive pronation and a reduction in the medial longitudinal arch in the extremity with the OA-affected knee [42]. This phenomenon has received considerable attention in various studies utilizing techniques like NDT and FPI-6 [41,43-47].

While our study did not uncover a noteworthy difference in NDT scores, it did reveal significant findings in ABD within the FPI-6 scale. Additionally, outcomes approaching significance were observed in MA, further underlining the notable discrepancy in the FPI-6 score. As emphasized by previous researchers, these outcomes support our study's conclusion that a reduction in the medial longitudinal arch occurs in patients who have undergone TKA. This alteration likely contributes to the substantial difference between pronation and ABD outcomes, as the collected data indicates.

Assessing post-TKA balance and functional capabilities necessary for daily activities is crucial [48]. Schilke et al. [49] emphasized that roughly 97% of lower extremity muscle strength is required for rising from a chair. The evaluation of walking assumes significance as it is closely linked with an active and self-reliant lifestyle post-TKA [50].

Within our study, mean scores derived from tests such as the 5STS [51], SCT [22,36], 6MWT [23,36], and BBS [52], designed to appraise post-TKA balance and functional capacities, closely mirrored those reported in various existing literature. Our study found no significant disparity between the OP and NONOP sides in these metrics. Generally, research efforts have often focused on contrasting the pre- and post-TKA periods or comparing TKA recipients with control groups. In our study, a distinct approach was adopted, comparing knees with TKA to non-operated knees diagnosed with OA. This, however, introduces a noteworthy limitation when juxtaposed with other studies. The scoring discrepancy arises because the scores displayed positivity on the OP side and negativity on the OA-diagnosed side, stemming from the amalgamation of both OP and OA-diagnosed sides during walking, sit-up, and balance evaluations.

Patients frequently develop a fear of movement, potentially leading to kinesiophobia after undergoing TKA [53]. This apprehension could reasonably impact their functional abilities. In a study by Doury-Panchout et al. [54], a TSK score exceeding 40 indicated kinesiophobia. They reported that individuals with kinesiophobia covered a significantly shorter distance in the 6MWT than those without kinesiophobia. While we didn't apply a similar categorization based on TSK results in our study, opting instead to assess mean scores, our TSK mean score of 46.4 aligns with findings in the literature [53,55], clearly indicating the presence of kinesiophobia among patients.

Our study's notably elevated TSK score could be attributed to the unilateral TKA approach taken with patients, combined with the diagnosis of Stage 3 and 4 OA in the other knee. Future research endeavors should consider studying patients undergoing bilateral TKA or unilateral TKA with a healthy or Stage 1 and 2 OA-diagnosed counterpart for a more definitive understanding. Such investigations could provide clearer insights into the outcomes.

In today's context, patient expectations and satisfaction have become crucial benchmarks for evaluating TKA outcomes [56,57]. Consequently, researchers have increasingly turned to health-related quality-of-life scales to offer more comprehensive assessments of disease impacts and treatment effects [58]. Our

study's mean scores, akin to those documented in the literature, align across various scales, including SF-12 (PCS, MCS) [58-60], KOOS [61], OKS [62,63], and LEFS [64].

The positive outcomes post-TKA surgery, in terms of knee scores and quality-of-life, are evident. Indeed, given the assessment of functional issues and pain experienced by patients diagnosed with Stage 3 and 4 OA, the relief provided by TKA has anticipated psychological and functional benefits. Notably, within our current patient cohort, it's reasonable to anticipate that sides without TKA but diagnosed with Stage 3 and 4 OA would yield higher positive outcomes in knee scores and quality-of-life following surgery. This conjecture supports the noteworthy difference between the OP and NONOP sides in the FFI. The findings of our study robustly underscore an enhancement in patient satisfaction and functional advancement post-TKA, closely aligned with established trends in the literature.

Researchers have notably underscored the importance of assessing proprioception, particularly within patient cohorts like those with OA, given its strong correlation with knee functional performance [65]. Generally, a trend toward enhanced proprioception levels post-TKA is recognized [65,66]. Nevertheless, some studies report no significant difference in proprioception levels between the preoperative and post-operative phases [67,68].

In our study, the resemblance in proprioception results between the OP and NONOP sides prompts consideration. This likeness suggests that using a prosthesis that preserves the ligament structure without interrupting it, as seen in TKA, potentially yields comparable knee functions and proprioception outcomes. This notion aligns with findings indicating that structures like the anterior cruciate ligament play a substantial role in proprioception [68].

Limitations and Conclusion

In our study, TKA was assessed using a variety of tests and scales. As a general outcome, it was determined that TKA plays a crucial role in recovery and the regaining of functional skills. It is believed that several factors, such as age, length of follow-up period, and the severity of osteoarthritis (OA) in patients, might influence the evaluation of post-TKA processes. Furthermore, our study exhibits several noteworthy limitations. The absence of a healthy control group and the lack of data from the preoperative period, coupled with the absence of post-operative evaluations at various follow-up periods, impeded more profound and insightful assessments and comparisons following TKA.

Notwithstanding these limitations, our study revealed that TKA significantly impacts knee scores and functional tests, though it appears to not affect proprioception levels. This understanding aids in gaining a clearer insight into the effects of TKA on OA patients. For future investigations, incorporating preoperative assessments involving control groups and encompassing both genders, exploring the correlations between tests and scales, and conducting distinct comparisons at diverse follow-up periods could all contribute to a more comprehensive evaluation of the results.

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