

# AN IMPROVEMENT IN KNEE DISABILITY DOES NOT MEAN AN IMPROVEMENT IN FUNCTIONAL STATUS IN GERIATRIC PATIENTS AFTER SIMULTANEOUS BILATERAL TOTAL KNEE ARTHROPLASTY

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## ABSTRACT

**Purpose:** We aimed to investigate the relationship between change in knee disability and change in functional status from before simultaneous bilateral total knee arthroplasty (TKA) to discharge in geriatric patients.

**Material and Methods:** We retrospectively analyzed the data of 88 patients who underwent simultaneous bilateral TKA. Before surgery and at discharge, knee disability and functional status of the patients were assessed using the Hospital for Special Surgery (HSS) knee score and the Iowa Level of Assistance Scale (ILAS), respectively. The Spearman correlation test was used to assess the correlation between the change in the HSS knee score and the change in the ILAS score.

**Results:** A statistically significant difference was found in the HSS knee score between before surgery and at discharge ( $p < 0.05$ ). No statistically significant difference was found in the ILAS score ( $p > 0.05$ ). A moderate relationship was found between the change in the HSS knee score and the change in the ILAS score ( $r = -0.48$ ,  $p < 0.05$ ).

**Conclusion:** The change in knee disability from before surgery to discharge does not reflect the change in functional status in geriatric patients who underwent simultaneous bilateral TKA.

**Keywords:** arthroplasty, functional status, knee joint, disability

## INTRODUCTION

Knee osteoarthritis is common in geriatric populations and is the most common indication for total knee arthroplasty (TKA) (1). In patients scheduled for TKA, the level of knee disability and functional status of patients are the main outcome measures at baseline, at discharge, and during follow-up (2, 3). These

outcomes especially are essential for clinicians to decide about whether to discharge a patient or not (3, 4). Some clinicians assume that change in knee disability of patients after TKA reflects a similar change in functional status (5). In the literature, conflicting findings have been reported regarding the association of the level of knee disability with

functional status in this patient population. Some studies found that increased knee range of motion improved functional status of patients (6, 7), whereas some studies did not (8, 9). Little is known about the association between changes in these outcomes from before to after TKA. It can be argued that if there is no relationship, it is necessary to evaluate knee disability and functional status of patients separately, and treatment approaches for both impairments should be considered in this population.

In patients after unilateral TKA, functional ability of patients was related to function of the uninvolved limb (10, 11). That is, if the relationship between knee disability and functional status is studied in unilateral cases, the contribution of the unaffected side can lead to wrong results; therefore, the relationship among these outcomes should be studied in bilateral cases. The aim of this study was to investigate whether change in knee disability from before surgery to discharge associates with change in functional status in geriatric patients who underwent simultaneous bilateral TKA. An understanding of the relationship between the mentioned outcomes may help to develop new strategies for physical therapy to improve functional status in the early post-operative period in this patient population.

## **MATERIAL AND METHODS**

### **Study Design and Patients**

The study had a retrospective design based on the clinical data of patients operated in a university hospital. The inclusion criteria were patients who underwent simultaneous bilateral TKA due to osteoarthritis with Kellgren-Lawrence classification grades 3 or 4 (12), and age  $\geq 65$  years. The exclusion criteria were patients who had rheumatoid arthritis, septic arthritis, gout, or metastatic bone disease, patients with a history of fracture in the lower extremities or those who had a neurological disease, or patients with revision surgery or post-operative complications (e.g., infection, admission to intensive care). Based on the eligibility criteria, 88 patients were included to the study.

All surgeries were performed by the same surgeon using the paramedian approach. All patients were operated with cemented cruciate retaining prostheses (NexGen®, Zimmer, USA). All patients received a standard physical therapy (continuous passive motion, active-assistive and active range of motion exercises, isometric and isotonic

strengthening exercises, and gait and transfer training) after surgery.

The study was approved by the Non-invasive Clinical Research Ethics Committee of İzmir Bakırçay University (Decision No: 519, 02.03.2022).

### **Outcome Measures**

All assessments were performed by the same physiotherapist.

### **The Assessment of Knee Disability**

Knee disability of the patients was assessed using the Hospital for Special Surgery (HSS) knee score before surgery and at discharge. The HSS knee score has seven domains: pain, function, range of motion, muscle strength, flexion deformity, instability, and subtractions. The total score ranges between 0 and 100, with a higher score reflecting a better knee function (13, 14).

We considered the mean value of the HSS knee scores of both knees for further statistical analysis, as recommended in the literature (15). The change in the HSS knee score was calculated as follows: value at discharge – pre-operative value.

### **The Assessment of Functional Status**

The Iowa Level of Assistance Scale (ILAS) was used to assess functional status of the patients before surgery and at discharge. The ILAS assesses the amount of assistance required to complete four functional activities. In addition, the time to walk a distance of 13.4 m and the use of any assistive devices are ranked using an ordinal scale from 0 to 6. A lower score indicates a better functional status (16, 17).

The change in the ILAS score was calculated as follows: value at discharge – pre-operative value.

### **Sample Size Estimation**

The sample size was calculated using the t test with correlation, point biserial model option by the G\*Power version 3.1.9.6 software (Heinrich-Heine University Düsseldorf, Germany) (18). We assumed that there would be a moderate relationship between the variables; therefore, the effect size was set as 0.3 based on the suggestion of the software. With  $\alpha=0.05$  and a power of 80%, 82 patients would be necessary.

**Statistical Analysis**

Data analyses and graphing were performed using the R language for statistical computing (<https://www.r-project.org>). The normality of the distribution of the data was checked by the Shapiro-Wilk test. Because the distribution was non-normal, the non-parametric tests were used. The Wilcoxon signed-rank test was used to compare the results before surgery and at discharge. The Spearman correlation test was used to assess the correlation between the change in the HSS knee score and the change in the ILAS score. The strength of the correlation was determined using the following criteria:  $\leq 0.19$ , very weak;  $0.20-0.39$ , weak;  $0.40-0.59$ , moderate;  $0.60-0.79$ , strong;  $\geq 0.80$ , very strong (19). A p-value  $< 0.05$  was defined as statistical significance. In the present study, the correlation  $\geq 0.60$  was considered as an acceptable relationship.

**RESULTS**

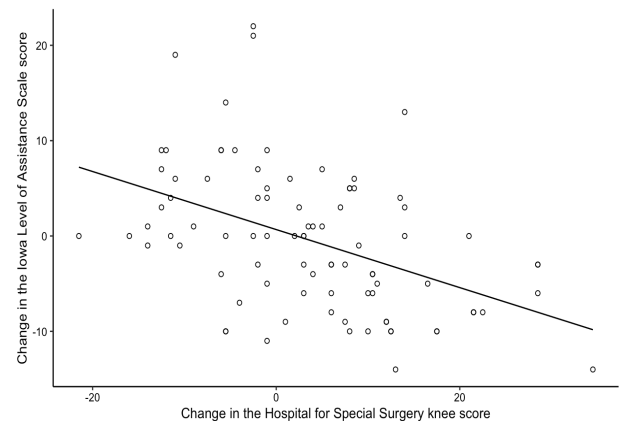
The demographic characteristics of the patients are presented in Table 1. The median (first quartile–third quartile) length of hospital stay of patients was 8.0 (7.0–9.0) days. The changes in the outcome measures from before surgery to discharge are shown in Table 2. A statistically significant difference was found in the HSS knee score between before surgery and at discharge ( $p < 0.05$ ). No statistically significant difference was found in the ILAS score ( $p > 0.05$ ). A moderate relationship was found between the change in the HSS knee score and the change in the ILAS score ( $r = -0.48, p < 0.05$ ) (Figure 1).

**Table 1** Table 1. The demographic characteristics of the patients, median (first quartile–third quartile) or N.

N	88
Age (years)	72.00 (68.00–75.00)
Body mass index (kg/m <sup>2</sup> )	30.08 (27.61–32.15)
Gender	
Male	8
Female	80

**DISCUSSION**

The main finding of our study is that the change in knee disability from before surgery to discharge does not reflect the change in functional status in geriatric patients who underwent simultaneous bilateral TKA. In the literature, some criteria for discharge have been defined following TKA, such as the ability to get in and out of bed, independent ambulation with a



**Figure 1.** The relationship between the change in the Hospital for Special Surgery knee score and the change in the Iowa Level of Assistance Scale score ( $r = -0.48, p < 0.05$ ).

walking aid, and active range of motion in knee flexion at least 75° (3, 4). Thus, the assessments of knee disability and functional status of patients before and after TKA are an essential part of the physical assessment. According to our findings, both of these outcomes should be considered separately in this patient population. Because the change in functional status of the patients in the early post-operative period is not related to the change in knee disability, a combined assessment of these outcomes after TKA can allow more rigorous decision making about discharge from hospital.

Traditional inpatient rehabilitation programs following TKA generally focus on functionality of the knee joint, e.g., to control pain and to improve knee range of motion and quadriceps muscle strengthening (20, 21). In the present study, the patients' knee disability improved significantly, while functional status of the patients did not (see Table 2). This, together with the finding that a moderate relationship between these outcomes, suggests that the improvement in knee disability after TKA is not enough to improve functional status in the early post-operative period in geriatric patients. In this patient population, what is meant by functional status is activities such as the ability to get in and out of bed, the ability to stand up from a sitting position, and independent ambulation with or without a walking aid (3). Trunk strength and postural control are important factors to perform mobility tasks (e.g., activities in bed or in upright stance) in older adults (22–24), even the contribution of the upper limb is significant (22, 25). In geriatric patients with TKA, incorporating strength training of the trunk and upper extremities, and balance

**Table 2.** The results of the outcome measures before surgery and at discharge, median (first quartile–third quartile).

	Before surgery	At discharge	Change	p
HSS knee score	58.00 (49.88 to 64.00)	61.75 (55.50 to 68.12)	3.25 (–4.75 to 3.63)	0.007*
ILAS score	15.00 (10.75 to 21.00)	14.50 (11.00 to 17.25)	0.00 (–6.00 to –0.43)	0.306

HSS: Hospital for Special Surgery, ILAS: Iowa Level of Assistance Scale, Change = value at discharge – pre-operative value, \*p < 0.05

exercises in the early post-operative rehabilitation program may further improve functional status of patients (26). Experimental studies are needed to substantiate this hypothesis.

No consensus on the relationship between knee disability and functional status exists in patients after TKA (6–9). Two studies reported that an improvement of a flexion contracture of the knee improved functional outcomes (6, 7). These studies focus on the effect of knee range of motion (6, 7), but knee disability does not only mean loss of range of motion of the knee joint; pain, quadriceps strength, knee instability, and varus alignment are also contributors to knee disability (27–30). In the present study, we assessed knee disability using the HSS knee score, which covers all mentioned parameters. This can explain differences between the earlier findings and the results of our study. Another possible reason for the discrepancy in findings is the differences in follow-up duration between these studies and our study. The mean follow-up periods were 7.1 years (6) and 3.2 years (7) in the previous studies, whereas we investigated the relationship in the early post-operative period. For our purpose, however, it was more appropriate to consider the results obtained before surgery and at discharge.

The effect of age on pre- and post-operative outcomes in TKA has been studied in the literature. A study found that young patients (<55 years) had lower knee range of motion compared to geriatric patients pre-operatively (31). Another study reported that young patients (<60 years) had worse pain and function scores compared to geriatric patients in the pre- and post-operative period (32). Since the outcome measures differ by age groups, the findings of our study may not be generalized to non-geriatric patients.

The limitation of the study is that comorbidities of the patients were not considered; this may effect the results (33, 34). The strength of the study is that the study population was selected from patients with bilateral TKA, so it was eliminated the effect of the unaffected limb on the results (10, 11).

## CONCLUSION

In conclusion, an improvement in knee disability does not mean an improvement in functional status in the early post-operative period in geriatric patients following simultaneous bilateral TKA. Each of these outcomes should be assessed separately to make a discharge decision.

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**Author contribution:** E. Sahinoglu, S. Bakirhan, and B. Unver contributed to the study design. All authors contributed to the data interpretation. E. Sahinoglu was the principal writer of the manuscript. All authors contributed to the writing of the final version.

**Conflict of interests:** None.

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