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Original Article / Özgün Araştırma

The influence of social and demographic features on functional level and quality of life after total knee arthroplasty

Sosyal ve demografik özelliklerin total diz artroplastisi sonrası fonksiyon düzeyinde ve yaşam kalitesindeki gelişime etkisi

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ABSTRACT

Objectives: This study aims to evaluate the influence of selected demographic, clinical and social features of patients diagnosed with primer knee osteoarthritis on the improvements increase in functional level and quality of life after total knee arthroplasty (TKA).

Patients and methods: Between January 2014 and August 2014, a total of 70 patients (17 males, 53 females; mean age 67.3±8 years; range 47 to 91 years) with unilateral primary knee osteoarthritis were included in this prospective study. Anteroposterior knee X-rays were graded according to the Kellgren-Lawrence system. Functional level was assessed using the Knee Injury and Osteoarthritis Outcome Score (KOOS-PS) and quality of life was evaluated using the Short Form 36 pre- and six months postoperatively.

Results: There were significant improvements in the functional level ($p<0.0001$) and quality of life ($p<0.0001$) of the patients in the sixth postoperative month. While patients with a higher radiological score and a higher education level demonstrated higher functional improvement rates, a significant increase was observed in the quality of life of these patients as well as of the patients with a lower body mass index (BMI) and fewer comorbidities. Age, gender, place of residence (rural or urban) and employment status did not influence the improvement rates of either functional level or of quality of life.

Conclusion: Patients with a higher radiological score and a higher education level show more significant improvement rates in both functional level and quality of life. Although lower BMI and fewer comorbidities do not have an influence on the rates of improvement in functional level, they have a positive impact on the rates of quality of life. The clinical relevance of this study is that same features do not influence the improvement rates in functional level and quality of life after TKA, and therefore physicians should consider the demographic, clinical and social features of the patients individually when they recommend TKA.

Keywords: Arthroplasty; demographics; knee osteoarthritis; short form 36; social.

ÖZ

Amaç: Bu çalışmada primer diz osteoartriti tanısı ile total diz artroplastisi (TDA) uygulanan hastalarda seçili demografik, sosyal ve klinik özelliklerin cerrahi sonrası fonksiyon düzeyinde ve yaşam kalitesindeki gelişime etkisi araştırıldı.

Hastalar ve yöntemler: Bu prospektif çalışmaya, Ocak 2014 - Ağustos 2014 tarihleri arasında, tek taraflı primer diz osteoartriti olan toplam 70 hasta (17 erkek, 53 kadın; ort. yaş 67.3±8 yıl; dağılım 47-91 yıl) dahil edildi. Ön-arka diz röntgenleri Kellgren-Lawrence sistemine göre derecelendirildi. Fonksiyonel düzey Diz İncinme ve Osteoartrit Sonuç Skoru (KOOS-PS) ile, yaşam kalitesi Kısa Form 36 ile ameliyat öncesi ve ameliyattan altı ay sonra değerlendirildi.

Bulgular: Hastalarda ameliyattan altı ay sonra anlamlı düzeyde fonksiyonel iyileşme ($p<0.0001$) ve yaşam kalitesi artışı ($p<0.0001$) görüldü. Radyolojik skoru ve eğitim düzeyi yüksek olan hastalarda fonksiyonel iyileşme oranları daha yüksek iken; bu hastaların yanı sıra daha düşük vücut kütle indeksi (VKİ) ve daha az eşlik eden hastalığı olan hastaların yaşam kalitesinde de anlamlı artış görüldü. Yaş, cinsiyet, yaşanan yer (kırsal veya kentsel) ve çalışma durumu hem fonksiyonel düzeydeki hem de yaşam kalitesindeki iyileşme oranlarını etkilememektedir.

Sonuç: Radyolojik skor ve eğitim düzeyi yüksek olan hastalar, fonksiyonel seviyede ve yaşam kalitesinde daha anlamlı gelişme oranları göstermektedir. Düşük VKİ ve daha az eşlik eden hastalık fonksiyonel iyileşme oranlarını etkilemezken, yaşam kalitesinin iyileşme oranlarını olumlu etkilemektedir. Bu çalışmanın klinik olarak anlamı TDA sonrası fonksiyonel ve yaşam kalitesindeki iyileşme oranları aynı özelliklerden etkilenmemektedir ve bu nedenle uzmanlar TDA önerirken, hastaların demografik, klinik ve sosyal özelliklerini bireysel olarak dikkate almalıdırlar.

Anahtar sözcükler: Artroplasti; demografik; diz osteoartriti; kısa form 36; sosyal.

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Total knee arthroplasty (TKA) is one of the most successful and cost-effective procedures in treating knee osteoarthritis and it has excellent long-term durability.[1] Socioeconomic parameters and the clinical status of the patients are poorly understood possible independent predictors of the outcome of TKA.[2-4] Identifying risk factors which need special attention to increase the response rate is critical to obtain successful results after TKA.[1,2,5,6] Throughout the world, there is growing recognition that sociodemographic disparities influence the outcomes of major surgeries such as TKA, and such disparities have recently triggered discussions on the adjustment of quality measures for sociodemographic risk factors.[7,8] As some patients have greater postoperative dissatisfaction, it is important to be careful with patient selection and to inform the patients individually regarding possible outcomes.

In the recent literature, elderly patients have been shown to show less improvement in postoperative function.[5,9,10] There is still debate about the effect of gender and body mass index (BMI) on postoperative functions and different results have been reported.[5,10,11] There is no doubt about the importance of patient selection in order to achieve desired outcomes. Although patient selection has been accepted as one of the critical factors in successful TKA, there is no consensus in respect to the criteria which are used for appropriate patient selection.[12] To the best of our knowledge, as shown in the Turkish literature, there has been only one study examining quality of life (QoL) after total hip arthroplasty (THA),[13] and no studies evaluating function and QoL after TKA.

Therefore, this study aimed to investigate whether age, gender, BMI, radiographic severity, educational status, comorbidities, employment status and place of residence of patients with osteoarthritis influence the postoperative functional status, QoL and gains of these patients,[1,2] and whether these factors have similar influences on the postoperative functional status and QoL after TKA.

PATIENTS AND METHODS

This prospective study was carried out between January 2014 and August 2014 and included 70 patients (17 males, 53 females; mean age 67.3±8 years; range 47 to 91 years) with knee osteoarthrosis who underwent primary total knee replacement according to the inclusion and exclusion criteria described below. The study was conducted in the Orthopedics and Physical Medicine and Rehabilitation departments of Ankara Numune Training and Research Hospital. The inclusion criteria were unilateral primary knee osteoarthritis. The exclusion criteria were rheumatological joint diseases, previous knee surgery, metabolic bone disease and osteoarthritis in the contralateral knee. None of the patients had any history of malignancy or major cardiac surgery. Approval for the study was granted by the Ethics Committee of the Ankara Numune Training and Research Hospital with the ID number of E-14-782. A written informed consent was obtained from each patient. The study was conducted in accordance with the principles of the Declaration of Helsinki.

The age, gender, BMI, employment status, educational status, place of residence (rural area or city center) and comorbidities of the patients were recorded. The weight-bearing, preoperative, anteroposterior X-rays of the knee were evaluated by the same physician and graded according to the Kellgren-Lawrence system; grade 0=no radiographic features of osteoarthritis, grade I=suspected joint space narrowing, grade II=definite osteophytes and possible joint space narrowing, grade III=joint space narrowing and sclerosis, grade IV=large osteophytes, marked joint space narrowing and severe sclerosis.[14]

The functional status and QoL of the patients were evaluated preoperatively and postoperatively after six months by the same physician. Functional status was determined with the Knee Injury and Osteoarthritis Outcome Score Physical Function Short Form (KOOS-PS), which is a shortened form of the Knee Injury and Osteoarthritis Outcome Score (KOOS). The KOOS-PS has seven items which are used to evaluate functions. These are rising from bed, putting on socks, rising from sitting, bending to the floor, twisting/pivoting on the injured knee, kneeling and squatting.[15] The KOOS-PS has been shown to be a valid and reliable scale for measuring functional loss in patients with a knee disability.[15-17] The total score ranges from 0 to 100 with a lower score indicating less functional difficulty. Quality of life was evaluated with the Short Form 36 (SF-36) Health Survey physical component. The SF-36 subscales no longer use the original (0-100) units and are z-scores after expressing as the SF-36 physical component score. This test has been shown to be reliable and useful for broader use by physical therapists among older community-dwelling adults due to the simplicity and brevity of the scale in addition to internal consistency for this patient group.[18]

All the operations were performed by the same senior surgeon using the same surgical technique

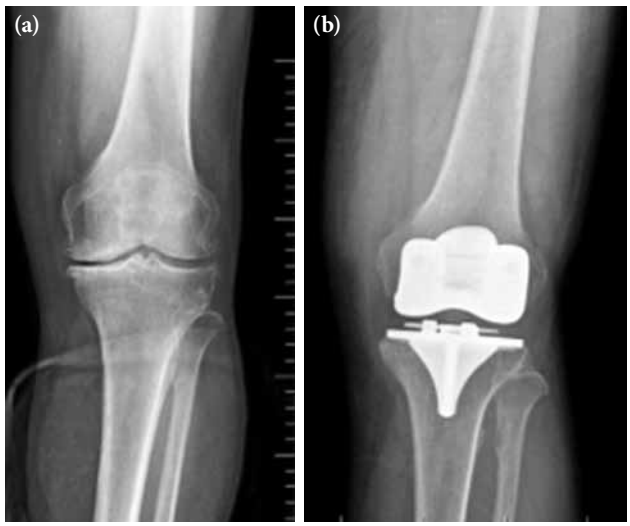

Figure 1. (a) Anteroposterior preoperative radiograph of a 64-year-old male patient with Kellgren-Lawrence grading scale type 3 knee osteoarthritis and **(b)** postoperative anteroposterior radiograph after total knee arthroplasty.

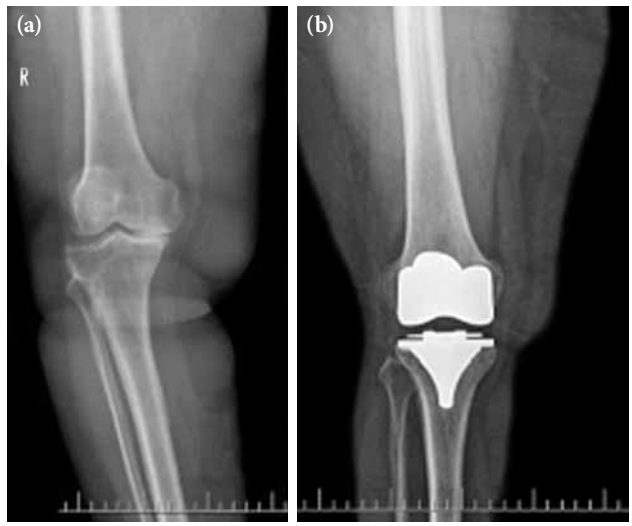

Figure 2. (a) Anteroposterior preoperative radiograph of a 68-year-old female patient with Kellgren-Lawrence grading scale type 4 knee osteoarthritis and **(b)** postoperative anteroposterior radiograph after total knee arthroplasty.

and a mid-patellar approach. During the operations, a posterior cruciate ligament retaining Vanguard Complete Knee System Prosthesis (Biomet Inc., Warsaw, IN, USA) was implanted using bone cement for both the femoral and tibial components. Patellar surface arthroplasty was not performed in any case. At 48 hours postoperatively, the Jones bandage and suction drain were removed. The patients were mobilized, and continuous passive motion was started just after removal of the drains. In all patients, perioperative antibiotic prophylaxis using a first generation cephalosporin was administered to prevent infection, and the same analgesic treatment to reduce pain was administered using patient-controlled analgesia. Pre- and postoperative radiographs of patients with grade III and grade IV knee osteoarthritis are shown in Figures 1 and 2.

Statistical calculations were performed with IBM SPSS version 20.0 sofware (IBM Corporation, Armonk, NY, USA). A value of $p<0.05$ was considered statistically significant. All data was calculated as mean and standard deviation. The paired simple t test was used to analyze the changes in KOOS-PS and SF-36 physical component scores. When the subjects were divided into different groups, a repeated measures analysis of variances was used to compare the decrease of KOOS-PS scores and the increase of SF-36 physical component scores between the groups. Pearson analysis was used to evaluate the correlation between the variables.

RESULTS

The demographic features of the study group are shown in Table 1. All the patients benefitted from the TKA in respect to functional status and QoL. There was a significant improvement in the functional status and QoL measurements six months after surgery.

Table 1. Demographic data of the patients

	n	%	Mean±SD	Min.-Max.
Age (years)			67.3±8	47-91
Gender				
Female	53			
Male	17			
Body mass index (kg/cm^2)			29.8±3.1	21.3-37.1
Radiologic score				
Grade 3	41	59		
Grade 4	29	41		
Living place				
Rural area	45	64		
Urban	25	36		
Employment status				
Employed	21	30		
Unemployed	49	70		
Comorbidities				
None	9	13		
Cardiovascular diseases	27	39		
Diabetes mellitus	22	31		
Other	12	17		
Educational status				
Illiterate	19	27		
Primary school	37	53		
Secondary-High school	10	14		
University	4	6		

SD: Standard deviation; Min.: Minimum; Max.: Maximum.

Table 2. Changes in functional status and quality of life at six months after total knee arthroplasty

	Preoperative	Postoperative	
	Mean±SD	Mean±SD	*p*
KOOS-PS	59.7±14.3	35.6±12.8	<0.0001
SF-36 (physical functioning scale)	17.8±12.1	40.1±16.2	<0.0001

SD: Standard deviation; KOOS-PS: Knee Injury and Osteoarthritis Outcome Score Physical Function Short Form; SF-36: Short Form 36.

Pre- and postoperative KOOS-PS and SF-36 physical component scores and *p* values are presented in Table 2. Complications of deep vein thrombosis were seen in two patients, surgical site infections occurred in two patients and wound site problems were seen in four patients, all of which were treated successfully without any follow-up loses in the present study.

It was determined that there was not a relationship between KOOS-PS changes and age, gender, BMI, presence of a comorbidity, employment status and place of residence (rural or city). All the patients had a radiographic score of grade III or IV preoperatively.

Table 3. The effect of patient characteristics on functional improvements

	Preoperative	Postoperative	
	KOOS-PS	KOOS-PS	
	Mean	Mean	*p*
Gender			0.112
Males	62.3	37.2	
Females	49.1	29.1	
Body weight			0.098
BMI <30	59.4	35.1	
BMI ≥30	60.3	36.2	
Radiological score			<0.0001
Grade 3	48.2	33.4	
Grade 4	58.9	36.8	
Place of residence			0.881
Rural	60.6	37.4	
Urban	57.7	34.2	
Employment status			0.521
Employed	59.1	34.7	
Unemployed	59.9	35.8	
Education			0.521
Illiterate	52.2	34.7	
Primary school	61.4	35.9	
High school	65.3	37.5	
University	69.6	44.3	
Comorbidities			0.092
None	61.2	35.4	
Cardiovascular disease	57.7	34.6	
Diabetes mellitus	60.5	36.2	
Other	59.3	36.1	

KOOS-PS: Knee Injury and Osteoarthritis Outcome Score Physical Function Short Form; BMI: Body mass index.

The group with a radiographic score of grade IV had greater functional gains compared to the patients with grade III radiographic osteoarthritis. In addition, educational status was found to be an influential factor. The functional status of primary school graduates improved statistically significantly more than that of patients who were illiterate (Table 3).

There was no relationship between SF-36 physical component score changes and age, gender, employment status and place of residence (rural or city). A lower BMI and higher radiographic score were determined to affect QoL improvement with a greater increase in the SF-36 physical component scores. In addition, educational status and presence of comorbidities were found to be influential factors. The QoL status of the patients with a higher educational level and fewer comorbidities improved statistically significantly more than that of patients with a lower educational level and more comorbidities (Table 4). Patients with a higher radiological score and higher level of education showed more improvement in both functional level and QoL. A lower BMI and fewer comorbidities had a positive impact on QoL, and there was not an impact on functional score.

DISCUSSION

The results of this prospective study showed that a higher radiological score and higher education level increased the improvement in both functional level and QoL after TKA. A lower BMI and fewer comorbidities had a positive impact on QoL, and no impact on functional score. Age, gender, place of residence (rural or urban) and employment status had no effect on functional level and QoL. In the postoperative sixth month check up following TKA surgery, all the patients showed improvement in respect to the functional score and QoL.

The mechanisms through which social and demographic risk factors have an effect on health outcomes are complex, and differences in socioeconomic composition, healthcare systems and

Table 4. The effect of patient characteristics on quality of life

	Preoperative SF-36 (Physical functioning scale)	Postoperative SF-36 (Physical functioning scale)	
	Mean	Mean	*p*
Gender			0.346
Males	15.3	36.9	
Females	19.1	42.3	
Body weight			0.041
Body mass index <30	15.4	40.0	
Body mass index ≥30	18.2	40.4	
Radiological score			<0.0001
Grade 3	20.9	42.4	
Grade 4	13.2	39.1	
Place of residence			0.112
Rural	17.1	39.4	
Urban	18.7	42.3	
Employment status			0.341
Employed	19.2	45.3	
Unemployed	16.2	39.8	
Education			0.028
Illiterate	12.2	30.7	
Primary school	17.4	41.4	
High school	21.3	44.5	
University	26.7	54.3	
Comorbidities			0.040
None	18.6	45.5	
Cardiovascular disease	17.4	39.1	
Diabetes mellitus	17.8	40.7	
Other	17.9	41.8	

SF-36: Short Form 36.

socioeconomic measures across countries imply that the findings of some excellent studies cannot always be generalized to other countries.[4] This emphasizes the importance of studies based on national data regarding the social and demographic factors and their influence on any type of medical situation. In the literature which is based on Turkish studies, there has only been one study examining postoperative outcomes with QoL after THA[13] and no study which has evaluated postoperative outcomes with function and QoL after TKA. Therefore, in this study we aimed to investigate the influence on functional improvements and QoL after TKA of the selected demographic, clinical and social features of patients in a Turkish population.

In contrast to the findings of the present study, it has been reported that a more advanced age, a higher BMI and a higher number of comorbidities are associated with lesser function at 12 months postoperatively.[5] Although, less improvement in function with increasing age has been reported,[19] in the current study, no relationship was determined between age and improvement in KOOS-PS and SF-36 physical component scores. This confusing result might be explained by the relatively higher ages of the patients in the two previous studies compared with those in the present study and the differences in lifestyle of western and Turkish patients. When patients in the current study with BMI ≥30 and BMI <30 were compared in respect of KOOS-PS and SF-36 changes, there was no difference between the groups in respect to function, whereas QoL was seen to improve more in patients with BMI <30.

Cardiovascular diseases and diabetes mellitus were the most frequent comorbidities. Only 13% of the patients did not have any comorbidities. Although the presence or type of comorbidity were not associated with the functional recovery level, it has been reported in other studies that patients with fewer comorbidities have shown better functional improvement.[5,6] In the current study, comorbidities were seen to decrease QoL but not to influence functional score. In a recent study, Santaguida et al.[10] reported that females showed less improvement in function than males. However, two other studies reported that males and females had similar improvement rates after TKA[9,19] and the results of the present study are consistent with these two recent studies.

In the present study, patients with a grade IV radiographic score had more functional restrictions preoperatively and the improvement in functional score and QoL was higher than in patients with grade III osteoarthritis. Thus, patients with KL grade IV benefited more from TKA than patients with KL grade IV. A multi-center study reported that patients with severe radiographic osteoarthritis had a better prognosis for physical function but the groups compared in that study had either mild or severe knee osteoarthritis.[20] That study supported the findings of the current study and emphasized the importance of preoperative knee X-rays to evaluate the grade of osteoarthritis and thereby prevent patients from being disappointed after the operation.[20] There were no patients with grade 0, I or II osteoarthritis in the present study and the results of the grade III and 4 patients showed that radiographically final stage patients may show the best functional improvement.

The educational level of the patients affects the level of benefit gained from the operation and in the current study more improvement was seen in patients with a higher level of education. Living in a rural region or in a city center had no effect on the improvement of functional score and QoL. Only one study could be found in the available literature that examined rural-urban differences in outcomes following total joint replacement. That study also reported no difference between rural and urban patients with regard to postoperative function.[21] The findings of our study showed the potential impact of social, demographic, and clinical factors on outcomes after TKA and highlighted the need for nationwide research of these factors and the examination of any other characteristics of the patients who were not included in this study.

There are some limitations to this study. First, this study was performed with 70 patients; further prospective studies with a higher number of patients may strengthen the conclusions of the present study. The results presented are only those of the selected patient-reported data, and so it might be possible to reach a more generalized conclusion with additional characteristics of the patients in terms of social, demographic and clinical factors. Finally, as this study was conducted in a single tertiary center, there is a need for further research utilizing a larger patient database from different hospitals which would strengthen the findings about the factors influencing the functional outcomes and QoL after TKA for Turkish patients.

In conclusion, patients with a higher radiological score and a higher level of education showed more improvement in both functional level and QoL. A lower BMI and fewer comorbidities had a positive impact on QoL, but no impact on functional score. The clinical relevance of this study is that the functional level and QoL are not influenced by the same features after TKA and therefore, the demographic, clinical and social features of patients need to be considered individually by physicians when recommending TKA surgery. Patients should be informed about the factors which influence postoperative functional level and QoL as part of a strategy to increase satisfaction after TKA.

Declaration of conflicting interests

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