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Functional Outcomes After Total Knee Arthroplasty Correlate With Spine Disability

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ABSTRACT

Background: Despite pain resolution in most patients after total knee arthroplasty (TKA), poor function persists in approximately 20% of patients and frequently is associated with patient dissatisfaction. Lumbar spine problems are a leading cause of functional disability. This study sought to determine the association between lower knee function scores and history of spine disability.
Methods: Prospective demographic, health, and knee-specific data were collected for 1156 consecutive TKAs from July 2010 to July 2012. A spine questionnaire and Oswestry Disability Index (ODI) score were obtained from 691 knees.
Results: Of 691 patients, 371 (54%) with TKA had daily back pain or back pain that limited activity. Oxford Knee Score was significantly worse in patients with vs without back problems preoperatively (36.9/34.8; $P = .0006$) and postoperatively (20.2/17.0; $P < .0001$), but not for improvement (16.7/17.8; $P = .10$). Knee Society (KS) pain scores were similar regardless of spine history. KS function scores were lower in patients with vs without back problems preoperatively (42.3/47.0; $P = .0005$), postoperatively (69.0/79.8; $P < .0001$), and for improvement (25.8/32.9; $P < .0001$). Lower KS function was associated with female gender, age, health, preoperative function, and ODI. ODI was associated with Oxford Knee Score ($R = 0.57$) and KS function score ($R = 0.54$).
Conclusion: Knee function scores were significantly worse in patients with a history of back problems and directly associated with ODI score. KS function scores indicated that TKA patients with back problems had worse function before and after TKA with less improvement. Poor TKA outcomes and dissatisfaction may reflect poor knee function, spine disability, or both. Awareness of coexisting spine disability should guide patient expectations and evaluation of TKA outcomes.

Although most patients consistently report pain relief after total knee arthroplasty (TKA), functional deficits persist for a significant number of patients, which have been associated with patient dissatisfaction [1]. Functional limitations following TKA have been reported to correlate with patient variables of increasing age, body mass index (BMI), health status, female gender, and poor preoperative knee function [2-5].

According to the Centers for Disease Control and Prevention, the 2 leading causes of chronic pain in the United States are low back pain (28.1%) and knee pain (19.5%) [6]. Spinal stenosis and osteoarthritis of the knee frequently occur in the same patient. Osteoarthritis of the knee is more prevalent in individuals with radiographic signs of spinal degeneration [7]. In addition, adults with low back pain often are in worse physical health: 28% of adults with low back pain reported limited activity compared with 10% of adults without low back pain [8]. Despite the frequent association of knee and back osteoarthritis and the reported functional limitations in back pain patients, published knee outcome reports have not included variables accounting for low back pain or spine disability.

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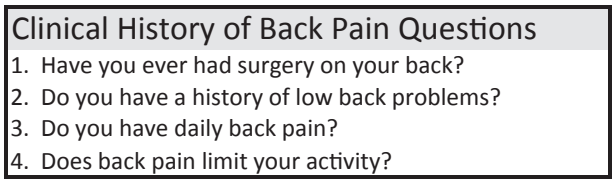

Fig. 1. Questions listed on the patient questionnaire to determine incidence of back pain.

Previous studies evaluating arthroplasty outcomes and low back pain primarily have looked at the benefit of arthroplasty on the incidence of low back pain rather than the potential negative association of chronic back problems and spine disability on TKA outcomes [9-11]. Currently, no published study has evaluated the fully rehabilitated TKA patient to determine the association of spine disability with knee outcome scores. The purpose of this study was to determine whether poor knee outcomes after TKA were associated with spine disability.

Methods

Patients included in this study were selected from a primary TKA database that prospectively collects patient demographics, surgical and knee-specific data, Oxford Knee Scores (OKS), and Knee Society (KS) pain and function scores preoperatively and throughout follow-up postoperatively. From this database, 1156 consecutive primary TKAs performed by the principal investigator between July 2010 and July 2012 were invited by mailed questionnaire to participate in an institutional review board–approved study. Patients voluntarily completed this questionnaire, which asked both a subjective general history of back problems (Fig. 1) and specific, objective questions required to complete the Oswestry Disability Index (ODI), the primary lumbar-specific outcome measure of spinal disability [12]. Responses for 691 TKAs were tabulated to create the study group. To minimize bias created by a voluntary response sample, demographic and knee-specific data of the study group (responders) were compared with those of the nonresponders in Table 1.

A single surgeon performed all primary TKAs with the same surgical technique and perioperative protocol. A mini-subvastus approach was used to implant an anterior-stabilized cemented Vanguard™ Knee (Biomet, Warsaw, IN). The posterior cruciate ligament was resected and the patella was resurfaced in all cases. A comprehensive perioperative management program was employed including preoperative education, perioperative multimodal pain/nausea management and prevention, and a postoperative therapy program focused on knee range of motion and return to activities. Patients were seen routinely 3, 6, and 12 weeks postoperatively. Extended office follow-up visits occurred at 1 and 3 years.

All study patients completed forms for OKS, KS pain score, and KS function score, which were determined at the time of their preoperative evaluation and at most recent follow-up [13]. All study patients had a minimum of 1-year follow-up (mean, 25.9 months; range, 12-42). Data for variables known to correlate with TKA outcomes such as age, BMI, American Society of Anesthesiologists (ASA) level, knee deformity, and gender were collected and compared with knee outcomes. New variables including the presence of back problems and spine disability, as measured by the ODI, were similarly compared to knee outcomes. Statistical analysis of demographic data used Wilcoxon's *t* test for quantitative measures and chi-square analysis for categorical measures. To compare change between preoperative and most recent postoperative evaluation, Wilcoxon's signed-rank test was used for knee measures and Wilcoxon's *t* test was used for back problem status, with $P < .05$ indicating statistical significance. For continuous characteristics, the Spearman correlation coefficients for a linear association between the characteristic and knee outcomes were determined. Linear association was determined significant for $R > 0.20$.

Table 1
Patient Demographics.

Variable	Responders (n = 691)	Nonresponders (n = 465)	*P* Value
Gender			
Male	237 (34%)	181 (39%)	.11
Female	454 (66%)	284 (61%)	
Age (y)	69 ± 8.4 (49-89)	67 ± 9.3 (41-96)	.001
BMI (kg/m^2)	32 ± 5.8 (18-53)	32 ± 6.0 (17-49)	.656
Side			
Left knee	327 (47%)	233 (50%)	.40
Right knee	364 (53%)	232 (50%)	
ASA level			
I	15 (2%)	9 (2%)	.08
II	458 (66%)	279 (60%)	
III	218 (31%)	177 (38%)	
Deformity	−1 ± 10.2 (−33 to 32)	−2 ± 10.4 (−38 to 35)	.186
Months f/u	25.9 ± 6.4 (12-42)	19 ± 14.3 (0-48)	.0001

ASA, American Society of Anesthesiologists; BMI, body mass index; f/u, follow-up.

Results

Knee pain and function scores at most recent follow-up improved significantly from preoperative scores ($P < .0001$) in all 691 patients (Table 2). However, KS function scores improved after surgery significantly less than KS pain scores (29.0 vs 45.4; $P < .0001$) and improved less consistently with wider variability in the standard deviation (24.0 vs 10.9; $P < .0001$).

Of 691 patients with TKAs, 371 (54%) reported a history of back problems. On the subjective back pain questionnaire (Fig. 1), 90 TKRs (13%) had a history of back surgery, 298 TKRs (43%) had a history of low back pain, 236 TKRs (34%) had a history of daily low back pain, and 208 TKRs (30%) had back pain that limits their activity. The OKS was significantly worse in patients with a history of back problems compared to patients without back problems both preoperatively (36.9 vs 34.8; $P = .0006$) and postoperatively (20.2 vs 17.0; $P < .0001$), but not for the amount of improvement (16.7 vs 17.8; $P = .10$; Table 3). KS function scores were significantly worse in patients with vs without back problems preoperatively (42.3 vs 47.0; $P = .0005$), postoperatively (68.0 vs 79.8; $P < .0001$), and also for improvement (25.8 vs 32.9; $P < .0001$). KS pain scores were similar both preoperatively and postoperatively regardless of spine history.

Postoperative KS function scores were associated with gender, ASA level, patient age, BMI, and preoperative KS function scores.

Table 2
Improvement From Preoperative to Follow-Up of Knee Outcome Measures.

Variable	Label	Mean	SD	Median	Q1	Q3	*P* Value
OKS	Preop	35.9	7.6	36	30	41	<.0001
	Postop	18.7	6.6	17	14	22	
	Change	−17.2	8.1	−17	−23	−12	
KS pain	Preop	47	15.2	48	35	56	<.0001
	Postop	92.4	10.9	95	90	100	
	Change	45.4	17.1	46	34	58	
KS function	Preop	44.4	18.1	40	35	50	<.0001
	Postop	73.5	24	80	50	100	
	Change	29	23	30	10	50	

All knee measures demonstrate significant improvement following TKA.
OKS, Oxford Knee Score; KS, Knee Society; preop, preoperative; postop, postoperative; SD, standard deviation; TKA, total knee arthroplasty.