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Does Body Mass Index Decrease Over Time Among Patients Who Undergo Total Knee Arthroplasty Compared to Patients With Osteoarthritis? Data From the Osteoarthritis Initiative

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ABSTRACT

Background: Although total knee arthroplasty (TKA) is associated with improved patient-reported function, pain, and quality of life, the effects on weight loss are less certain. In this study, we use data from a large, prospective cohort study of osteoarthritis (OA) patients to compare the changes in body mass index (BMI) across 6 years in OA patients who received TKA compared with OA patients who did not receive TKA.

Methods: Using data from the Osteoarthritis Initiative, a prospective cohort study of patients with OA, our study divided patients into two groups: patients who received a TKA during the Osteoarthritis Initiative study (N = 140) and those who did not (N = 697). The initial BMI, final BMI, and change in weight over 72 months were compared between groups. Subgroup analysis was performed by dividing patients by their initial BMI, gender, and age.

Results: The TKA group's change in weight, initial BMI, and final BMI were not significantly different from the non-TKA group over 72 months (weight change: −0.763 kg vs +0.191 kg; $P = .597$). Subgroups of women and patients aged 51-60 years with TKA gained more weight than respective non-TKA OA patients.

Conclusions: Overall, patients who received TKA did not lose or gain more weight than OA patients who did not receive TKA. Patients with longer follow-up after TKA (>2 years) still gained weight on average. Despite the improved patient-reported pain levels, function, and quality of life after TKA, it appears that TKA alone is not a sufficient intervention for obesity.

Total knee arthroplasty (TKA) has been established as a definitive treatment for end-stage osteoarthritis (OA) of the knee [1-4]. TKA has been shown to improve patient-reported pain, function, and overall quality of life [5-7], while also being one of the most cost-effective procedures for end-stage OA [8-11]. Furthermore, these outcomes have been demonstrated in TKA patients with other comorbidities, including obesity [6,12-15].

However, although TKA is still generally regarded as a successful procedure in obese patients, obesity has been shown to increase the incidence of several TKA complications, including venous thromboembolism [16,17], surgical site infection [18,19], medical complications [14,18,19], and prolonged hospital stays [18]. Although it is established that increased body mass index (BMI) is a risk factor for these complications, the effect that primary TKA has on postoperative weight changes is more controversial. Several studies have reported contradictory results in terms of weight change after TKA [20-26], although many studies seem to support the notion that patients generally gain weight after TKA when compared with matched control groups of healthy individuals [21,23,27-29]. This finding is especially important because many patients tend to attribute their difficulties losing weight to their limited physical function due to OA. As one study concluded,

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weight management and end-stage OA of the knee need to be considered as separate, independent entities [21].

A recent literature review by Inacio et al [22] found that there are a limited number of studies that properly address the effects that TKA has on BMI. Furthermore, although some studies have compared the weight change in total joint arthroplasty patients to natural weight progression in age-matched healthy individuals [27-29], to our knowledge, there has been no attempt to compare weight change in TKA patients to the natural progression of weight change in other patients suffering from knee OA. This is a clinically important distinction, as the isolated effects of TKA on weight change must be examined in light of the OA that these patients are already afflicted with.

In this study, we use data from the Osteoarthritis Initiative (OAI), a large prospective, observational study of patients with either clinically significant OA or substantial risk factors for the development of OA. As many of these patients received a TKA during the course of the OAI study, our study uses the data to compare the weight changes in patients with clinically significant OA to weight changes in OA patients who receive TKA. Our hypothesis was that patients who received TKA would not lose significantly more weight over the study period than OA patients who did not. Secondary objectives of this study were to identify potential predictors of weight loss or gain in TKA patients and observe the progression of weight change after TKA in terms of follow-up time.

Methods

All data for the study was obtained from the OAI database. The OAI is a publically and privately funded, prospective observational study of patients with OA or with risk factors for OA. Within the OAI study, there is a progression subcohort, formed of 1389 patients with clinically significant OA at baseline, an incidence subcohort, formed of 3285 patients with risk factors for the development of clinically significant OA, and a control subcohort of 122 patients with no clinically significant OA or risk factors for OA. Every participant in the OAI is required to report to their respective study center for an annual visit where clinical, radiographic, and biomarker data are obtained. Physical examination and biomarker data have been obtained and recorded for the study up to 6 years at the time of our study [30].

The OAI study is a multicentric study, with study centers at the Ohio State University, the University of Maryland School of Medicine, the University of Pittsburgh, and Memorial Hospital of Rhode Island in Pawtucket, Rhode Island. All data, including radiographic and biomarker data, as well as further information regarding the study design and institutional review board approval are publically available at http://www.oai.ucsf.edu.

For our study, we included only patients within the progression subcohort of the OAI study. Patients were enrolled in the progression subcohort if, in at least one knee, they had *both* frequent knee symptoms defined as “pain, aching, or stiffness in or around the knee on most days” for at least 1 month in the past 12 months and radiographic tibiofemoral knee OA, defined as definite tibiofemoral osteophytes, on the fixed flexion radiograph (Osteoarthritis Research Society International grade 1-3). We further divided the patients within the progression subcohort into those who received a TKA at some point during the course of the 6-year study and those who did not receive a TKA during the course of the study. Exclusion criteria for both groups included any patient who did not have BMI measurements taken during the first or the last visit of the OAI study and any partial knee arthroplasty procedure.

For those patients who received bilateral TKA procedures during the course of the OAI study, the follow-up period was determined based on the first unilateral (or bilateral if TKAs were performed simultaneously) operation.

For each patient included in the study, initial BMI, final BMI, and change in weight were obtained, as well as baseline characteristics and clinical symptom scores using the Western Ontario and McMaster Universities Arthritis Index (WOMAC) scoring system. BMI measurements and weight changes were compared across TKA and non-TKA patients. Although BMI provided the best means of comparing TKA and non-TKA patient groups at the beginning and end of the study because it accounts for height, change in weight (kg) was uszed rather than change in BMI because changes in BMI potentially could be subject to decreases in height (especially pertinent in an older population where height loss is common). Subgroup analysis was performed by dividing patients by their initial BMI in increments of 5. Further subgroup analysis was also performed by dividing patients by gender and age (patients were grouped by decade).

As the follow-up time was variable in patients with TKA (some patients had a TKA performed early in the OAI study and others had a TKA performed late in the OAI study), subgroup analysis was performed on the TKA group by dividing patients according to their follow-up time (time between TKA and final BMI measurement). Among these subgroups, initial BMI, final BMI, and change in weight were compared to observe any change in the relationship between TKA and BMI given different follow-up lengths. No attempt was made to standardize the follow-up time for the TKA patients because of the goal of comparing TKA and non-TKA patients across a similar period. Further analysis of the effects of follow-up time after TKA on weight changes was performed by comparing weight changes between TKA and non-TKA patients using different inclusion criteria; analysis was performed using only TKA patients with >3 months, >6 months, or >12 months follow-up.

For power analysis, it was assumed that the standard deviations (SDs) would be similar between the non-TKA and TKA groups—the SD of the groups combined was 2.43. Power analysis determined

Table 1
Baseline Characteristics.

Baseline Characteristics	Non-TKA Patients (N = 697)	TKA Patients (N = 140)	*T*-Test/ Chi-square	*P* Value
Age	60 (8.9)	64 (8.2)	4.449	<.001
Sex	45.9% male	45.7% male	0.002	.966
Race (%)			13.701	.003
Other nonwhite	2.0	2.9		
White/Caucasian	70.3	82.9		
African American	27.1	12.9		
Asian	0.6	1.4		
Education level (%)			1.918	.860
Less than high school graduate	3.7	2.9		
High school graduate	13.0	16.4		
Some college	25.1	25.0		
College graduate	23.3	21.4		
Some graduate school	8.9	7.1		
Graduate degree	25.9	26.4		
Annual income (%)			5.712	.222
Less than $10,000	4.6	1.2		
$10,000-$25,000	11.0	6.5		
$25,000-$50,000	23.1	21.9		
$50,000-$100,000	32.6	32.0		
>$100,000	21.7	17.2		
Currently employed (%)	65.7	57.9	3.136	.077
Initial BMI	30.0 (4.85)	30.2 (4.82)	0.39	.696
Initial WOMAC total score	18.5 (14.9)	21.5 (12.7)	2.426	.016

TKA, total knee arthroplasty; BMI, body mass index; WOMAC, Western Ontario and McMaster Universities Arthritis Index.