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Is Pain and Dissatisfaction After TKA Related to Early-grade Preoperative Osteoarthritis?

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Abstract

Background There is growing evidence to suggest many patients experience pain and dissatisfaction after TKA. The relationship between preoperative osteoarthritis (OA) severity and postoperative pain and dissatisfaction after TKA has not been established.

Questions/Purposes We explored the relationship between early-grade preoperative OA with pain and dissatisfaction after TKA by (1) determining the incidence of early-grade preoperative OA in painful TKAs with no other identifiable abnormality; and (2) comparing this incidence with the incidence of early-grade OA in three other cohorts of patients undergoing TKA.

Methods We evaluated all (n = 49) painful TKAs in a 1-year period that had no evidence of loosening, instability, malalignment, infection, or extensor mechanism dysfunction and classified the degree of preoperative OA according to the scale of Kellgren and Lawrence. For comparison, we identified three other cohorts of TKAs from the same center and classified their preoperative grade of OA: Group B (n = 100) was a consecutive series of primary TKAs performed for OA during the same year; Group C (n = 80) were asymptomatic TKAs from 1 to 4 years postoperatively; and Group D (n = 80) were TKAs with some degree of pain at 1 to 4 years postoperatively.

Results Patients in Group A had a higher incidence of early-grade OA is preoperatively (49%) compared with any of the comparison groups: Group B, 5%; Group C, 6%; and Group D, 10%.

Conclusions A high percentage of patients referred for unexplained pain after TKA had early-grade osteoarthritis preoperatively. Patients undergoing TKA for less than Grade 3 or 4 OA should be informed that they may be at higher risk for persistent pain and dissatisfaction.

Level of Evidence Level III, prognostic study. See Guidelines for Authors for a complete description of levels of evidence.

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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Introduction

Total joint arthroplasty is among the most successful, highest volume procedures in medicine [16, 26, 33]. In recent years, TKA has exceeded THA in both volume and growth rate [14] with a predicted volume of two to three million cases per year in the United States alone within 20 years [24]. Although TKA volumes are escalating more rapidly than THA, there is evidence that patient satisfaction may not be as high after TKA compared with THA [8, 28]. In the largest study to date on this subject, Robertsson et al. [34] reported on a questionnaire of more than 25,000 patients from the Swedish Knee Arthroplasty Registry. A response rate of over 95% was achieved and 8% were dissatisfied with their knee. In a more recent large-scale study of patient satisfaction, Baker et al. [2] surveyed recipients of TKA in England and Wales and reported an 18% rate of dissatisfaction. Similarly, a cross-sectional Canadian study suggested 19% of patients undergoing TKA were not satisfied with their outcome [9]. The revision rate after TKA remains very low with 10-year survival rates as high as 95% to 99% reported [16, 33]. Many patients with surviving implants, however, have moderate or greater degrees of pain and dissatisfaction. This may be particularly true of young patients. Price et al. [30] reported on 60 patients younger than age 60 years at the time of TKA at minimum 12-year followup. Although the implant survival rate was 82%, over 40% of patients had pain rated at least moderate.

A number of studies have examined the issue of persistent pain after TKA. Virtually all have focused on specific patient characteristics as a predictor of low knee outcome scores and high pain scores. Patient factors such as age, sex, low preoperative WOMAC scores, narcotic use, the presence of comorbidities, and psychological factors all predicted a lower knee score and higher degree of pain and dissatisfaction after TKA [1, 2, 7, 9–13, 31, 32, 35]. Two recent studies [27, 29] examined pain and revision rates after unicompartmental knee arthroplasty (UKA). These studies suggested patients with earlier stage osteoarthritis (OA) preoperatively (less than bone-on-bone appearance radiographically) were more likely to have persistent pain and go on to subsequent conversion to TKA. It is, however, unclear whether a similar relationship applies to dissatisfaction after TKA.

The purpose of the current study was to explore the relationship between early-grade preoperative OA with pain and dissatisfaction after TKA by (1) determining the incidence of early-grade preoperative OA in painful TKAs with no other identifiable abnormality; and (2) by comparing this incidence with the incidence of early-grade OA in three other cohorts of patients undergoing TKA.

Patients and Methods

To determine the presence and magnitude of the problem of pain and dissatisfaction after TKA and its relationship to preoperative degree of OA, we identified all 132 new patients referred to a total joint clinic for evaluation of a painful knee arthroplasty during a 1-year period. Because of their persistent pain, none of these patients were satisfied with the results of their knee arthroplasty and sought or were referred for a second opinion to evaluate their painful TKA to see if revision surgery was indicated. From this group we excluded six patients who had previous revision, unicompartmental, and patellofemoral arthroplasties. These exclusions left 126 symptomatic primary TKAs for review. Of these, 36 knees (15 male, 21 female with an average age of 66.9 years; range, 38–83 years) were treated with revision surgery. The most common reason for revision was component loosening followed by infection (Table 1). A total of 41 symptomatic TKAs (16 male, 25 female; average age of 64.1 years; range, 39–90 years; mean length of followup, 3.5 years; range, 1–11 years) were assigned a specific diagnosis based on an objective physical examination or radiographic finding but elected nonoperative treatment because the degree of symptoms and/or functional limitation was not great enough to warrant surgical intervention. The most common diagnoses were anterior knee pain (seven with a resurfaced patella, two nonresurfaced) followed by instability and malalignment/malrotation (confirmed by CT scan or weightbearing radiographs) (Table 2). The remaining 49 knees (39%) showed no signs of loosening, instability, malalignment, infection, or extensor mechanism dysfunction and thus had a high degree of pain and dissatisfaction in the absence of

Table 1. Revision procedures performed during the study period (n = 36)

Diagnosis	Number
Loosening	15
Both components	10
Tibial component	3
Femoral component	1
Patella component	1
Infection	8
Polyethylene wear/osteolysis	5
Instability	2
Painful unresurfaced patella	1
Tibial liner wear/dislodgement	2
Heterotopic ossification	1
Malrotation	1
Quad tendon rupture and component malrotation	1

Table 2. Symptomatic primary knees with diagnosis treated conservatively (n = 41)

Diagnosis	Number
Loosening	4
Anterior knee pain	9
Instability	8
Malalignment/malrotation	7
Stiffness	5
Other	8
Patella (1 subluxed; 1 maltracking; 2 tendinitis; 1 clunk)	5
Lumbar radiculopathy	1
Peripheral neuropathy	1
Soft tissue/lateral epicondylitis	1

any objective clinical, radiographic, or serologic abnormality and constitute the primary study group for this investigation (Group A). All patients in this group had pain that was rated moderate to severe on a regular basis and were therefore dissatisfied with the result of their TKA.

All patients completed a detailed questionnaire regarding their history, prior treatments, and degree of symptoms. A standardized clinic note detailing the physical findings was reviewed as were radiographs including a standing AP view of both knees as well as a lateral and a sunrise view. All patients underwent joint aspiration unless they had a normal erythrocyte sedimentation rate and C-reactive protein and no clinical or radiographic suspicion of infection. Patients suspected of having component malrotation based on an asymmetric appearance of the component radiographically or of the extremities clinically underwent CT to measure component rotation as described by Berger et al. [6]. Patients suspected of having occult loosening based on localized start-up pain or well-localized weightbearing pain underwent Tc^{99} nuclear medicine scans.

We defined patients with well-localized peripatellar or anterior knee pain with or without radiographic evidence of patellar subluxation or tilting as having anterior knee pain. Those with lucency at the implant-bone or bone-cement interface that was progressive, involved more than 25% of the interface, or associated with a localized area of increased uptake on Tc^{99} scanning were determined to have failure of ingrowth or probable early loosening. We defined patients with symptomatic giving way and greater than 1 + varus, valgus, or sagittal plane laxity as having instability.

To provide comparison groups for the expected incidence of different grades of preoperative OA, we identified three additional cohorts of patients from the total joint arthroplasty registry at the authors' institution: (1) Group B: a consecutive series of 100 patients undergoing primary TKA by the senior surgeon (RLB) for OA in the same calendar year; (2) Group C: patients with asymptomatic TKAs defined as clinical pain scores rated none on Knee Society scoring (KSS) or rated 0 out of 10 on a visual analogy scale (VAS) returning for 1- to 5-year followup after primary TKA for OA during the same time period; and (3) Group D: symptomatic TKAs with KSS pain scores (moderate, comes and goes, or worse or knee pain rated > 4 of 10 on VAS) returning for 1- to 5-year followup after primary TKA for OA during the same time period. The patients in Group B were consecutive TKAs identified to allow comparison between the incidence of early-grade OA in patients at our institution with patients referred for a second opinion for a painful total knee during the same time period. Groups C and D were identified to see if it was more common for patients with no pain after TKA (Group C) to have early-grade OA compared with patients who do have substantial pain after TKA at our institution (Group D). The mean age, body mass index, and sex distribution were not statistically significant among these groups, whereas the incidence of prior arthroscopy was different ($p = 0.006$) among groups (Table 3). Because there was a difference among groups for prior arthroscopy, Mann-Whitney tests were used for individual comparisons between groups, which showed differences between Groups A and D ($p < 0.001$) and near statistically significant differences between Groups A and C ($p = 0.056$) and between Groups C and D ($p = 0.058$) on rates of prior arthroscopy. Patients with symptomatic TKAs also had their postoperative radiographs and clinic notes reviewed to assure that there was no clinical or radiographic abnormality to account for the symptoms and that no surgical intervention had occurred or was being considered.

The preoperative weightbearing AP radiographs were obtained for all four groups of patients and were combined into a deidentified blinded pool. We were able to obtain preoperative radiographs in 38 of the 49 knees referred for evaluation in Group A (78%) and 100% of the cases in Groups B (n = 100), C (n = 80), and D (n = 80) from our own institution. The preoperative radiographs were reviewed by a blinded reviewer (GGP), and the grade of OA was rated according to the scale of Kellgren and Lawrence [21, 22] (Fig. 1). Severe arthritis was defined as Grade 4 (marked joint space narrowing, normally bone-on-bone).

We then compared the radiographic grades of OA across the different groups of cohorts. Early-grade arthritis was defined as Grade 1 or 2 (possible joint space narrowing). The incidence of early arthritis among the study group and the comparison groups was compared using the Kruskal-Wallis test. We followed this with post hoc individual comparisons between groups with sequential Mann-Whitney tests for nonparametric data.

Table 3. Characteristics of Group A with comparison Groups B, C, and D

Cohorts	Total number	Sex (male/female) p value* = 0.496	Age (mean; range; years) p value† = 0.517	Body mass index (mean; range; kg/m^2) p value† = 0.475	Prior arthroscopy (number; %) p value* = 0.006
Group A: referred patients‡	38	11/27	66.4 (40–86)	32.1 (22.7–49.2)	15 (39.5%)
Group B: consecutive series	100	42/58	63.7 (31–89)	32.5 (18.2–56.5)	26 (26.0%)
Group C: asymptomatic normal TKAs, 1- to 5-year followup	80	28/52	65.5 (37–89)	32.2 (18.0–50.6)	18 (22.5%)
Group D: symptomatic normal TKAs, 1- to 5-year followup	80	28/52	65.2 (33–89)	31.0 (19.4–51.2)	9 (11.3%)

* Kruskal-Wallis test; †one-way analysis of variance; ‡with no abnormalities identified clinically or radiographically.

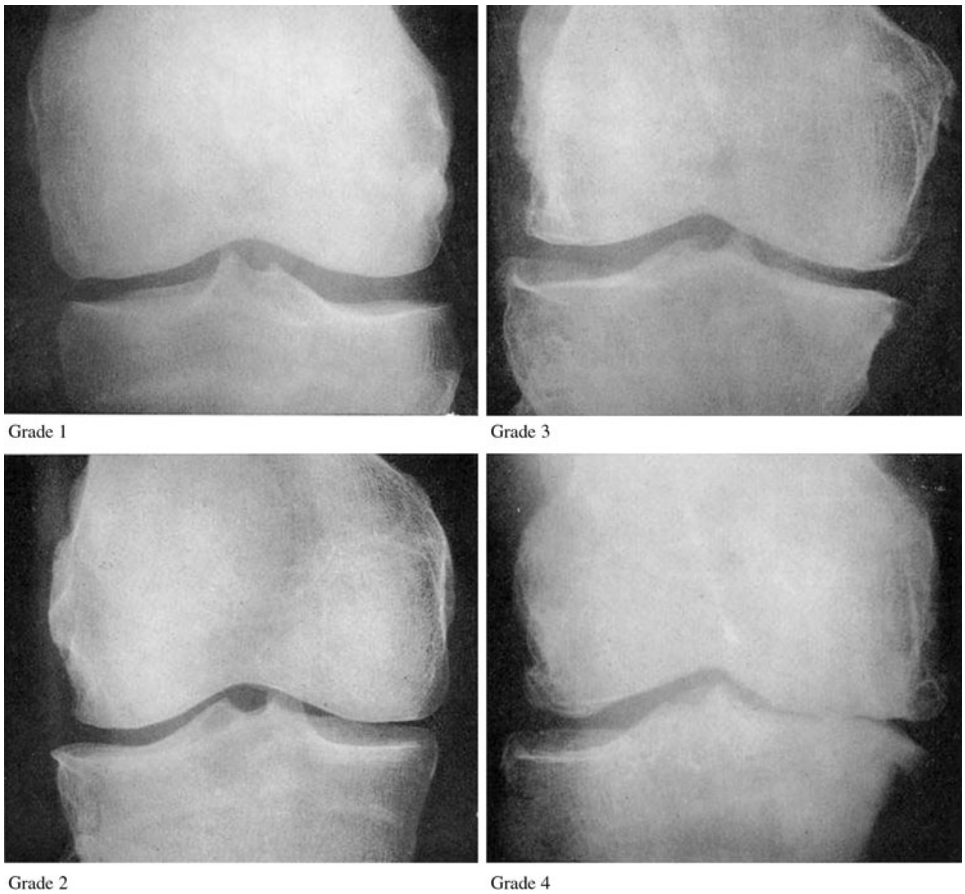

Fig. 1 The Kellgren and Lawrence grading system of knee osteoarthritis is shown. Grade 1 = doubtful narrowing of joint space and possible osteophytic lipping; Grade 2 = definite osteophytes and possible narrowing of joint space; Grade 3 = moderate multiple osteophytes, definite narrowing of joint space, and some sclerosis and possible deformity of bone ends; Grade 4 = large osteophytes, marked narrowing of joint space, severe sclerosis, and definite deformity of bone ends. Reprinted, with permission, from Kellgren JH. *Atlas of Standard Radiographs of Arthritis. The Epidemiology of Chronic Rheumatism.* Vol II. Oxford, UK: Blackwell Scientific Publications; 1963:10–11.

Results

When the blinded analysis of preoperative weightbearing AP radiographs using the Kellgren and Lawrence radiographic grades of OA were stratified into two groups including early-stage OA (Grades 1 and 2) and late-stage OA (Grades 3 and 4), the incidence of early-stage OA in the cohort of patients with painful TKAs with no discernable abnormality (Group A) was 50% with 19 of the 38 knees having either Grade 1 or 2 OA (Fig. 2; Table 4). Of the patients in the remaining comparison groups, only five knees (5%) in Group B had early-stage OA. Five knees (6%) in Group C and eight knees (10%) in Group D had early-stage OA. A comparison of early- and late-stage OA grades across all groups indicated a difference ($p < 0.001$, Kruskal-Wallis test). A stepwise analysis of OA grades between Group A and each of the control groups using sequential Mann-Whitney tests also indicated differences

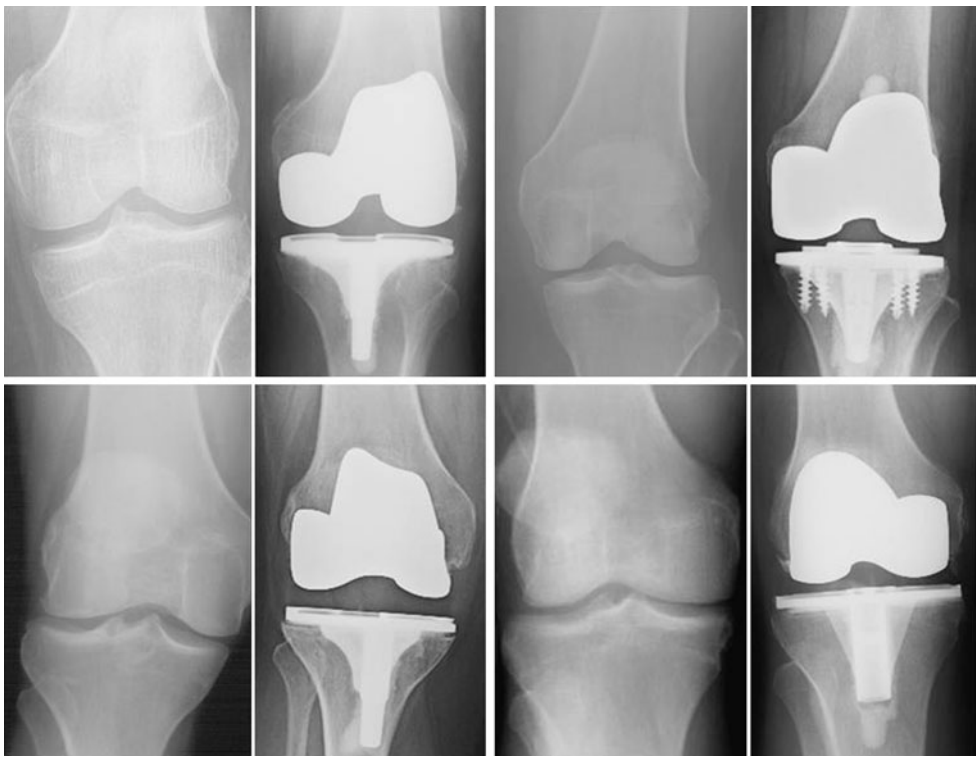

Fig. 2 The illustrations show preoperative AP weightbearing knee radiographs rated by a blinded reviewer as having minimal (Grade 1) arthritis with corresponding postoperative total knee radiographs of the symptomatic knee.

Table 4. Kellgren-Lawrence grades of preoperative OA for the study group (A) and the comparison groups (B, C, D) with differences among groups in OA grade significant at a level of $p < 0.001$ using the Kruskal-Wallis test

Patient cohort	K-L OA grade (1–4)	Number	Percent
A = painful TKA with no abnormality defined (n = 38)	1	7/38	18.4%
	2	12/38	31.6%
	3	11/38	29%
	4	8/38	21%
B = consecutive primary TKAs during the same year (n = 100)	1	2/100	2%
	2	3/100	3%
	3	31/100	31%
	4	64/100	64%
C = normal TKAs with no pain at followup (n = 80)	1	1/80	1.25%
	2	4/80	5%
	3	20/80	25%
	4	55/80	68.75%
D = normal TKAs with some pain at followup (n = 80)	1	2/80	2.5%
	2	6/80	7.5%
	3	30/80	37.5%
	4	42/80	52.5%

OA = osteoarthritis; K-L = Kellgren-Lawrence.

when each comparison was made ($p < 0.001$ for each). The incidence of early-stage OA for the pain-free registry TKAs (Group C) and painful registry knees (Group D) was also compared using Mann-Whitney, and the groups were similar ($p = 0.387$).

Discussion

Despite the widespread use of TKA for the treatment of end-stage knee disease, many patients have persistent pain and dissatisfaction after their surgery, which can be attributed to a variety of causes. We assessed the association between the objective rating of preoperative degree of OA and the occurrence of pain and dissatisfaction after TKA.

There are several limitations in the study. First, we only reviewed preoperative weightbearing AP radiographs and did not review lateral or sunrise view radiographs that allow for visualization of the patellofemoral joint. In many cases these additional radiographic views were not available in the primary study group, and so these were not considered in the analysis. It may be that in some of these patients, TKA was performed in the absence of substantial tibiofemoral arthrosis, whereas a sunrise radiograph may have uncovered more advanced patellofemoral disease for which TKA was determined to be an appropriate treatment. To help accommodate for this, we only analyzed the AP radiographs of the patients in the control group cohorts as well in an effort to be consistent. Isolated patellofemoral OA is relatively rare, however, compared with tibiofemoral

disease, and even if a few of such diagnoses were missed in our analysis, they would similarly have been missed in the radiographic analysis of our cohorts. Also, long radiographs of the hip-knee-ankle were not routinely obtained so assessment of alignment was based on standard standing radiographs that only included the knee. Second, because of the retrospective nature of this study, we are unaware of the total number of patients who underwent TKA with lower grades of preoperative radiographic OA who did well and had minimal pain after their surgery. We attempted to control for this by analyzing all patients who presented for routine postoperative TKA followup between 1 and 5 years after their surgery by analyzing the preoperative radiographs and stratifying them according to their postoperative pain levels at their followup visits.

We found a high incidence of early-grade OA (50%) in our cohort of patients who we evaluated for painful TKAs in which no identifiable source of pain could be determined, and this was strikingly different compared with the incidence of early-grade OA from our consecutive series of TKAs performed at our institution (Group B). We cannot fully explain the difference between OA grades between groups. The classic descriptions for indications for TKA in the orthopaedic literature have focused on the presence of major joint space narrowing on plain knee radiographs [5, 15, 23], which correlates with Kellgren and Lawrence Grade 3 and 4 OA [21, 22]. In their review of indications for TKA, Della Valle and Rosenberg [15] advise that "Radiographic confirmation of knee arthritis is important…" and further that "…absence of radiographic findings should alert the physician to an alternative diagnosis." A recent report suggests a 56% increase in the incidence of knee arthroscopy performed from 1997 to 2006 in patients older than 65 years [20], and it may be the case that the arthroscopic finding of articular chondrosis is being used more frequently as an indication for TKA by some surgeons rather than the presence of advanced knee arthrosis using plain radiographs. Our data suggest this may be the case, because prior arthroscopy was performed in a higher percentage of Group A patients (40%) than any other comparison group. Because this group of patients experienced substantial pain and dissatisfaction after TKA, prearthroplasty knee arthroscopy demonstrating more cartilage damage than weightbearing radiographs may not be a reliable predictor of successful TKA.

Our analysis of the painless registry TKAs (Group C) and painful registry TKAs (Group D) did not indicate a significant difference in early-grade OA between groups. That a difference does not exist between these groups does not disprove a relationship between TKA pain and early-grade preoperative OA. It suggests that for the 1 to 5 years preceding this study, our surgeons were using fairly conservative radiographic criteria to indicate patients with knee pain for TKA. We have not performed a comprehensive analysis of the physical and psychological factors that could have attributed to the persistent symptoms of the Group D patients, because it was not possible with this study design. Such factors have previously been described and include surgical factors such as component malrotation and patellar maltracking [3, 4]. Other patient factors such as female sex, higher body mass index, previous surgery, patients on disability, diabetes mellitus, pulmonary disease, and depression are deleterious to the outcome after TKA [17]. Lower preoperative WOMAC scores [18, 25], high preoperative narcotic use [19], and pessimistic explanatory style [35] have also all been linked to high levels of postoperative pain after TKA.

There was a striking difference in the incidence of early-grade OA in the Group A patients compared with the Group D patients. Although a strong correlation between the incidence of early-grade OA between these groups would strengthen the contention that early-grade OA may represent a risk factor for persistent pain and dissatisfaction after TKA, the finding of no difference between these groups can be partly explained by differences in surgical indications between these groups and the finding of higher rates of prearthroplasty arthroscopy in Group A patients further supports this point. Our findings suggest that early-grade OA should be added to the list of known risk factors for pain and dissatisfaction after TKA, an effect that has not been well studied to date. This relationship has been studied in the UKA population. Pandit et al. [29] described higher rates of postoperative pain and dissatisfaction requiring conversion to TKA in patients when UKA was performed in the absence of bone of bone OA. Niinimaki et al. [27] found an eight times higher reoperation rate when the medial tibiofemoral space was $> 40\%$ of the lateral space and suggested avoiding UKA if the medial joint space is greater than 40% of the lateral space, even with arthroscopic evidence of severe cartilage damage.

The results of this study indicate an alarmingly high percentage of patients referred to a university joint arthroplasty referral center for evaluation of unexplained pain after TKA had early-grade OA on preoperative weightbearing AP radiographs compared with other cohorts of patients undergoing TKA at that institution. This is certainly not the only risk factor for persistent pain after TKA because 50% of patients with pain of uncertain etiology did have advanced arthritis. Performing a TKA on early-grade arthritis is not only counter to most generally accepted indications [5, 15, 23], but based on these results, there is strong circumstantial evidence that these patients are at risk for pain and dissatisfaction after TKA, even when performed technically well. The incidence of this problem is not known, but given that 19 such patients were identified in a single surgeon's practice during 1 year and this represented 13% of symptomatic total knees referred for evaluation (19 of 142), it seems likely that this situation

is not rare. Given the higher rates of unexplained pain in the presence of minimal degenerative changes on preoperative radiographs, patients should be informed that they may be at higher risk for persistent pain and dissatisfaction after TKA in the absence of advanced degenerative arthritis.

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