

Establishing Realistic Patient Expectations Following Total Knee Arthroplasty

Adeel Husain, MD
Gwo-Chin Lee, MD

Abstract

Nearly 20% of patients are dissatisfied following well-performed total knee arthroplasty with good functional outcomes. Surgeons must understand the drivers of dissatisfaction to minimize the number of unhappy patients following surgery. Several studies have shown that unfulfilled expectations are a principal source of patient dissatisfaction. Patients contemplating total knee arthroplasty expect pain relief, improved walking ability, return to sports, and improvement in psychological well-being and social interactions. However, patients are typically overly optimistic with regard to expected outcomes following surgery. Patient expectations and satisfaction can be influenced by age, socioeconomic factors, sex, and race. The interplay of these factors can be complex and specific to each person. Published data on clinical and functional outcomes show that persistence of symptoms, such as pain, stiffness, and failure to return to preoperative levels of function, are common and normal. Therefore, the surgeon needs to help the patient to establish realistic expectations.

From the Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, PA.

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Total knee arthroplasty (TKA) has been shown to be a durable and reliable method of relieving pain and improving function in patients with end-stage knee arthritis.¹⁻³ Most patients report less pain and increased function following surgery; however, in one study, nearly 20% of patients who underwent TKA remained dissatisfied, and unmet expectations were one of the strongest predictors of dissatisfaction after TKA.⁴ Other studies have reported similar rates of patient dissatisfaction following primary TKA.⁵

Identification of the drivers of patient expectations and satisfaction following TKA is essential. A good result following TKA may not necessarily imply a pain-free or symptom-free knee, but may simply be a knee joint that meets a patient's preoperative

expectations.⁶ Thus, understanding what is important to each patient before TKA and appropriately managing his or her expectations may improve overall patient satisfaction. In today's healthcare environment, patient satisfaction is being recognized as a measure of healthcare quality that could have an effect on physician and hospital reimbursement.⁴ Patient factors, such as preoperative mental and general health status and residual postoperative limitations, can affect satisfaction. Here, we identify patient expectations prior to and following primary TKA and evaluate patient factors that affect satisfaction to aid surgeons in communicating to patients what can realistically be expected in terms of pain, range of motion, ambulation, and return to activities following TKA.

Patient Expectations of a Successful TKA

Before realistic expectations can be developed, surgeons need to understand what patients undergoing TKA expect and want from surgery. Bourne et al⁴ showed that the risk of patient dissatisfaction following TKA was approximately 10 times greater when patient expectations were unmet. Surgeons and patients consider pain relief and improved function to be universal goals of TKA; however, other less intuitive expectations can vary by diagnosis, socioeconomic factors, and preoperative mental health status.⁶⁻⁸ Mancuso et al⁶ developed and validated a survey to measure patients' expectations of knee surgery and found that expectations can be diverse. The authors surveyed 161 patients who underwent primary TKA and asked them open-ended questions about their expectations of knee surgery. Patients cited 1,161 expectations that were grouped into 52 categories. These categories were transformed into a specific questionnaire that was validated against a second sample of 163 patients. Pain relief, improved walking ability, and return to sport were among the most common patient expectations. Other expectations included improvement in psychological well-being, sexual activity, social interactions, and gainful employment. Other prospective TKA patients around the world share these expectations.⁹ In a prospective study of patient expectations of TKA, Yoo et al⁹ found that patient expectations correlated with sociodemographic and functional factors. The authors reported that pain relief was considered the most important expectation followed by psychological well-being, return to baseline activities, the ability to perform high flexion activities, and return to social activities.

Age, socioeconomic factors, the surgeon's previous surgical experience, sex, and race can influence patient expectations.^{6,10} Younger patients are more likely to expect improvement in sports performance, whereas older patients are more likely to expect improvement in pain relief and walking ability.⁶ Additional expectations in terms of improvement are more likely in patients who are employed and those with poorer Western Ontario and McMaster Universities (WOMAC) osteoarthritis index function scores (ie, pain, stiffness, function; odds ratio [OR] = 1.1 per five points) and a low Medical Outcomes Study 36-Item Short Form (SF-36) social score (ie, bodily pain and social function; OR = 0.9 per five points).^{6,9} Hepinstall et al¹⁰ found that patients who lived alone or had a prior history of joint arthroplasty had significantly lower expectations going into surgery, and male sex and Caucasian race were associated with higher expectations. The factors that contribute to a patient's expectations of TKA are complex.

Patient Factors That Affect Satisfaction

Several studies have examined the patient factors that affect satisfaction following TKA. In a prospective registry study of 8,050 primary, unilateral TKAs, Franklin et al¹¹ showed that functional outcome after TKA varied with patient factors, including knee diagnosis and preoperative physical function. Outcomes have also been shown to be affected by comorbidities, mental health status,¹² socioeconomic status, and ethnicity⁸ (Table 1). Thus, an understanding of how these physical and psychological factors affect pain and function following TKA is necessary to establish realistic patient expectations.

Appropriate patient selection is critical for maximizing clinical results. In a multivariate analysis of 264 patients who underwent TKA for knee osteoarthritis (OA), Merle-Vincent et al¹³ found that a body mass index (BMI) <27 kg/m² and radiographic evidence of significant narrowing of the joint space were important preoperative predictors of patient satisfaction. Another study reported increased rates of dissatisfaction among patients with mild to moderate arthritis treated with TKA.¹⁴ Schnurr et al¹⁵ reported that the risk of dissatisfaction in patients with OA classified as grade 3 or 2 on the Kellgren-Lawrence scale was approximately 2.5 and 3 times higher, respectively, than that of patients with grade 4 OA.

Patients undergoing TKA for mild to moderate knee arthritis may seek revision knee surgery for persistent symptoms and dissatisfaction. Polkowski et al¹⁴ evaluated 49 painful TKAs at 1 year postoperatively and found that, in nearly 50%, mild to moderate OA was present at the time of the index arthroplasty. TKA provides reliable and reproducible results in patients with end-stage knee arthrosis, and the indications for TKA, particularly in the younger population, continue to expand.

Preoperative pain, health status, and function can affect postoperative pain and function following primary TKA. In a prospective analysis of 215 patients treated with TKA, Noiseux et al¹⁶ found that patients with severe pain on a simple knee range-of-motion test were 10 times more likely to report persistent moderate to severe pain at 6 months postoperatively. In a series of 307 knees treated with TKA, Roth et al¹⁷ showed that a patient's SF-36 general health score was the most predictive patient factor for functional outcome. The authors also found that other factors, including sex, BMI, hypertension, narcotic use, and pulmonary disease, had a substantial effect on postoperative

function. Finally, in a series of 412 patients who underwent TKA, Lizaur-Utrilla et al¹⁸ showed that a high Charlson Comorbidity Index, worse preoperative Knee Society function scores, and low WOMAC pain scores (ORs = 2.1, 0.7, and 0.3, respectively) were independently more likely to be associated with either revision surgery or clinical failure, which was defined as a Knee Society score of <70 points.

Controversy exists on whether obesity is a contraindication to TKA. Several studies have reported increased risks of surgical complications in this patient population.^{19,20} In a meta-analysis, Kerkhoffs et al¹⁹ showed that, in patients with a BMI >30 kg/m², infection occurred 1.9 times more often than in patients with a healthy weight, and revision surgery performed for any reason increased 1.3 times. Complications and reoperations negatively affect patient satisfaction.^{4,20-22} Bourne et al⁴ reported that the risk of patient dissatisfaction increased 1.9 times in the setting of postoperative complications that require readmission. Type 2 diabetes mellitus, a comorbid condition in patients who are obese, has also been shown to lead to poorer functional outcomes. In a case-matched study of 734 patients who underwent TKA, Robertson et al²⁰ reported that, at 1 year postoperatively, patients with type 2 diabetes mellitus had decreased knee flexion and total range of motion and lower Knee Society scores. However, one study has shown that patients who are obese can benefit from TKA. Baker et al²¹ examined patient-reported outcome measures linked to the United Kingdom National Joint Registry and stratified these results based on BMI. The authors showed that the change in patient-reported outcomes was similar in patients regardless of BMI, but wound complications were significantly increased in patients with a BMI of 40 to 60 kg/m² compared

with those with a BMI <25 kg/m². Consequently, patients who are obese and contemplating TKA should be made aware of the potential risk for poorer functional outcomes and increased complications following TKA.

Psychological well-being can significantly affect postoperative satisfaction.^{5,7,23} Scott et al⁵ reported that a low SF-12 mental component score, depression, and pain in other joints was associated with dissatisfaction following TKA. Gandhi et al²³ reviewed a cohort of 1,720 patients undergoing TKA or total hip arthroplasty and reported that, when adjusted for all other variables, a lower preoperative SF-36 mental health score was found to be an independent predictor of patient dissatisfaction following TKA. The authors concluded that interventions to reduce psychological distress before surgery could improve subjective outcomes.

Some studies have found no link between depression and a negative effect on Knee Society scores and satisfaction following TKA. Pérez-Prieto et al⁷ found that the level of improvement from preoperative levels was similar in patients with or without depression, and more importantly, these authors found that depression did not affect overall satisfaction rates. Thus, the effect that depression has on patient satisfaction with TKA remains unknown. Development of psychometric tools to identify at-risk patients may allow for preoperative intervention, such as education and counseling, and help establish realistic patient expectations before TKA.

Socioeconomic status has also been shown to impact satisfaction. Barrack et al⁸ found that satisfaction correlated with socioeconomic (eg, income, education, employment) and demographic (eg, sex, ethnicity) factors. They found that patients with incomes <\$25,000 were more likely to be dissatisfied following TKA and

Table 1

Risk Factors for Patient Dissatisfaction Following Primary Total Knee Arthroplasty

Patient Characteristics

- Mild to moderate arthritis
- Severe pain with simple range of motion
- Desire to return to high-impact activities
- Narcotic use

Preoperative Function

- Low SF-36 General Health Score
- Low Knee Society function score
- Low WOMAC pain score
- Low Oxford Knee Score
- High Charlson Comorbidity Index

Comorbidities

- Obesity
- Diabetes mellitus
- Pulmonary disease
- Back pain

Mental Health

- Low SF-12 mental score
- Coexisting mental condition
- Depression

SF = short form, WOMAC = Western Ontario and McMaster Universities

have more functional limitations. Compared with men, women were found to be less likely to be satisfied and more likely to have functional limitations. Finally, minority patients had more functional limitations than nonminority patients following TKA. In a cohort of Scottish patients, Clement et al²⁴ found that the most socially “deprived” patients (based on the Scottish Index of Multiple Deprivation) underwent surgery at a younger age and were more likely to be female, have more comorbidities, and have poor mental health. Although the authors did not establish a direct link between low income and patient dissatisfaction, they found that lower Oxford knee and SF-12 mental component scores, back pain, and the presence of four or more comorbidities were associated with lower rates

Table 2
Reported WOMAC Scores Following Primary Total Knee Arthroplasty

WOMAC Outcome Scores	Time
Reduction in Pain Score (%)	
50–60	3–6 mo ^{22,27}
40–70	12 mo ^{2,25}
65–75	24 mo ^{25,26}
Improvement in Functional Score (%)	
40–60	6–12 mo ²⁵
55–65	24 mo ^{25,26}
Improvement in Stiffness Score (%)	
40–60	12 mo ²⁵

of satisfaction. Consequently, patient factors such as mental health, general health status, and socioeconomic factors can affect overall satisfaction (Table 1). The interplay between these factors can be unique to each patient and illustrates the complexity of the drivers of satisfaction following TKA.

Physical Function and Limitations Following TKA

Primary TKA is one of the most effective surgical procedures in medicine and is associated with significant reduction in pain, proven health utility, and improvement in quality-adjusted life years.¹ However, residual pain, functional deficits, and other unmet expectations are among the main reasons for patient dissatisfaction. Therefore, surgeons need to be familiar with realistic, achievable levels of pain relief and function to aid patients in establishing realistic expectations before TKA.

Although most patients achieve significant pain relief after TKA, the process is gradual, variable, and often incomplete.^{22,25} In a study of 112 patients with osteoarthritis who were surveyed about their expected outcomes after knee surgery, Mannion et al²⁶ reported that 85% of patients expected to be pain free following TKA, but only 43% of patients re-

ported no pain at final follow-up. In a study of 116 patients treated with TKA, Brander et al²² reported that 18% and 13% of patients reported significant postoperative knee pain at 6 and 12 months, respectively. A similar trend of decreasing knee pain (based on WOMAC pain scores) at different time points was reported in other studies^{2,25-27} (Table 2). Although many patients initially report good or excellent results following TKA, many later admit to continued, albeit improved, pain. Therefore, prospective TKA patients should be counseled that, although improved levels of pain can be expected following surgery, the extent of pain relief can be gradual and sometimes inconsistent.

Residual pain, stiffness, prosthetic noises, and difficulty with stairs commonly persist for up to 24 months following TKA.^{2,22,25} In a multicenter study, Parvizi et al²⁸ surveyed 661 TKA patients younger than 60 years and found that nearly one third reported residual symptoms and functional limitations after TKA. These symptoms included pain (33%), stiffness (41%), swelling (33%), grinding or other noises (33%), and difficulty with stairs (54%). Patients may also experience common symptoms, such as prosthetic noise, numbness or decreased sensitivity around the surgical site, and feelings

that the replaced knee is not normal. Sharkey and Miller²⁹ surveyed 49 patients who underwent TKA and reported that 69% and 71% of patients reported noise and numbness, respectively. If patients are unprepared, these common and unavoidable consequences of surgery and the inability of current TKA designs to reproduce normal knee kinematics can become a source of patient disappointment and dissatisfaction.

Improvement in function and return to activities can be unpredictable following TKA.²⁵ Although most patients can achieve better function following TKA, studies have shown that they rarely approach prearthritic functional levels and those of age-matched control subjects.²⁷ In the study by Parvizi et al,²⁸ only 66% of patients reported that their knees felt normal after TKA. However, Hawker et al² reported that most of the surveyed Medicare patients had less pain, improved walking ability, required less medication, and >50% had little or no difficulty performing any of the 17 activities assessed with the WOMAC osteoarthritis index at 2 to 7 years after TKA. Most series report gradual improvement in function over time in most patients (up to 90%).^{2,28} Using the WOMAC function scores as a reference, patients can expect improvement in functional scores from a mean of 45 points preoperatively to a mean of 70 points at 12 months postoperatively.²⁵ Thus, although TKA can improve overall function in most patients, a significant number of patients can fail to achieve levels of desired function.

Quadriceps function may be limited for up to 2 years in patients recovering from TKA. It is common for patients recovering from TKA to struggle with activities such as stairs, kneeling, and squatting.^{2,27,30,31} Even walking ability, which is important to patients, can remain limited. Ouellet and Moffet³²

compared healthy patients with those who underwent TKA and found that the TKA group had difficulty with a Timed Up and Go test, covered less distance during a 6-minute walk test, walked at a slower pace, and took longer to negotiate stairs at all intervals ranging from 2 months to 5 years following surgery. Additionally, Rossi et al³⁰ showed that tasks, such as going up and down stairs, heavy domestic duties (eg, vacuuming, cleaning), and getting in and out of the bath, remained challenging to patients after knee surgery. Several studies have reported that >50% of patients with well-functioning TKA continue to have difficulty with stairs, kneeling, and squatting for >1 year following surgery.^{28,30,33}

Return to sports is another functional goal that is highly valued by patients undergoing TKA.^{31,34} Patients with knee arthritis want to return to a wide variety of sports including golf, dancing, swimming, skiing, and tennis.^{31,34} In a study of 101 patients' expectations of TKA, Meneghini et al³⁵ reported that 19% of patients underwent the procedure primarily to return to sport-related activities. Although return to low-impact activities is feasible and recommended following TKA, return to preoperative levels of sporting activities cannot be guaranteed. In a study of TKA outcomes, Dahm et al³⁶ surveyed 1,206 patients regarding their participation in 40 different athletic activities. The authors reported that the mean University of California Los Angeles activity level score was 7.1 points at an average of 5.7 years after surgery. This reflects regular participation in activities such as bicycling but not activities more strenuous than golf or bowling. The authors also found that men younger than 70 years had higher University of California Los Angeles scores, Knee Society scores, and self-assessment of activity than did peers. Jones et al³³

Table 3**Persistent Symptoms and Functional Deficits Following Total Knee Arthroplasty**

Symptom/Functional Deficit	Time (mo)	Prevalence (%)
Noise or clicking from the prosthesis ²⁹	NR	≤76
Numbness after TKA ²⁹	NR	≤68
Return to preoperative sport participation ³⁴	60	25–35
Difficulties with kneeling and squatting ^{28,30,33}	>12	30–50
Difficulties negotiating stairs ^{27,28,30}	2–60	60–80
Stairs requiring use of handrails ²	24	55–75
Slower walking speed ³²	2–12	50–67 of normal
Bicycling ^{33,36}	12	24–45
Golf ^{33,36}	12	4–20
Walking for exercise ^{33,36}	12	59–64

NR = not reported

compared the differences between actual and expected return to leisure activities following TKA and found that patients underperformed their expected activity level by an equivalent of walking 14 miles less per week. Other studies have also shown that patients either choose not to return to desired sporting activities or showed an overall decline in participation after TKA because of residual pain.³⁴ Consequently, evidence-based counseling of patients before TKA can help them to establish realistic expectations and minimize disappointment postoperatively. Commonly reported limitations following TKA are outlined in Table 3.

Management of Patient Expectations

In today's competitive healthcare environment, patients contemplating TKA are bombarded with images and perceptions of rapid recovery, return to normal life, and high levels of function following TKA. This undoubtedly fuels unrealistic expectations that can contribute to patient dissatisfaction. However, data show that appropriate management of patient expectations can

positively influence patient satisfaction.^{31,37} In a literature review, Culliton et al³⁸ found that fulfillment of postoperative expectations did predict patient satisfaction, but the nature of the preoperative expectation (eg, amount of pain relief and functional improvement at 1 year) did not predict satisfaction. In a study of 102 patients' preoperative expectations of TKA and postoperative satisfaction, Nilsdotter et al³⁷ found that although 80% of patients were satisfied with their eventual functional recovery, 93% were satisfied with the surgery at 5 years postoperatively. This suggests that patients with less than complete pain relief and function following TKA can be satisfied if expectations are appropriately managed. Therefore, patients should be counseled that residual symptoms, such as mild pain, swelling, and stiffness, are likely despite the reliability and reproducibility of TKA for relieving pain and improving function in patients with knee arthritis. Additionally, the recovery process can take up to 2 years, and the surgical knee is not likely to feel or function like the natural knee. These discussions must occur as part of the informed consent procedure before surgery.

Surgeons must define and challenge the drivers of what qualifies as a successful TKA. Traditional measures of a successful TKA, such as Knee Society scores and implant survivorship, are poorly correlated with patient ratings of health status, particularly in subjective domains, including pain, function, and quality of life.³ As a result, there has been a recent shift in focus to patient-reported outcome measures.³ The Knee Society recently introduced a new scoring system that takes into account patient satisfaction and specific physical activities to help more accurately quantify the successes and failures of modern TKA.³⁹ Finally, surgeons' traditional goals of surgery, such as alignment, ligament balance, component rotation, and patellar tracking, often have been related to implant survivorship rather than patient satisfaction.⁴⁰ Lee and Lotke⁴⁰ showed that a surgeon's intraoperative impression of the quality of a TKA did not correlate with postoperative Knee Society scores. Thus, the optimal individual alignment, laxity, and ligament balance of today's TKA designs are yet to be determined.

Summary

Although TKA has been shown to be durable, reliable, and reproducible in relieving pain and improving function in patients with end-stage arthritis of the knee, nearly 20% of patients remain dissatisfied following surgery. Although the drivers of patient satisfaction are complex and multifactorial, unmet expectations have been shown to be a significant source of dissatisfaction. However, common causes of dissatisfaction, such as residual pain, stiffness, and failure to return to high levels of function, can be expected following normal and well-performed TKAs. Therefore, careful patient selection, identification of patients at risk for dissatisfaction,

and the establishment of realistic patient expectations can minimize disappointment following TKA.

References

Evidence-based Medicine: Levels of evidence are described in the table of contents. In this article, references 5-7, 9, 10, 12, 13, 18, 33, and 37 are level I studies. References 1-4, 11, 15-17, 19, 21-27, 34, 39, and 40 are level II studies. References 8, 14, 20, 28-30, 35, 36, and 38 are level III studies. References 31 and 32 are level IV studies.

References printed in **bold type** are those published within the past 5 years.

- Carr AJ, Robertsson O, Graves S, et al: Knee replacement. *Lancet* 2012;379(9823):1331-1340.
- Hawker G, Wright J, Coyte P, et al: Health-related quality of life after knee replacement. *J Bone Joint Surg Am* 1998;80(2):163-173.
- Matsuda S, Kawahara S, Okazaki K, Tashiro Y, Iwamoto Y: Postoperative alignment and ROM affect patient satisfaction after TKA. *Clin Orthop Relat Res* 2013;471(1):127-133.
- Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD: Patient satisfaction after total knee arthroplasty: Who is satisfied and who is not? *Clin Orthop Relat Res* 2010;468(1):57-63.
- Scott CE, Howie CR, MacDonald D, Biant LC: Predicting dissatisfaction following total knee replacement: A prospective study of 1217 patients. *J Bone Joint Surg Br* 2010;92(9):1253-1258.
- Mancuso CA, Sculco TP, Wickiewicz TL, et al: Patients' expectations of knee surgery. *J Bone Joint Surg Am* 2001;83(7):1005-1012.
- Pérez-Prieto D, Gil-González S, Pelfort X, Leal-Blanquet J, Puig-Verdié L, Hinarejos P: Influence of depression on total knee arthroplasty outcomes. *J Arthroplasty* 2014;29(1):44-47.
- Barrack RL, Ruh EL, Chen J, et al: Impact of socioeconomic factors on outcome of total knee arthroplasty. *Clin Orthop Relat Res* 2014;472(1):86-97.
- Yoo JH, Chang CB, Kang YG, Kim SJ, Seong SC, Kim TK: Patient expectations of total knee replacement and their association with sociodemographic factors and functional status. *J Bone Joint Surg Br* 2011;93(3):337-344.
- Hepinstall MS, Rutledge JR, Bornstein LJ, Mazumdar M, Westrich GH: Factors that impact expectations before total knee arthroplasty. *J Arthroplasty* 2011;26(6):870-876.
- Franklin PD, Li W, Ayers DC: The Chitranjan Ranawat Award: Functional outcome after total knee replacement varies with patient attributes. *Clin Orthop Relat Res* 2008;466(11):2597-2604.
- Ayers DC, Franklin PD, Ploutz-Snyder R, Boisvert CB: Total knee replacement outcome and coexisting physical and emotional illness. *Clin Orthop Relat Res* 2005;440:157-161.
- Merle-Vincent F, Couris CM, Schott AM, et al: Osteoarthritis Section of the French Society for Rheumatology: Factors predicting patient satisfaction 2 years after total knee arthroplasty for osteoarthritis. *Joint Bone Spine* 2011;78(4):383-386.
- Polkowski GG II, Ruh EL, Barrack TN, Nunley RM, Barrack RL: Is pain and dissatisfaction after TKA related to early-grade preoperative osteoarthritis? *Clin Orthop Relat Res* 2013;471(1):162-168.
- Schnurr C, Jarrous M, Güdden I, Eysel P, König DP: Pre-operative arthritis severity as a predictor for total knee arthroplasty patients' satisfaction. *Int Orthop* 2013;37(7):1257-1261.
- Noiseux NO, Callaghan JJ, Clark CR, Zimmerman MB, Sluka KA, Raket BA: Preoperative predictors of pain following total knee arthroplasty. *J Arthroplasty* 2014;29(7):1383-1387.
- Roth JS, Buehler KC, Shen J, Naughton M: Patient factors predict functional outcomes after cruciate retaining TKA: A 2-year follow-up analysis. *J Arthroplasty* 2013;28(8):1321-1326.
- Lizaur-Utrilla A, Gonzalez-Parreño S, Miralles-Muñoz FA, Lopez-Prats FA, Gil-Guillen V: Patient-related predictors of treatment failure after primary total knee arthroplasty for osteoarthritis. *J Arthroplasty* 2014;29(11):2095-2099.
- Kerkhoffs GM, Servien E, Dunn W, Dahm D, Bramer JA, Haverkamp D: The influence of obesity on the complication rate and outcome of total knee arthroplasty: A meta-analysis and systematic literature review. *J Bone Joint Surg Am* 2012;94(20):1839-1844.
- Robertson F, Geddes J, Ridley D, McLeod G, Cheng K: Patients with Type 2 diabetes mellitus have a worse functional outcome post knee arthroplasty: A matched cohort study. *Knee* 2012;19(4):286-289.
- Baker P, Petheram T, Jameson S, Reed M, Gregg P, Deehan D: The association between body mass index and the outcomes of total knee arthroplasty. *J Bone Joint Surg Am* 2012;94(16):1501-1508.

22. Brander VA, Stulberg SD, Adams AD, et al: Predicting total knee replacement pain: A prospective, observational study. *Clin Orthop Relat Res* 2003;416:27-36.
23. Gandhi R, Davey JR, Mahomed NN: Predicting patient dissatisfaction following joint replacement surgery. *J Rheumatol* 2008;35(12):2415-2418.
24. Clement ND, Jenkins PJ, MacDonald D, et al: Socioeconomic status affects the Oxford knee score and short-form 12 score following total knee replacement. *Bone Joint J* 2013;95(1):52-58.
25. Lingard EA, Sledge CB, Learmonth ID; Kinemax Outcomes Group: Patient expectations regarding total knee arthroplasty: Differences among the United States, United Kingdom, and Australia. *J Bone Joint Surg Am* 2006;88(6):1201-1207.
26. Mannion AF, Kämpfen S, Munzinger U, Kramers-de Quervain I: The role of patient expectations in predicting outcome after total knee arthroplasty. *Arthritis Res Ther* 2009;11(5):R139.
27. Jones CA, Voaklander DC, Suarez-Alma ME: Determinants of function after total knee arthroplasty. *Phys Ther* 2003;83(8):696-706.
28. Parvizi J, Nunley RM, Berend KR, et al: High level of residual symptoms in young patients after total knee arthroplasty. *Clin Orthop Relat Res* 2014;472(1):133-137.
29. Sharkey PF, Miller AJ: Noise, numbness, and kneeling difficulties after total knee arthroplasty: Is the outcome affected? *J Arthroplasty* 2011;26(8):1427-1431.
30. Rossi MD, Hasson S, Kohia M, Pineda E, Bryan W: Mobility and perceived function after total knee arthroplasty. *J Arthroplasty* 2006;21(1):6-12.
31. Weiss JM, Noble PC, Conditt MA, et al: What functional activities are important to patients with knee replacements? *Clin Orthop Relat Res* 2002;404:172-188.
32. Ouellet D, Moffet H: Locomotor deficits before and two months after knee arthroplasty. *Arthritis Rheum* 2002;47(5):484-493.
33. Jones DL, Bhanegaonkar AJ, Billings AA, et al: Differences between actual and expected leisure activities after total knee arthroplasty for osteoarthritis. *J Arthroplasty* 2012;27(7):1289-1296.
34. Huch K, Müller KA, Stürmer T, Brenner H, Puhl W, Günther KP: Sports activities 5 years after total knee or hip arthroplasty: The Ulm Osteoarthritis Study. *Ann Rheum Dis* 2005;64(12):1715-1720.
35. Meneghini RM, Russo GS, Lieberman JR: Modern perceptions and expectations regarding total knee arthroplasty. *J Knee Surg* 2014;27(2):93-97.
36. Dahm DL, Barnes SA, Harrington JR, Sayeed SA, Berry DJ: Patient-reported activity level after total knee arthroplasty. *J Arthroplasty* 2008;23(3):401-407.
37. Nilsson AK, Toksvig-Larsen S, Roos EM: Knee arthroplasty: Are patients' expectations fulfilled? A prospective study of pain and function in 102 patients with 5-year follow-up. *Acta Orthop* 2009;80(1):55-61.
38. Culliton SE, Bryant DM, Overend TJ, MacDonald SJ, Chesworth BM: The relationship between expectations and satisfaction in patients undergoing primary total knee arthroplasty. *J Arthroplasty* 2012;27(3):490-492.
39. Noble PC, Scuderi GR, Brekke AC, et al: Development of a new Knee Society scoring system. *Clin Orthop Relat Res* 2012;470(1):20-32.
40. Lee GC, Lotke PA: Can surgeons predict what makes a good TKA? Intraoperative surgeon impression of TKA quality does not correlate with Knee Society scores. *Clin Orthop Relat Res* 2012;470(1):159-165.