Predicting dissatisfaction following total knee replacement

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A PROSPECTIVE STUDY OF 1217 PATIENTS

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Up to 20% of patients are not satisfied with the outcome following total knee replacement (TKR). This study investigated the pre- and post-operative predictors of dissatisfaction in a large cohort of patients undergoing TKR. We assessed 1217 consecutive patients between 2006 and 2008 both before operation and six months after, using the Short-form (SF)-12 health questionnaire and the Oxford Knee Score. Detailed information concerning comorbidity was also gathered. Satisfaction was measured at one year when 18.6% (226 of 1217) of patients were unsure or dissatisfied with their replacement and 81.4% (911 of 1217) were satisfied or very satisfied. Multivariate regression analysis was performed to identify independent predictors of dissatisfaction. Significant ($p < 0.001$) predictors at one year included the pre-operative SF-12 mental component score, depression and pain in other joints, the six-month SF-12 score and poorer improvement in the pain element of the Oxford Knee Score.

Patient expectations were highly correlated with satisfaction. Satisfaction following TKR is multifactorial. Managing the expectations and mental health of the patients may reduce dissatisfaction. However, the most significant predictor of dissatisfaction is a painful total knee replacement.

Total knee replacement (TKR) has proved a successful and cost-effective treatment for improving pain and function in patients with arthritis.[1,2] The incidence of serious complications is low, with national joint registries demonstrating a revision rate of 3.7% at five years in England and Wales[3] and 6.86% over 16 years in Scotland.[4] However, up to 20% of patients are not satisfied with their outcome.[2,5-8]

There are a number of validated scores for measuring outcome following TKR. These focus on pain, function, recreational activity and knee-related quality of life. Some have different contributions from both patient and surgeon. It is now recognised that the rating of success of the patient and the surgeon differ, and there is poor correlation between the two.[9] Functional outcome scores do not necessarily correlate with patient satisfaction.[10] Patient-reported pain and function scores (PROMs) and measures of patient satisfaction are becoming more widely used as measures of success. In 2008 the United Kingdom Department of Health published the Darzi report[11] highlighting the quality of healthcare provision. The United Kingdom government and the National Joint Registry have adopted the Oxford Knee Score (OKS)[12] as a validated PROM to assess outcome.[13]

Previous studies have shown satisfaction rates of 80% to 89% following TKR.[2,5-8] A number of variables have been implicated in dissatisfaction, including female gender,[2,14] younger age,[2] older age,[6,15] rheumatoid arthritis,[2,10] worse pre-operative pain[16] and recently, a pessimistic personality trait.[17] Patient expectations[6,18] and mental health scores,[7,19,20] have been correlated with satisfaction, as have post-operative pain and function,[2,6,18] but few of these effects have been reproduced with any consistency.[13] Sample sizes have been small, or data have been collected retrospectively. However, patient expectation, pain relief and the functional outcome appear the most significant predictors of satisfaction in the literature.

The biomechanics of the knee are not replicated by contemporary knee replacements. The functional limitations of knee replacements, especially as regards to squatting, kneeling and twisting, may be attributable to this, and result in dissatisfaction in high-demand individuals.[8,21,22] This is known as the impairment hypothesis.[22]

Little is known about the predictors of dissatisfaction in TKR in relation to PROMs of pre- and post-operative pain and function and

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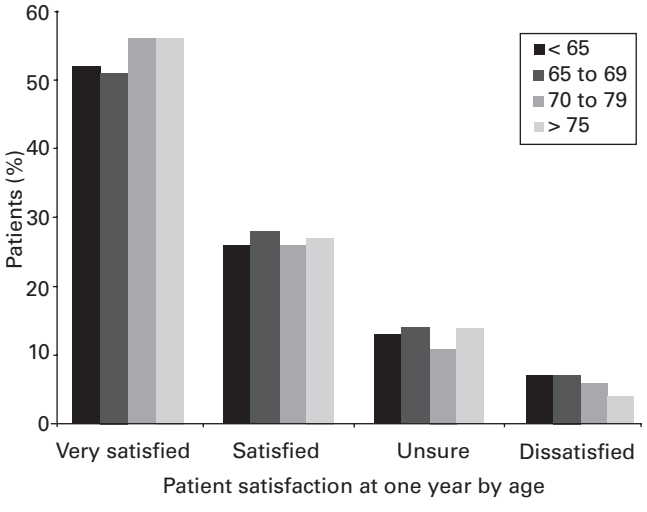

Fig. 1

Bar chart showing patient satisfaction by age group.

patient comorbidity. The aim of this study was to investigate these parameters in a large cohort of patients undergoing TKR.

Patients and Methods

Ethical approval was obtained for this study. From 2006 to 2008, 1290 consecutive TKRs were performed at our institution. All were performed or supervised by 13 consultant surgeons. Three different cruciate-retaining implants were used according to surgeon preference: the PFC Sigma (DePuy, Johnson & Johnson Professional Inc, Raynham, Massachusetts), the Kinemax (Stryker Howmedica Osteonics, Allendale, New Jersey) and the Triathlon (Stryker). The patella was not routinely resurfaced. All patients followed a standardised post-operative programme of rehabilitation. All data were collected prospectively.

Before operation, a postal questionnaire was sent to all patients. This included the Short-form (SF)-12 health questionnaire,[23] the OKS, and questions related to comorbidities. Specifically, patients were asked if they suffered from heart disease, high blood pressure, lung disease, vascular disease, neurological problems, diabetes, stomach ulcer, kidney disease, liver disease, anaemia, depression, back pain or pain in other joints. Completed questionnaires were collected at a nurse-led pre-assessment clinic.

Post-operatively, questionnaires were sent out at six and 12 months. At six months, the SF-12 and OKS were collected. At 12 months, in addition to these scores, the questionnaires included measures of satisfaction. Specifically, patients were asked, 'How satisfied are you with your operated knee?' with tick box answers for 'very satisfied', 'satisfied', 'unsure' or 'dissatisfied'. They were also asked how well the surgery had relieved pain in the affected joint; how it had increased their ability to perform regular activities; how it enabled the performance of heavy work/sporting activity and lastly, how it met their expectations. These questions were graded from excellent to poor, with six possible options. Their overall hospital experience was graded from excellent to poor in the same fashion. These questionnaires were collected at routine follow-up by specialist nurse practitioners. Any patients who did not bring completed questionnaires to the clinic were asked to complete one while waiting to be seen. All questionnaires were completed in the absence of medical and nursing staff. Collection of data was independent of the routine clinical care of the patient.

Data including age, gender, the responsible consultant, the type of implant, the date of operation, length of stay, comorbidities, the SF-12 score and the OKS before operation and after six and 12 months and the 12-month satisfaction scores were collected. The SF-12 score was separated into physical and mental component scores.

The OKS is a reliable and validated outcome measure with 12 questions, each with five possible answers, giving a score out of 60.[12] It is designed to minimise the influence of comorbidity. Five questions relate to pain, and seven to function. The range of possible scores was therefore 5 to 25 for pain, and 5 to 35 for function with lower scores reflecting better outcomes. In addition to the absolute Oxford scores, we divided scores into pain and function components, in a similar manner to Baker et al.[2] The six-month SF-12 and OKS scores were used as they were predictive of satisfaction, as opposed to the 12-month scores, which were assessed at the same time as satisfaction scores. We also evaluated improvements in individual scores.

Statistical analysis. Analysis was performed using SPSS version 17.0. Univariate analysis was carried out using Spearman's rank correlation for quantitative factors and the chi-squared test for categorised factors. In order to identify independent predictors of satisfaction and correct for compounding factors, multiple ordinal logistic regression was used. This was done in stages using only factors that were significant on their own. A p-value of < 0.05 was considered to be statistically significant.

Results

A total of 1290 consecutive primary TKRs were performed in 1213 patients. All were recruited to the study. At one year, satisfaction data were collected for 1141 patients (94%) who had undergone 1217 TKRs. These patients formed the study group. Their mean age was 70.1 years (35 to 92) and there were 698 women and 515 men.

In total 666 (54.7%) patients were very satisfied, 325 (26.7%) were satisfied, 158 (13%) were unsure and 68 (5.6%) were dissatisfied. We grouped these into two groups, giving 991 (81.4%) satisfied patients and 226 (18.6%) dissatisfied. Age ($p = 0.44$), gender ($p = 0.73$) and responsible surgeon ($p = 0.53$) did not influence satisfaction (Fig. 1).

Implant data were available for 1076 of 1141 knees (94%): 305 were PFC Sigma, 287 Kinemax and 484 were

Table I. Univariate analysis of pre-operative factors in relation to patient satisfaction at one year; n = 1217. Figures shown are mean (SD) or number (%)

Factors*	Satisfied (n = 991)	Dissatisfied (n = 226)	p-value
Age in yrs (SD)	70 (9)	69 (9)	0.44
Male gender (%)	418 (*42*)	97 (*43*)	0.73
SF-12			
PCS (SD)	29.6 (7.6)	28.9 (6.4)	0.28
MCS (SD)	51.3 (10.9)	46.4 (11.7)	< 0.001
OKS			
Pain (SD)	18.0 (3.2)	18.9 (3.0)	< 0.001
Function (SD)	23.2 (4.9)	24.8 (4.4)	< 0.001
Comorbidities (SD)			
Heart disease	156 (16)	38 (17)	0.50
Hypertension	426 (43)	113 (50)	0.051
Lung disease	102 (10)	27 (12)	0.90
Vascular disease	40 (4)	14 (6)	0.18
Neurological problems	44 (4)	16 (7)	0.033
Diabetes	102 (10)	32 (14)	0.29
Stomach ulcer	42 (4)	17 (8)	0.10
Kidney disease	19 (2)	8 (4)	0.014
Liver disease	10 (1)	8 (4)	0.012
Anaemia	71 (7)	10 (4)	0.69
Depression	82 (8)	45 (20)	< 0.001
Back pain	342 (34)	105 (47)	< 0.001
Pain in other joints	571 (58)	167 (74)	< 0.001
Number of comorbidities	1.1 (1.3)	1.4 (1.7)	0.001

* SF-12, short-form 12 questionnaire; PCS, physical component score; MCS, mental component score; OKS, Oxford Knee Score

Table II. Univariate analysis of six-month outcomes in relation to satisfaction at one year

Factor*	Satisfied	Dissatisfied	p-value
Length of stay (SD)	6.3 (4.0)	7.3 (6.6)	0.003
SF-12			
PCS (SD)	40.5 (10.0)	32.0 (7.1)	< 0.001
MCS (SD)	53.2 (9.4)	44.4 (12.3)	< 0.001
Six-month OKS			
Pain (SD)	10.3 (4.1)	15.9 (4.0)	< 0.001
Function (SD)	14.9 (5.1)	21.7 (5.5)	< 0.001
OKS improvements (SD)			
Pain	7.6 (4.2)	3.0 (3.7)	< 0.001
Function	8.3 (5.2)	3.6 95.1)	< 0.001

* SF-12, short-form 12 questionnaire; PCS, physical component score; MCS, mental component score; OKS, Oxford Knee Score

Triathlon knee replacements. There was no significant difference in satisfaction between implants using a Kruskal-Wallis test of non-parametric variables ($p = 0.33$).

Pre-operative factors, the six-month SF-12 score and the OKS were examined to assess their influence on satisfaction, initially using univariate analysis (Tables I and II).

Low projective SF-12 and OKS scores, depression, back pain and pain in other joints were found to be highly significant predictors of dissatisfaction ($p < 0.001$). The total number of comorbidities excluding back pain and pain in other joints was also significant ($p = 0.001$). Both satisfied and dissatisfied patients had significant improvements in the SF-12 score and the OKS at six months, although this was significantly greater in satisfied patients ($p < 0.001$). Length of hospital stay, as a measure of complications, was of borderline significance ($p = 0.003$).

Fig. 2

Bar chart showing satisfaction in patients with depression.

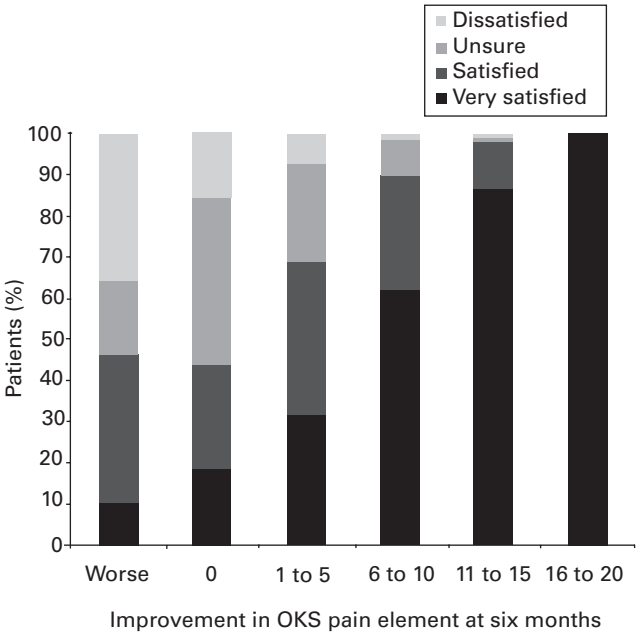

Fig. 3a

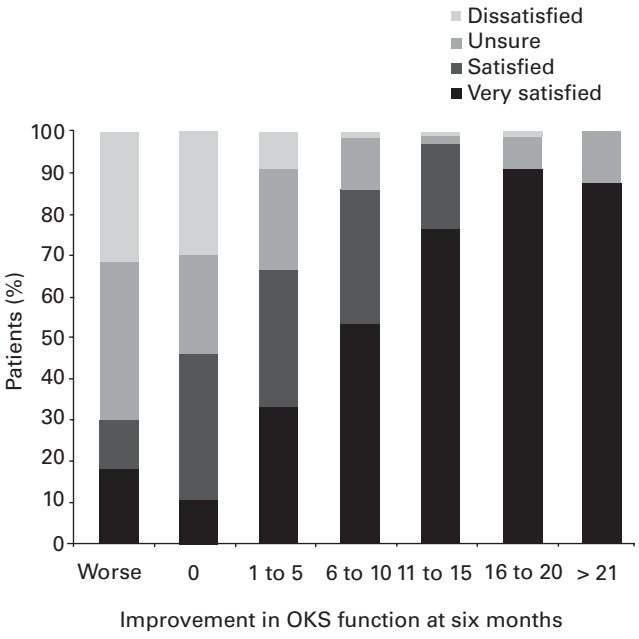

Fig. 3b

Bar chart showing patient satisfaction related to a) improvement between pre-operative and six-months Oxford knee score (OKS) pain element and b) improvement between pre-operative and six-months OKS function element.

After adjusting for other factors, depression, a low SF-12 mental component score and pain in other joints were the only pre-operative factors that remained significant predictors of dissatisfaction ($p < 0.001$). The pre-operative OKS for function was borderline ($p = 0.014$). Of patients known to suffer from depression pre-operatively, 42 of 127 (33%) were very satisfied, 40 (31%) satisfied, 28 (22%) unsure and 17 (13%) dissatisfied (Fig. 2).

Multivariate analysis of both pre-operative and six-month factors showed that both SF-12 elements and improvement in the OKS pain element were independently significant ($p < 0.001$) in predicting satisfaction at one year (Fig. 3a). None of the other pre-operative indices were significant when adjusted for these three significant factors. Improvement in the OKS for function did not add significantly to this (Fig. 3b). The responses to the additional satisfaction questionnaire were correlated with overall patient satisfaction using Pearson's correlation (Table III). Satisfaction correlated most accurately with pain relief, followed by expectation and then functional ability. High-demand functional ability had poor correlation with satisfaction, but this may reflect the older age of most patients.

Of the 76 patients who had staged bilateral TKRs, six (7.9%) were unsure about both knees, two (2.6%) were unsure about one. One was dissatisfied with both knees, and seven (9.2%) were dissatisfied with one.

Discussion

The patient satisfaction rate of 81.4% at 12 months in this study is comparable to other studies.[2,5-8] It is important to clarify whether the dissatisfaction is a consequence of surgical technique, implant design, patient selection, or counselling and the management of expectation. This study provides information to aid in patient selection and counselling and represents the largest prospective cohort to date.

Pain. Baker et al[2] reported satisfaction in 81.8% of 8231 patients from the National Joint Registry for England and Wales. They found that a poorer post-operative OKS was associated with a lower level of satisfaction, and that persistent pain was the strongest predictor of dissatisfaction. Data were collected retrospectively and no pre-operative measures of pain and function were assessed. Pre-operative pain and function are the best predictors of post-operative OKS.[12] This study has supported their finding, as a lack of improvement in pain in the operated

Table III. Correlation between patient satisfaction and other elements of questionnaires

	Pearson's correlation with satisfaction
Pain in affected joint	0.784
Met expectations	0.773
Increase regular activity ability	0.670
Have operation again	0.599
Overall hospital experience	0.515
Increased ability for heavy work/sports	0.416

knee is the most significant independent predictor of dissatisfaction on multivariate analysis.

Although pre-operative pain was significantly associated with dissatisfaction in univariate analysis, when corrected for compounding factors in multivariate analysis it did not predict dissatisfaction. This is contrary to previous studies[16] which suggested that severe pre-operative pain, of greater chronicity, introduces pathways of pain and predicts less favourable pain relief via central and peripheral sensitisation. Pain at this stage of follow-up, however, is not necessarily permanent. Brander et al[19] showed progressive improvement at five years in patients with heightened pain one year post-operatively, nearly all of whom were satisfied by five years. Therefore, although we have found ongoing post-operative pain to be the largest predictor of dissatisfaction, resolution over time may improve satisfaction.

Function. The impairment hypothesis suggests that satisfaction is dependent upon the mechanical performance of the TKR, and that dissatisfaction reflects abnormal biomechanical function.[22] This implies that improving implant designs to mirror more natural biomechanics of the knee would improve satisfaction, and that younger patients with higher baseline functional activities and fewer limiting comorbidities would be less satisfied. This theory is not supported by our results, or by those of previous smaller studies,[6,24] as age and post-operative function were not associated with dissatisfaction. Function undoubtedly plays a role in patient satisfaction,[6,17] but this study showed that its influence is not as great as pain, expectation and comorbidity.

Age did not predict dissatisfaction. Previously, younger patients have been shown to have larger functional deficits than older patients following TKR, compared to age- and gender-matched peers.[22] Perception of symptoms is also affected by age: younger patients may comsider disability as more severe and pain worse than do older patients.[1] Conversely, other papers have suggested older age to be associated with dissatisfaction.[7,15] Undoubtedly, physiological age is more important than chronological age, and there is a significant relationship between the number of comorbidities and satisfaction. Fitter, more active elderly patients, with correspondingly high expectations may be blurring the divisions between younger and older patients in this preselected, relatively fit orthopaedic population. A larger sample size of younger patients is needed to draw firm conclusions.

Mental health and comorbidities. Depression is known to affect illness behaviour, experience of pain and perception of disability. Gandhi et al[7] showed that a poorer SF-36 mental health score independently predicted dissatisfaction following hip or knee arthroplasty in 1720 patients. Brander et al[19] similarly found that depressive symptoms and anxiety were predictive of long-term pain and functional impairment as measured by the Knee Society Score in 83 patients at five years. That study excluded patients with pre-operative depression and with other musculoskeletal causes of pain, so their study group is not representative of the standard orthopaedic patient. Our study found depression and a poor mental health score to be independently significant predictors of dissatisfaction in a standard unselected group of patients. Completing a mental health questionnaire on patients prior to TKR may enable further investigation and treatment of depressive symptoms by appropriate clinicians before surgery.

Back pain and pain in other joints significantly reduced satisfaction. The total number of comorbidities was also significant, albeit less so. Successful and complete rehabilitation following TKR is limited by concomitant musculoskeletal pathologies. Other arthritic joints may require treatment to maximise benefit.

Expectations. In agreement with other studies,[6,7,18,25,26] we found that patient expectations correlated well with satisfaction. Expectations are related not just to joint pain and function, but also to more psychologically complex subjective factors such as body image and ageing.[6] Joint replacement surgery is unlikely to meet these expectations. Previous studies[6,8] have shown that 51% to 56% of dissatisfied patients report no adverse symptoms from their knee. This dissatisfaction, despite a painfree, objectively well-functioning knee, has been attributed largely to unrealistic expectations. This highlights the importance of managing these expectations pre-operatively. The limitations of TKR in restoring premorbid function and feeling like a natural knee should be emphasised.

The limitations of this paper are that the influences on satisfaction of body mass index, previous knee surgery, underlying pathology or the presence of complications have not been explored. Using length of stay as a measure of complications, there was no significant difference between satisfied and dissatisfied patients. Although the OKS is a joint-specific and well-validated PROM, it has not been validated when its pain and function components are separated.

Patient dissatisfaction following TKR is multifactorial. It appears that whereas pre-operative function may be significant, pre-operative pain is not. Although poor mental health, other musculoskeletal pain and patient expectations influence dissatisfaction, the biggest determinant of satisfaction following TKR is the improvement in the pain relief it produces.

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