Correlations Between Commonly Used Clinical Outcome Scales and Patient Satisfaction After Total Knee Arthroplasty

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Abstract: Patient satisfaction is becoming increasingly important as a crucial outcome measure for total knee arthroplasty. We aimed to determine how well commonly used clinical outcome scales correlate with patient satisfaction after total knee arthroplasty. In particular, we sought to determine whether patient satisfaction correlates better with absolute postoperative scores or preoperative to 12-month postoperative changes. Patient satisfaction was evaluated using 4 grades (enthusiastic, satisfied, noncommittal, and disappointed) for 438 replaced knees that were followed for longer than 1 year. Outcomes scales used the American Knee Society, Western Ontario McMaster University Osteoarthritis Index scales, and Short Form–36 scores. Correlation analyses were performed to investigate the relation between patient satisfaction and the 2 different aspects of the outcome scales: postoperative scores evaluated at latest follow-ups and preoperative to postoperative changes. The Western Ontario McMaster University Osteoarthritis Index scales function score was most strongly correlated with satisfaction (correlation coefficient = 0.45). Absolute postoperative scores were better correlated with satisfaction than the preoperative to postoperative changes for all scales. Level of evidence: Level IV (retrospective case series) **Keywords:** total knee arthroplasty, patient satisfaction, outcome scale.

The availability of an appropriate tool for evaluating outcome is vital for assessing the real benefits and risks of proposed total knee arthroplasty (TKA) modalities. The scoring system of the American Knee Society (AKS) has been widely accepted as an objective measure of knee status [1], whereas the Western Ontario McMaster University Osteoarthritis Index scales (WOMAC) [2] and Short Form–36 (SF-36) [3] have been frequently used as patient-derived, disease-specific, and generic measures, respectively. All of these systems underwent rigorous psychometric validation before being accepted as appropriate clinical outcome tools in Western countries [4-7].

Recently, patient satisfaction has become more important as a key parameter for assessing overall TKA outcome [8-10]. However, patient satisfaction is a complex phenomenon that is affected by many domains that determine health-related quality of life [5,11-14] and is liable to many biases, which makes it difficult to assess the patient satisfaction in an objective and reliable manner. Therefore, it would be prudent to balance assessed patient satisfaction with the data produced by the commonly used outcome scales. Moreover, knowledge of the correlations between outcome scales and patient satisfaction would be helpful to assess the real benefits and risks of novel propositions. Previous studies have shown that patient-derived outcome scales represent patient satisfaction better than physician-driven outcome scales [10,15,16]. However, most of these studies were performed in Western subjects; and the current literature contains little information about how well commonly used outcome scales, which were designed primarily for white patients, correlate with patient satisfaction after TKA in Asian patients, who have different lifestyles and expectations concerning the performance of TKA. When interpreting results obtained using outcome scales, we typically consider that patient satisfaction is conceivably more related to the amount of

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change rather than the absolute outcome after TKA. However, the question of whether absolute levels or postoperative changes are better correlated with patient satisfaction has not been studied substantially.

In the current study, we sought to determine how well the commonly used outcome scales (AKS, WOMAC, and SF-36) are correlated with patient satisfaction after TKA in Asian patients. We also examined whether postoperative change amounts correlate better with patient satisfaction than absolute levels. It was hypothesized that patient-derived, disease-specific outcome scales (WOMAC) would correlate better with patient satisfaction than physician-driven (AKS) or generic (SF-36) measures and that postoperative change amounts according to these scales are better correlated with patient satisfaction than absolute outcome levels.

Materials and Methods

Four hundred seventy-three consecutive patients that underwent TKA between November 2003 and March 2005 were evaluated for eligibility in this study. Criteria for eligibility included a diagnosis of primary osteoarthritis, an absence of postoperative complications likely to affect postoperative outcome, an absence of systemic comorbidities that might prevent patients from fully benefiting from a replaced knee, and the availability of clinical outcome data for the 12-month period after surgery. Sixty patients were excluded for the following reasons: a diagnosis other than osteoarthritis (15; posttraumatic arthritis [6], rheumatoid arthritis [5], postinfectious arthritis [3], and neuropathic arthroplasty [1]); periprosthetic infection (4); death unrelated to surgery (2); significant medical problems unrelated to surgery including a cardiovascular or cerebrovascular incident, Parkinson disease, or a spine/hip fracture (8); and the lack of 12-month follow-up data (31). Another 26 patients were excluded because they could not be contacted by telephone to confirm a correct mailing address for the questionnaire examining patient satisfaction. Consequently, 387 patients (622 TKAs) were mailed the patient satisfaction questionnaire. Four weeks were given as the due day to return the completed questionnaire, and no additional contacts prompting a reply were made. Patient satisfaction was evaluated using the grading system developed by the British Orthopaedic Association [17,18], which is divided into 4 levels, that is, enthusiastic, satisfied, not committed, and disappointed Of these 622 targeted TKAs, 438 (70.4%) returned a completed questionnaire and 184 (29.6%) did not. Of the 438 TKAs with the response, 121 (27.6%), 284 (64.8%), 29 (6.6%), and 4 (0.9%) were enthusiastic, satisfied, noncommittal, and disappointed, respectively. There were 261 female patients (96.7%) and 9 male patients among the responders. The mean patient age was 68.5 years (range = 50–86), and mean patient body mass index was 26.6 kg/m^2 (range = 17–41). This study was approved by the institutional review board of our hospital, and informed consent for the use of medical information was obtained from all patients.

All surgical procedures were performed by a single surgeon (KTK). Three hundred thirty-six TKAs were performed as bilateral procedures, staged with intervals ranging from 1 to 3 weeks; and 102, as unilateral procedures. One of 2 TKA systems (Genesis II; Smith and Nephew, Memphis, Tenn, and Emotion; B Braun-Aesculap, Tuttlingen, Germany) was used for all knees. In all cases, patellae were resurfaced; and implant fixation was carried out using cement.

All clinical information was prospectively collected using predesigned data sheets with a regular follow-up schedule (6 months, 12 months, and annually thereafter) and was maintained in our database by an independent investigator (KYG). Clinical information included demographic data, preoperative clinical status, and postoperative outcomes. Preoperative clinical status and postoperative outcomes were evaluated using the following: AKS [1], WOMAC [2], and SF-36 scores [3]. The motion arc of the knee was represented by maximum flexion and range of motion that was calculated by subtracting the degree of flexion contracture from the degree of maximum flexion. An independent investigator (KYG) measured flexion contracture and maximum flexion to the nearest 5° using a goniometer, with the patient in the supine position.

Statistical analysis was performed using the SPSS for Windows statistical package (version 15.0; SPSS, Chicago, Ill), and P values of $< .05$ were considered significant. Correlations between patient satisfaction, based on questionnaire responses, and postoperative 12-month scores according to the outcome scales were estimated for 438 knees in the 270 patients who returned a properly completed questionnaire. Mean postoperative 12-month scores showed significant improvements vs preoperative values for all scales (Table 1). Spearman nonparametric correlation coefficients were calculated to determine the strengths of correlations for the following clinical outcome scales: AKS—pain, knee, and function scores; WOMAC—pain, stiffness, and function scores; and SF-36—8 scales and 2 summary scales. To facilitate the comparisons of the correlation coefficients, all WOMAC scores were converted to a 0 (worst) to 100 (best) scoring system. To determine whether postoperative changes in outcome scales correlated better than absolute levels with patient satisfaction, Spearman correlation coefficients were calculated separately for postoperative scores and postoperative change amounts. To determine whether our sample size had a sufficient power to detect a significant correlation, a priori power analysis was performed using a 2-sided hypothesis test with an α level of .05. We regarded a correlation coefficient greater than 0.3 as being suggestive of a clinically significant correlation based upon a previous study where correlation coefficients were interpreted as follows: almost

Table 1. Comparisons of the Preoperative Status and the Clinical Results at 12 Months After Surgery*

Variable	Preoperative Score	12-mo Score
Motion arc		
Maximum flexion	141.0 (13.4)	132.9 (10.5)
Range of motion (MF − FC)	127.2 (17.0)	132.9 (10.5)
AKS		
Pain score	22.7 (6.0)	47.7 (5.0)
Knee score	46.1 (9.9)	95.0 (6.6)
Function score	53.6 (13.5)	93.8 (10.9)
WOMAC		
Pain	11.8 (4.1)	2.1 (2.8)
Stiffness	5.0 (2.1)	1.7 (1.5)
Function	42.0 (12.6)	15.4 (8.7)
SF-36		
Physical function	24.1 (6.9)	40.3 (8.0)
Role physical	29.3 (8.6)	44.0 (11.2)
Bodily pain	28.8 (7.1)	48.4 (10.5)
General health	39.1 (8.7)	43.5 (10.4)
Vitality	38.1 (8.2)	46.3 (8.4)
Social function	34.4 (11.3)	48.0 (10.6)
Role emotion	29.7 (12.9)	45.3 (12.6)
Mental health	40.0 (10.8)	49.2 (9.7)
Physical component summary	28.2 (6.1)	42.7 (8.4)
Mental component summary	40.1 (10.7)	49.4 (9.4)

*Data are presented as mean with standard deviation in parentheses. The differences between the preoperative and postoperative values are statistically significant for all parameters ($P < .01$, the paired t test). MF indicates maximum flexion; FC, flexion contracture.

perfect, 0.81 to 1.00; excellent, 0.61 to 0.80; good or moderate, 0.41 to 0.60; fair, 0.21 to 0.40; slight, 0.00 to 0.20 [19]. Eighty-three cases were required to detect a clinically significant correlation with the power of 80%. The level of correlation that would be detected with our sample size of 438 knees was 0.14, indicating that this study had a sufficient power to detect a clinically significant correlation.

Results

Patient satisfaction was found to correlate better with patient-derived and disease-specific scales (WOMAC) than physician-driven (AKS) or generic (SF-36) measures (Table 2). The best correlating scale was WOMAC function score (correlation coefficient = 0.45). The AKS scores had similar correlation strengths to the SF-36 scales and showed weaker correlations than the WOMAC scores. Postoperative scores were better correlated than preoperative to postoperative changes for all scales. Demographic factors, for example, age, sex, and body mass index, were not found to be significantly correlated with patient satisfaction ($P > .05$).

Discussion

In an environment of limited resources, the availability of an appropriate tool for assessing the effectiveness or success of a surgical intervention is imperative to maximize treatment efficacy and costs. In the case of TKA, patient satisfaction is becoming evermore important as a measure of procedure efficacy [8-10]. In this study, we attempted to determine how well the commonly used clinical outcome scales correlate with patient satisfaction after TKA in Korean patients and whether preoperative to postoperative changes in outcome scales correlate better with patient satisfaction than absolute levels. We hypothesized that patient-derived, disease-specific outcome scales (WOMAC) correlate better than the physician-driven (AKS) or generic (SF-36) measures and that postoperative change amounts as determined by these scales correlate better with patient satisfaction than absolute postoperative levels.

Several limitations should be noted when interpreting our findings. First, in our study, 69.8% of the target patients responded to the questionnaire; and the response rate was comparable with the previous studies using a questionnaire [7,10,15]. However, this study does not contain the information of the patients who did not respond to the questionnaire. Second, we evaluated patient satisfaction using the 4-level grading system proposed by the British Orthopaedic Association Research Sub-committee [17,18]. Four-level grading systems or similar multilevel grading systems have been used frequently to evaluate satisfaction level after TKA [7,10,15], but the optimal way of assessing patient satisfaction remains debatable [9,20]. A previous study used a visual analog scale to assess patient satisfaction [8], and this method might provide more quantitative information. In addition, the use of correlation analyses might not be an optimal statistical tool for the 4-level

Table 2. Correlations Between the Scores by the Clinical Outcome Scoring Systems and the Patient's Satisfaction*

Variable	Absolute Levels	Amount of Postoperative Changes
Motion arc		
Further flexion	−0.02 (.737)	0.20 (<.001)
Range of motion	−0.02 (.673)	0.23 (<.001)
AKS		
Pain score	0.32 (<.001)	0.22 (<.001)
Knee score	0.22 (<.001)	0.20 (.001)
Function score	0.26 (<.001)	0.19 (.001)
WOMAC		
Pain	0.28 (<.001)	0.01 (.877)
Stiffness	0.40 (<.001)	0.12 (.047)
Function	0.45 (<.001)	0.23 (<.001)
SF-36		
Physical function	0.32 (<.001)	0.17 (.005)
Role physical	0.22 (<.001)	0.11 (.056)
Bodily pain	0.33 (<.001)	0.23 (<.001)
General health	0.23 (.002)	0.06 (.296)
Vitality	0.27 (<.001)	0.09 (.116)
Social function	0.24 (<.001)	0.13 (.028)
Role emotion	0.22 (<.001)	0.15 (.014)
Mental health	0.20 (<.001)	0.14 (.021)
Physical component summary	0.32 (<.001)	0.14 (.018)
Mental component summary	0.24 (<.001)	0.18 (.002)

*Data are given as Spearman correlation coefficient with P value in parentheses.

ordinal data of patient satisfaction. However, we used correlation analyses to compare our data with previous studies with similar study objectives [8,10,16]. Third, the clinical data compared in this study were collected at 1-year follow-ups. It has been documented that the clinical outcomes of TKAs reach a plateau around 1 year after surgery, and few further clinically significant changes take place thereafter [21-23]. However, patient's satisfaction and its correlation to the outcome scales may vary with the follow-up period [10]. In addition, as the questionnaire surveying patient satisfaction was mailed to all eligible patients at the same time, the time intervals between 12-month clinical outcome evaluation and patient satisfaction survey might have varied with patients. This should be considered as a confounder in the correlations between clinical outcomes and satisfaction scores. Finally, the characteristics of our study population should be considered before extrapolating our findings to other patient populations. Because of the female sex dominance (96.7%), the elderly nature (mean age, 68.5 years), and high proportion of bilateral cases (76.7%) of our patient cohort, our findings concern elderly women whose physical activities and lifestyles would differ from those of patient populations with different ages or sex. Total knee arthroplasty is typically indicated for elderly subjects, and female sex dominance is observed universally across the countries [24,25]. For some reasons, however, this female sex dominance seems more pronounced in Korean patients. It has been a consistent finding in most TKA series undertaken in Korea that more than 90% of patients are female [26-30]. In addition, a recent study, which used national TKA registry data (maintained by the Korean Health Insurance Review Agency), reported that of 47 961 Korean patients who underwent TKA from 2002 to 2005, 90.7% were women [31], which indicates that the extreme female sex dominance reported in previous TKA series does in fact reflect the nationwide female sex dominance. Similarly, high prevalence of bilateral cases is a consistent finding in TKA series from Korea. Therefore, although this study could not provide why the extreme female sex dominance and high prevalence of bilateral involvements are the case in Korean patients for TKAs, we believe our study population could be representative of general Korean patient populations for TKAs. Another issue to consider in interpreting our findings is that patient satisfaction can be influenced by patient's own preoperative expectations for knee arthroplasty [14], and preoperative expectations of our Korean patients might be different from those of Western patients with different cultural backgrounds.

One interesting finding was that the correlations of the scores by the clinical outcome scales to patient's satisfaction seemed to be weaker than those reported by the studies in Western patients [7,8,10]. Comparisons with the previous studies in Western subjects discover that the correlation coefficients in the present study are smaller than the corresponding figures in Western patients (Table 3). It is not clear why the correlation strengths are weaker in Korean patients than in Western subjects. One possible explanation is that the outcome scales investigated in the current study might not reflect patient's status in Korean patients as well as in Western patients. The commonly used outcome scales were originally developed with the considerations of a lifestyle in the Western culture and might not depict the real status of Korean patients whose lifestyles would be different from those of Western patients. The current literature has little information on how well the commonly used outcome scales function for Asian patients [32]. In addition, patient's satisfaction might be influenced by the differences in lifestyle between Korean and Western patients.

The findings of this study support the hypothesis that patient-derived, disease-specific outcome scales (WOMAC) are better correlated with patient satisfaction than physician-driven (AKS) or generic (SF-36) measures. The most strongly correlated scale was WOMAC function score. The AKS and SF-36 scores had weaker correlations than the corresponding WOMAC (Table 2). These findings concur with most of the related studies [7,10,15]. In a study of 98 TKAs performed in patients 75 years and older, Anderson et al [15] found that patient satisfaction was significantly correlated with WOMAC scores, but not with Hospital for Special Surgery scores. Lingard et al [7] in a study of 697 TKAs in 3 countries (United States, United Kingdom, and Australia) reported that WOMAC scores better reflected patient satisfaction than AKS scores. In addition, Robertsson and Dunbar [10] in a study of 2711 TKAs found that WOMAC scores better correlated with patient satisfaction than SF-36 scores. However, Bullens et al [8] in a study of 126 TKAs concluded that AKS knee scores correlated as well as WOMAC scores with patient satisfaction.

Previous studies have found that pain-related scores are better correlated to patient satisfaction than function-related scores [7-10]. In the present study, excepting WOMAC scores, pain-related scores (AKS pain and knee scores, and SF-36 body pain score) were similarly found to be slightly better correlated than function-related scores (Tables 2, 3). In contrast, WOMAC function scores were found to be better correlated with patient satisfaction than WOMAC pain scores (0.45 vs 0.28). However, we are uncertain why the WOMAC scales showed this different pattern.

We originally hypothesized that postoperative change amounts would better correlate with patient satisfaction better than absolute outcome measures. It would appear reasonable to expect that patients with substantial pain and a poor functional status preoperatively are more likely to achieve a postoperative improvement and that this would be reflected by patient satisfaction [9]. However, contrary to our hypothesis, we discovered that absolute outcome levels

Table 3. Comparisons of the Correlation Strengths Between the Current Study in Korean Patients and the Previous Studies in Western Patients

	Posbottomerative Score			Amount of Change	
Variable	Current Study	Bullen et al [8]	Robertsson and Dunbar [10]	Current Study	Lingard et al [16]
AKS					
Pain score	0.32*			0.22*	
Knee score	0.22*	0.62†		0.20*	0.28*
Function score	0.26*			0.19*	0.23*
WOMAC					
Pain	0.28*	0.55†	0.67*	0.01	0.43*
Stiffness	0.40*	0.56†	0.63*	0.12†	
Function	0.45*	0.48†	0.64*	0.23*	0.42*
SF-36					
Physical function	0.32*		0.43*	0.17*	0.42*
Role physical	0.22*		0.29*	0.11	
Bodily pain	0.33*		0.48*	0.23*	0.30*
General health	0.23*		0.39*	0.06	
Vitality	0.27*		0.35*	0.09	
Social function	0.24*		0.38*	0.13†	
Role emotion	0.22*		0.32*	0.15†	
Mental health	0.20*		0.34*	0.14†	
Physical component summary	0.32*		0.45*	0.14†	
Mental component summary	0.24*		0.32*	0.18*	

The data are given as Spearman correlation coefficient except for the study by Lingard et al [16], for which Pearson correlation coefficient is given. The amount of change in score was calculated by subtracting the preoperative score from the 12-month score.

*$P < .01$.

†$P < .05$.

correlated better with patient satisfaction than degrees of change. In fact, postoperative scores were better correlated with patient satisfaction than preoperative to postoperative change for all scales (Table 2). Thus, our findings suggest that patients appear to discount extent of disability before surgery and that achieved improvements do not drive patient satisfaction. In other words, patients appear to revise their previous goals and redefine treatment success. A recent study reported on such a response shift in patients after TKA [33].

This finding of the stronger correlation between absolute levels and patient satisfaction has clinical implications concerning the timing of TKA during the course of knee osteoarthritis. Traditionally, TKA is delayed until pain and functional limitations are intolerable, whereas it has been documented that worse preoperative pain and function are associated with poorer postoperative outcomes [34,35]. Our findings advocate that delayed surgical intervention is likely to adversely effect patient satisfaction. This notion is supported by previous authors who also advocated earlier surgical intervention in patients with advanced osteoarthritis [35,36]. This point should be considered in offering treatment options to patients with advanced osteoarthritis.

The present study demonstrates that patient-derived, disease-specific outcome measures (WOMAC) better correlate with patient satisfaction than physician-driven (AKS) or generic measures (SF-36). In addition, correlations between commonly used outcome scales and patient satisfaction were found to be weaker in Korean patients than has been reported in Western patients. Furthermore, patient satisfaction was found to be better correlated with absolute postoperative levels than preoperative to postoperative changes. These findings need to be considered when interpreting the clinical outcomes of TKA in Asian patients and when offering treatment options about surgical timing to patients with advanced osteoarthritis.

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