Aetiology of patient dissatisfaction following primary total knee arthroplasty in the era of robotic-assisted technology

a review of 674 cases

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Aims

Patient dissatisfaction following primary total knee arthroplasty (TKA) with manual jig-based instruments has been reported to be as high as 30%. Robotic-assisted total knee arthroplasty (RA-TKA) has been increasingly used in an effort to improve patient outcomes, however there is a paucity of literature examining patient satisfaction after RA-TKA. This study aims to identify the incidence of patients who were not satisfied following RA-TKA and to determine factors associated with higher levels of dissatisfaction.

Methods

This was a retrospective review of 674 patients who underwent primary TKA between October 2016 and September 2020 with a minimum two-year follow-up. A five-point Likert satisfaction score was used to place patients into two groups: Group A were those who were very dissatisfied, dissatisfied, or neutral (Likert score 1 to 3) and Group B were those who were satisfied or very satisfied (Likert score 4 to 5). Patient demographic data, as well as preoperative and postoperative patient-reported outcome measures, were compared between groups.

Results

Overall, 45 patients (6.7%) were in Group A and 629 (93.3%) were in Group B. Group A (vs Group B) had a higher proportion of male sex ($p = 0.008$), preoperative chronic opioid use ($p < 0.001$), preoperative psychotropic medication use ($p = 0.01$), prior anterior cruciate ligament (ACL) reconstruction ($p < 0.001$), and preoperative symptomatic lumbar spine disease ($p = 0.004$). Group A was also younger ($p = 0.023$). Multivariate analysis revealed preoperative opioid use ($p = 0.012$), prior ACL reconstruction ($p = 0.038$), male sex ($p = 0.006$), and preoperative psychotropic medication use ($p = 0.001$) as independent predictive factors of patient dissatisfaction.

Conclusion

The use of RA-TKA demonstrated a high rate of patient satisfaction (629 of 674, 93.3%). Demographics for patients not satisfied following RA-TKA included: male sex, chronic opioid use, chronic psychotropic medication use, and prior ACL reconstruction. Patients in these groups should be identified preoperatively and educated on realistic expectations given their comorbid conditions.

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Take home message

- Robotic-assisted surgery has demonstrated improved outcomes in patients undergoing primary knee arthroplasty.
- Despite the use of robotic-assisted surgery, there is a subset of patients (6.7%) who were dissatisfied in this study.
- These patients fell into the category of prior anterior cruciate ligament reconstruction, on chronic opioid and psychotropic medications.

Introduction

Historically, postoperative outcomes following total knee arthroplasty (TKA) were focused on objective measures including implant survival and clinician assessment of patient status. However, these measures were found to be poorly correlated with patient satisfaction.[1] As a result, there has been a greater emphasis placed on patient-reported outcome measures (PROMs) following TKA, with many studies focusing on patient satisfaction as an important indication of successful surgery.[2-11] Despite ongoing improvements in implant design, surgical technique, and perioperative care, patient dissatisfaction after manual jig-based TKA is reported to exceed 20%.[1,3,4,12,13]

Multiple factors have been identified as a source of patient dissatisfaction, including malalignment and instability following TKA.[14-17] These are often related to technical factors during surgery, including inaccurate bony resection, implant malposition, and poor soft-tissue balancing which leads to asymmetric flexion and extension gaps.[18] The introduction of robotic-assisted TKA (RA-TKA) has provided an array of surgical tools to help perform 3D preoperative and intraoperative planning for the individual patient's target alignment and implant position, while providing information on accurate soft-tissue balance with real-time intraoperative data for adjustments in implant position.[19-23]

The use of RA-TKA has significantly increased in the USA, as evidenced by the American Joint Replacement Registry reporting a six-fold increase in the use of robotic RA-TKA over the past five years and recent projections estimating the use of this technology in over 50% of primary TKAs by 2032.[24,25] Despite the significant increase in the use of RA-TKA, there is still a paucity of data on PROMs and patient satisfaction using robotic-assisted technology. The purpose of this study was to determine the incidence of patient dissatisfaction following primary TKA given the use of modern design implants, along with the use of advanced technology, and identify risk factors associated with patient dissatisfaction.

Methods

Study population

This was an institutional review board-approved retrospective review of 800 consecutive primary RA-TKAs performed between October 2016 and September 2020 at an urban, academic medical centre (UofL Health) by a single surgeon (ALM) with significant arthroplasty experience. A total of 126 of 800 patients (15.8%) were excluded: 22 patients (2.8%) who required revision TKA and 104 patients (13%) with incomplete follow-up data. Reasons for revisions included: instability in eight patients (1%), three infections (0.38%), three arthrofibrosis (0.38%), two traumatic arthrotomies (0.25%), two periprosthetic fractures (0.25%), two instances of unexplained pain treated at another institution (0.25%), one aseptic loosening (0.13%), and one extensor mechanism rupture (0.13%). This left 674 patients with a minimum of two-year follow-up available for review. Mean follow-up was 36.6 months (24 to 75). There were 291 males (43.2%) and 383 females (56.8%). Mean age was 65 years (26 to 85) and mean BMI was 32.5 kg/m^2 (17.7 to 52.9). Patients were asked to rate their overall satisfaction on a Likert scale from 1 to 5.[26] These patients were divided into two cohorts based on their most recent Likert satisfaction score.[4,5,27,28] Group A included patients with scores of 1 (very dissatisfied), 2 (dissatisfied), or 3 (neutral), and Group B consisted of patients with scores of 4 (satisfied) or 5 (very satisfied). There were 45 patients (6.7%) in Group A and 629 patients (93.3%) in Group B (Table I).

Surgical technique

All patients underwent the same preoperative total joint education, anaesthesia protocol, and postoperative management. Spinal anaesthesia was used preferentially. The same cruciate-retaining or posteriorly stabilized TKA implant design was used in all patients, along with the use of robotic-assisted technology (Triathlon, Mako; Stryker, USA). A virtual 3D individualized preoperative plan was created for all patients based on their CT scan to determine the 3D target alignment, implant size, and implant position. Based on intraoperative data following ligamentous tensioning, the plan was adjusted to obtain balanced medial and lateral gaps in extension within 1 mm, along with balanced extension and flexion gaps, with the overall goal to approximate the patient's native joint line and achieve a well-balanced soft-tissue sleeve. This was primarily achieved through bone cuts of both femur and tibia as well as adjustments in implant positioning. Soft-tissue releases were performed sparingly and only when necessary. In varus deformity cases, our surgical technique consisted of tibial bony cut in varus trying to match the medial proximal tibial angle (MPTA) but not exceeding 4° of tibial varus. The tibial cut was first performed, followed by use of a ligament-tensioning device to make adjustments in the bony cuts, implant position, and implant size to achieve the desired alignment and soft-tissue balancing goals. The native patella was routinely resurfaced. Patients without significant cardiac, pulmonary, or other medical comorbidities trended towards discharge home on the day of surgery. Patients without adequate support systems at home were discharged to rehabilitation facilities if needed.

Collection of PROMs and demographic data

Electronic medical records were reviewed to assess patient demographic information, including age, sex, and BMI, comorbidities via the Charlson Comorbidity Index (CCI),[29] preoperative opioid use, preoperative psychotropic drug use, prior anterior cruciate ligament reconstruction (ACL-R) of the operative knee, and history of preoperative lumbar spine disease. A medication was classified as an opioid if it was a natural, semi-synthetic, or synthetic opioid. Tramadol was also considered an opioid for this study. A patient was considered as using psychotropic drugs if they were using drugs from the following classes: selective serotonin reuptake inhibitor (SSRI), serotonin and norepinephrine reuptake inhibitor (SNRI), antipsychotics, tricyclic antidepressants, monoamine oxidase inhibitors, or a benzodiazepine. Patient satisfaction

Table I. Distribution of Likert satisfaction scores in study population

Likert score	N (%)
1	4 (0.6)
2	16 (2.4)
3	25 (3.7)
4	108 (16.0)
5	521 (77.3)
Group A (1 to 3)	45 (6.7)
Group B (4 to 5)	629 (93.3)
Total	674

and PROMs were collected via an in-person questionnaire during office follow-up visits (451 patients) or via structured phone interview (223 patients). PROMs included Knee Society (KS) knee score, KS function score,[10] and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC),[30] which were collected at both preoperative and postoperative office visits, and Forgotten Joint Score-12 (FJS-12)[31] and Knee injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS, JR),[32] which were collected postoperatively.

Statistical analysis

All data were recorded in Excel software (Microsoft, USA). Characteristics between cohorts A versus B were compared using the chi-squared test for categorical variables and the Mann-Whitney U test for continuous variables. A p-value < 0.05 was used to denote significance. Variables that met significance after univariate analysis were used in a multivariate binary regression model to show variables that were independently predictive of patient dissatisfaction. Receiver operating characteristic (ROC) curve analysis was used to assess the accuracy of the multivariate regression model. Area under the curve (AUC) was used as a marker for model accuracy, with values greater than 0.7 indicating an acceptable model.

Additionally, statistical analysis was performed to assess patient characteristics and numerical Likert satisfaction score (1 to 5). Univariate analysis involved the Mann-Whitney U test for categorical variables and analysis of variance for continuous variables. A p-value of < 0.05 was used to denote significance. Variables that met significance after univariate analysis were used in a multivariate ordinal regression model to identify variables that were independently predictive of change of Likert satisfaction score. All statistical analyses were performed via SPSS software v, 29.0.1.0 (IBM, USA).

Results

Patient characteristics of Group A versus B

Of the 674 patients, 45 (6.7%) were in Group A: very dissatisfied (n = 4), dissatisfied (n = 16), or neutral (n = 25) (Likert 1 to 3). A total of 629 (93.3%) were in group B: satisfied (n = 108) or very satisfied (n = 521) (Likert 4 to 5) (Table I). Univariate analysis between Group A and B showed significantly more males in group A (62.2% vs 41.8%; p = 0.008, chi-squared test) and significantly younger mean age (61.3 vs 65.4 years; p = 0.023, Mann-Whitney U test). Group A had a significantly higher rate of preoperative opioid use (44.4% vs 19.9%; p < 0.001, chi-squared test), greater preoperative psychotropic medication use (55.6% vs 36.7%; p = 0.012, chi-squared test), higher incidence of prior ACL-R surgery of the operative knee (13.3% vs 3.3%; p < 0.001, chi-squared test), and higher incidence of preoperative symptomatic lumbar spine disease (28.9% vs 13.3%; p = 0.004, chi-squared test). There was no statistically significant difference in BMI, CCI, or American Society of Anesthesiologists (ASA)[33] grade between groups (Table II). There was also no difference between Group A and B in mean follow-up time (36.6 vs 36.6 months; p = 0.986, Mann-Whitney U test), but there was a difference between groups in method of data collection, with a greater number of phone interviews in Group A (46.7%) than in Group B (32.1%) (p = 0.045, chi-squared test).

Table II. Univariate analysis of patient characteristics: Group A (Likert score 1 to 3) versus Group B (Likert score (4 to 5).

Characteristic	Group A	Group B	p-value
Mean age, yrs (SD)	61.3 (11.3)	65.4 (8.9)	0.023
Mean BMI, kg/m^2 (SD)	33.1 (6.8)	32.5 (6.2)	0.582
Mean CCI (SD)	2.8 (1.8)	2.9 (1.5)	0.624
Mean ASA grade (SD)	2.5 (0.5)	2.4 (0.6)	0.265
Sex, n (%)			0.008
Male	28 (62.2)	263 (41.8)	
Female	17 (37.8)	366 (58.2)	
Preop opioid use, n (%)			< 0.001
Yes	20 (44.4)	125 (19.9)	
No	25 (55.6)	504 (80.1)	
Preop psychotropic drug use, n (%)			0.012
Yes	25 (55.6)	231 (36.7)	
No	20 (44.4)	398 (63.3)	
Prior ACL reconstruction, n (%)			< 0.001
Yes	6 (13.3)	21 (3.3)	
No	39 (86.7)	608 (96.7)	
Lumbar spine disease, n (%)			0.004
Yes	13 (28.9)	84 (13.4)	
No	32 (71.1)	545 (86.6)	

ACL, anterior cruciate ligament; ASA, American Society of Anesthesiologists; CCI, Charlson Comorbidity Index.

PROMs

There was no significant difference between Group A and Group B in preoperative KS Knee (44.7 vs 45.0; p = 0.923, Mann-Whitney U test), KS Function (45.5 vs 49.1; p = 0.098, Mann-Whitney U test), or WOMAC (43.7 vs 47.0; p = 0.484, Mann-Whitney U test) scores. Analysis of postoperative PROMs (Table III) demonstrated a trend of lower PROMs in Group A versus Group B, including KS Function (67.0 vs 88.0; p

Table III. Univariate analysis of patient-reported outcome measures: Group A versus Group B.

PROM	Group A	Group B	p-value
Mean KS Knee (SD)			
Preoperative	44.7 (15.1)	45.0 (13.1)	0.923
Postoperative	73.4 (15.5)	93.3 (8.2)	< 0.001
Mean KS Function (SD)			
Preoperative	45.5 (12.6)	49.1 (10.9)	0.098
Postoperative	67.0 (18.3)	88.0 (15.2)	< 0.001
Mean WOMAC (SD)			
Preoperative	43.6 (22.1)	47.0 (18.4)	0.484
Postoperative	59.2 (23.2)	91.1 (11.9)	< 0.001
Mean FJS (SD)			
Postoperative	29.0 (22.4)	74.4 (26.3)	< 0.001
Mean KOOS, JR (SD)			
Postoperative	59.4 (14.7)	87.6 (13.5)	< 0.001

FJS, Forgotten Joint Score; KOOS, JR, Knee injury and Osteoarthritis Outcome Score for Joint Replacement; KS, Knee Society; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

Table IV. Multivariate binary logistic regression analysis: Group A vs Group B.

Independent variable	Patient dissatisfaction		p-value
	OR	95% CI	
Age	1.03	0.99 to 1.06	0.094
Sex (male)	2.5	1.3 to 4.8	0.006
Preop opioid use	2.4	1.2 to 4.7	0.012
Preop psychotropic drug use	1.7	0.9 to 3.4	0.121
ACL reconstruction	3.1	1.1 to 9.1	0.038
Lumbar spine disease	1.8	0.9 to 3.9	0.115

ACL, anterior cruciate ligament; OR, odds ratio.

< 0.001, Mann-Whitney U test), KS Knee (73.4 vs 93.3; p < 0.001, Mann-Whitney U test), WOMAC (59.2 vs 91.1; p < 0.001, Mann-Whitney U test), FJS-12 (29.0 vs 74.4; p < 0.001, Mann-Whitney U test), and KOOS, JR (59.4 vs 87.6; p < 0.001, Mann-Whitney U test) scores.

Multivariate analysis of Group A versus B

The multivariate binary logistic regression model identified preoperative opioid use (odds ratio (OR) 2.4; p = 0.012), prior ACL-R (OR 3.1; p = 0.038), and male sex (OR 2.5; p = 0.006) as independent predictive factors of patient dissatisfaction (Table IV). ROC analysis resulted in an AUC of 0.763 (p < 0.001), indicating an acceptable model (Figure 1).

Analysis of patient characteristics versus Likert satisfaction score

Univariate analysis was performed to identify patient characteristics that were significantly associated with change of Likert satisfaction scores. Significant variables were input into a multivariate ordinal regression model which identified preoperative opioid use (effect on Likert score -0.45 (95% CI -0.87 to 0.03); p = 0.035), preoperative psychotropic drug use (-0.62 (95% CI -1.0 to 0.24); p = 0.001), and prior ACL reconstruction (-0.936 (95% CI -1.73 to 0.15); p = 0.020) as variables which were independently predictive of Likert satisfaction scores (Table V).

Discussion

This study found a 93.3% patient satisfaction score with RA-TKA that had not undergone revision, with 629 out of 674 patients reported to be satisfied or very satisfied. These findings differ from many recent studies which have found inferior rates of patient satisfaction using manual techniques.[4,7,8,27] Patient satisfaction after TKA has been reported frequently in recent literature with dissatisfaction rates exceeding 20%.[1,3,4,8,12,13,27,34,35] This has been investigated throughout a variety of study designs, with the majority using manual jig-based techniques. Investigations involving large joint replacement registries have reported 19% dissatisfaction in a population of 1,703 Canadian patients,[3] and 18.2% in a population of 8,095 patients in England and Wales.[12] Recent prospective trials conducted in the USA have reported one-year postoperative satisfaction rates of 89% in a cohort of 174 patients and 83.5% in a cohort of 4,402 patients who underwent primary TKA.[4,27] The causes of patient dissatisfaction after TKA are multifaceted. Intraoperative factors including deviation from native joint line and inappropriate implant positioning have been associated with patient dissatisfaction due to continued pain, instability, and functional limitations.[8] Additionally, improper gap balancing in knee flexion and extension can cause pain and instability after TKA.[36]

RA-TKA was introduced in an effort to improve PROMs through improvements in surgical technique by providing accuracy, reproducibility, and real-time intraoperative data on alignment, implant position, and gap-balancing data. Shalhoub et al[37] demonstrated that robotic-assisted techniques allowed for accurate prediction of gap balancing prior to making the femoral cut. Manual jig-based techniques which rely on intramedullary guides, cutting blocks, and manual tensioning can be challenging in achieving a reproducible balanced knee. In contrast, RA-TKA utilizes CT-generated 3D planning and real-time intraoperative data to allow for accurate intraoperative gap adjustments with 1 mm-increment accuracy.

In a prospective randomized trial of 100 patients undergoing primary TKA, Song et al[22] found that RA-TKA resulted in fewer cases of flexion and extension gap mismatch compared to a manual group, using a measured resection technique for both groups. The RA-TKA used CT-based preoperative planning, with the intent to restore the original premorbid size and shape of the distal femur with an assumed

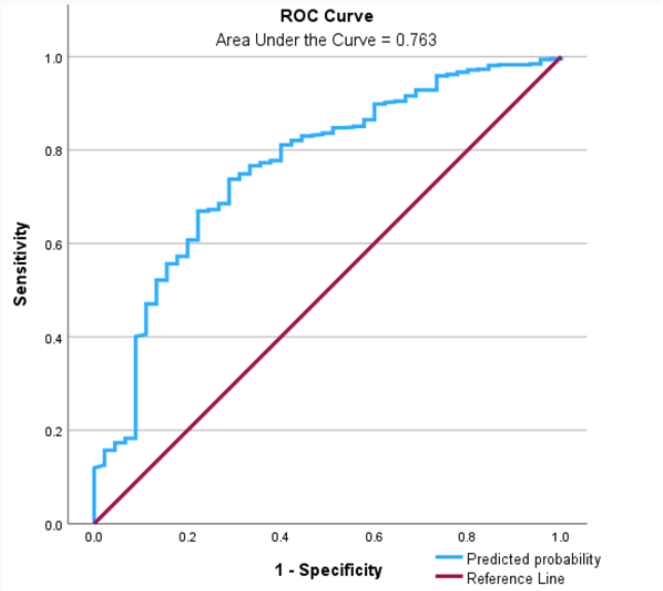

Fig. 1
Receiver operating characteristic (ROC) curve for predicting dissatisfaction after total knee arthroplasty.

Table V. Multivariate ordinal regression analysis: patient characteristics versus Likert satisfaction score (1 to 5).

Independent variable	Likert satisfaction score (1 to 5)		p-value
	Effect	95% CI	
Age	0.008	-0.01 to 0.03	0.467
Sex (male)	-0.343	-0.71 to 0.03	0.069
Preop opioid use	-0.451	-0.87 to -0.03	0.035
Preop psychotropic drug use	-0.62	-1.00 to -0.24	0.001
ACL reconstruction	-0.936	-1.73 to -0.15	0.020

ACL, anterior cruciate ligament.

cartilage thickness of 3 mm and made all cuts using the ROBODOC (Curexo Technology, USA). Meanwhile, the manual group used the manufacturer's recommended technique of 6° of valgus and 3° of external rotation of the femoral component with a posterior slope of 7° in the tibial cut. Song et al[22] showed better consistency in achieving the target joint alignment, with no outliers in the robotic group compared to the manual group which contained outliers in 24% of cases. Among the few studies that have evaluated satisfaction in RA-TKA, Marchand et al[38] reported significantly higher satisfaction scores six months after RA-TKA versus the manual technique cohort. In a larger study, Smith et al[23] compared 120 patients who underwent RA-TKA to 103 patients who underwent TKA using a manual jig-based technique and found satisfaction rates of 94% versus 82%, respectively, with significantly higher KS Knee and Function scores in the robotic group at the one-year postoperative visit.

Our findings differ from many recent studies which have found inferior rates of patient satisfaction using manual techniques.[4,7,8,27] It is our belief that using robotic technology to assist in approximating the native joint line, restoring soft-tissue tension in the medial and lateral gaps along with the flexion and extension gaps through bone cuts, implant positioning, and avoiding soft-tissue releases of normal ligamentous structures, led to a decreased number of patients who expressed dissatisfaction with their primary TKA as compared to historical numbers. We identified 45 patients (6.7%) who were not satisfied or neutral (Group A) with their RA-TKA despite achieving the desired target alignment and soft-tissue balance.

Univariate analysis of patient characteristics between Group A and Group B identified younger age, male sex, preoperative opioid use, preoperative psychotropic medication use, history of ACL-R of operative knee, and history of lumbar spine disease as significant variables associated with patient dissatisfaction. Preoperative PROMs including KS Knee, KS Function, and WOMAC scores were not significantly different between the groups, suggesting similar rates of preoperative knee pain and function between groups prior to RA-TKA. Lower preoperative PROMs have been shown to be associated with dissatisfaction in many previous studies.[3,11,16,39] However, the relationship between these factors remains controversial, as other studies have found no association.[8,9,39] Conversely, there is consistent evidence in current literature regarding the direct relationship between inferior postoperative PROMs and patient dissatisfaction.[3,4,40–43] Our data, which demonstrate significantly inferior PROMs including KS Knee, KS Function, WOMAC, FJS-12, and KOOS, JR in Group A versus Group B, also reflect these findings.

Patient characteristics that were significantly associated with not being satisfied were identified via univariate analysis, then input into a multivariate analysis which demonstrated that male sex, preoperative opioid use, and history of ACL-R were independently predictive of dissatisfaction (Likert 1 to 3). Additional analysis was performed, in which patient satisfaction was designated by the numerical five-point Likert score in place of dichotomous grouping (Group A vs B). In a similar fashion, univariate analysis was repeated to identify patient characteristics that show a significant impact on satisfaction. Significant variables then underwent multivariate ordinal regression analysis to identify those which independently impact Likert satisfaction score (1 to 5) and quantify the magnitude of impact. Multivariate analysis identified preoperative opioid use, preoperative psychotropic medication use, and ACL-R as independent factors predictive of diminished Likert satisfaction score. Within the non-satisfied cohort, at least one predictive factor (preoperative opioid/psychotropic medication use or ACL-R) was identified in 34/45 (76%) of the non-satisfied patients.

Preoperative opioid use has become commonplace in the USA, with large database studies reporting narcotic usage incidence of 29% in patients undergoing total hip arthroplasty or TKA.[44] Consequently, there has been increasing interest in the potential impact of opioid use on postoperative outcomes. In a population of 580 patients undergoing TKA, Rizzo et al[28] found that preoperative opioid use was predictive of patient dissatisfaction (OR 1.73; p = 0.01). This was also seen in a study involving matched patient cohorts undergoing RA-TKA, which showed that chronic preoperative opioid use was associated with lower patient satisfaction and KS Function

scores.[45] Similarly, our data indicated that preoperative opioid use was also predictive of patient dissatisfaction (OR 2.4; p = 0.012) and independently associated with a lower Likert score (-0.45 (95% CI -0.87 to 0.03); p = 0.035).

The ACL is the most commonly ruptured ligament in the knee, affecting a large number of active and healthy patients each year. The mainstay of treatment after ACL rupture involves surgical reconstruction of the ACL. Increased risk of osteoarthritis (OA) development is a known sequela after ACL injury, affecting 20% of these patients.[46] A recent meta-analysis has shown a risk ratio of 3.8 (p < 0.001) for developing OA after ACL injury, regardless of nonoperative versus operative management.[46] The high prevalence of both ACL injury and subsequent development of OA leads to a significant population of patients who eventually require TKA. Treating these patients may be more challenging, as primary TKA after ACL-R is often a more technically difficult and lengthy procedure.[47,48] Wilson et al[49] found that TKA in patients with ACL-R resulted in decreased ten-year implant survival and listed symptomatic instability as the leading cause of revision, occurring in 7% of their patients. Although many studies have found higher rates of reoperation in TKA after ACL-R,[48,49] evidence indicating significant differences in postoperative outcomes have yet to be shown in the literature.[47,48,50,51] Our findings show prior ACL-R of the operative knee is predictive of both patient dissatisfaction (OR 3.1; p = 0.038) and lower Likert score (-0.936 (95% CI -1.73 to 0.15); p = 0.020). This study is the first to provide evidence that ACL-R independently impacts patient satisfaction after TKA.

Recent focus on mental health disorders in patients undergoing arthroplasty has revealed inferior outcomes with the presence of psychological disease or psychotropic medication use. It is suggested that these patients may experience pain in a different way, which may help to explain this disparity of outcomes. Gandhi et al[7] calculated preoperative mental health scores before TKA/THA and found an association between poorer preoperative scores and dissatisfaction. A study by Scott et al[11] found a significant association between presence of depression prior to surgery and patient satisfaction after TKA (p < 0.001). Similarly, Clement et al[34] showed depression to be independently predictive of poor satisfaction after TKA (OR 0.4; p = 0.001). More recent investigations have evaluated medications which are commonly prescribed to treat many psychiatric illnesses. In a series of 3,020 patients, Stone et al[52] found that 26.8% of patients undergoing TKA were prescribed psychotropic medications including antidepressants, anxiolytics, antipsychotics, and stimulants. Their study, which focused on short-term metrics after TKA, demonstrated higher rates of emergency department visits and discharges to skilled nursing facilities in patients with psychiatry diagnosis. In our study, the use of psychotropic medication was found to be predictive of a lower Likert score (-0.62 (95% CI -1.0 to 0.24); p = 0.001).

Knee OA often occurs in conjunction with lumbar back pain. The mutual connection between knee and spine alignment relating to overall upright sagittal balance may, in part, contribute to the coexistence of both knee and back pain in many patients. This relationship is illustrated in cases when lumbar lordosis is lost as a result of knee flexion contracture or when spinal deformity causes altered knee mechanics and abnormal degenerative wear.[53] The exact impact of lumbar spine pain and disease on the outcomes after TKA remains poorly understood, although its association with dissatisfaction after TKA has been demonstrated in studies.[4,28,34,43] Our data did demonstrate an association between lumbar spine disease and dissatisfaction after univariate analysis, however this lost significance after multivariate analysis. This relationship may have been better investigated in our study if our data had included severity of back pain symptoms, as previous studies have demonstrated.[4,43]

Our study did show significant difference in satisfaction between the sexes. Our data indicated male sex to be independently predictive of dissatisfaction (OR 2.9; p = 0.006). This is contrary to findings in the recent literature, with a majority of recent studies showing no difference in satisfaction rates between the sexes.[3,6–9,11,34,43,54,55] Our study was consistent with recent literature showing no difference in patient satisfaction rates between differences in age,[7–9,11,54] BMI,[6–9,54,56] ASA grade,[8,12] or presence of comorbidities.[6,7,42,54]

Limitations of this study include its retrospective nature and the exclusion of patients due to inadequate follow-up data or need for revision. Although this study analyzed many patient demographics and PROMs, additional investigations including further stratifying pre-existing variables (severity of back pain, number of psychotropic medications, etc), adding additional variables (radiological findings, socioeconomic factors, etc), and collecting PROMs at multiple postoperative timepoints could further strengthen its findings.

This study provides novel findings in RA-TKA, including patient factors that may predict dissatisfaction following surgery. The use of RA-TKA did not ensure satisfaction in all patients undergoing primary TKA. However, the results of the study with RA-TKA are encouraging, with an overall satisfaction rate surpassing 93%, which is an improvement from historical data using manual jig-based instruments. The tools provided by RA-TKA helped approximate the native joint line and obtain a balanced soft-tissue sleeve about the knee. One of the limitations to this study is the lack of a control group using manual jig-based TKA. We do not know the actual effect of using RA-TKA in the improved overall satisfaction percent in this study (93.3%) compared to historical data using manual instruments. In addition, to adequately address the multifaceted nature of patient satisfaction, variables across all phases of patient care must be accounted for. This includes addressing preoperative factors which predispose patients to suboptimal outcomes. Strategies include preoperative optimization of modifiable risk factors and discontinuing the use of opioid or psychotropic medications; however, it may be challenging to discontinue medications affecting mental disorders and chronic pain. Based on this study, patient education is paramount regarding realistic outcomes to mitigate the impact of these predisposing comorbid factors, which may be associated with inferior outcomes in some patients undergoing primary TKA despite the use of robotic-assisted technology.

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