Factors Leading to Satisfaction Following a total Knee Arthroplasty

Scot Bauman
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ABSTRACT

FACTORS LEADING TO SATISFACTION FOLLOWING A TOTAL KNEE ARTHROPLASTY

Scot Bauman, PhD
College of Health and Human Sciences
Northern Illinois University, 2023
MJ Blaschak, PhD, Director

One of the most common surgical treatment options for knee osteoarthritis (OA) is a total knee arthroplasty (TKA), which utilizes a combination of metal and plastic to resurface the damaged cartilage surfaces of the knee, leading to decreased pain and improved function for the patient. However, despite fairly good subjective scores following surgery, up to 20% of patients report being dissatisfied with their outcome. Previous research has assessed reasons for this high dissatisfaction rate including postoperative range of motion (ROM), preoperative education, and postoperative strength. Nevertheless, there continues to be a paucity in the literature regarding how preoperative function affects postoperative satisfaction. Three studies were performed to determine factors leading to satisfaction following surgery including an assessment of subjective function before surgery, objective function before surgery, as well as a qualitative analysis utilizing semi-structured interviews to ask patients about their preoperative experience and how it affected postoperative satisfaction.

Subjectively, it was discovered that patients having lower preoperative scores, indicating worse function, can lead to higher rates of satisfaction after surgery. Objectively, lower gait speeds before surgery can lead to higher rates of satisfaction following surgery. Lastly, through a
qualitative analysis, it was found that most patients value their healthcare provider developing and setting realistic expectations preoperatively through high level education more so than hitting certain objective thresholds for measures like ROM and strength. The results of the three studies show that a patient meeting expectations, independent of their preoperative objective function, may be the most important factor leading to satisfaction following TKA.
FACTORS LEADING TO SATISFACTION FOLLOWING A TOTAL KNEE ARTHROPLASTY

BY

SCOT BAUMAN, PhD
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A DISSERTATION SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE
DOCTOR OF PHILOSOPHY

COLLEGE OF HEALTH AND HUMAN SCIENCES

Doctoral Director:
MJ Blaschak, PhD
ACKNOWLEDGEMENTS

Many individuals have contributed to this dissertation and to them I am incredibly grateful. Some have given their time, expertise, resources, while others have given their support. I would first like to thank my academic advisor and dissertation committee chair, MJ Blaschak, PhD. She has been there every step of the way, guiding me to the point of completion. I would also like to think the other members of my dissertation committee, William Pitney, EdD, ATC, Nicholas Grahovec, PhD, ATC, CSCS, and Hamad Bateni, PhD. Their expertise and support throughout this process has been a large part of me completing this project. Another large part of my success has been the faculty within the College of Health and Humans Science. Through their education, I was well prepared to conduct these studies, analyze the data, and organize the findings in a logical manner.

I would also like to think those individuals away from the university that have been integral in me finishing this project and program. Most notably my wife, Allison, who has shown nothing but support for me over the past few years. Next is my family and friends who have continued to push me and support me throughout the program. Without any of these individuals, I would not have been able to get to the point where I am now, and for that, I am forever grateful.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>v</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIST OF FIGURES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>vii</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIST OF APPENDICES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>viii</td>
</tr>
</tbody>
</table>

## Chapter

1. SATISFACTION RATES FOLLOWING TOTAL KNEE ARTHROPLASTY ................................................................. 1
   - Introduction .......................................................... 1
   - Theoretical Framework ............................................. 3
   - Goals of the Research Studies .................................... 5
   - Preview of Papers and Methodology ............................... 6
   - References .................................................................... 14
   - Appendix ....................................................................... 17

2. SUBJECTIVE FACTORS THAT LEAD TO SATISFACTION FOLLOWING A TOTAL KNEE ARTHROPLASTY .......................... 24
   - Introduction .......................................................... 24
   - Methods ....................................................................... 26
   - Results ......................................................................... 31
   - Discussion .................................................................... 35
   - References .................................................................... 41
3. OBJECTIVE FACTORS THAT LEAD TO SATISFACTION FOLLOWING A TOTAL KNEE ARTHROPLASTY
Introduction ................................................................. 43
Methods ................................................................. 45
Results ................................................................. 50
Discussion ............................................................. 57
References .............................................................. 63

4. FACTORS THAT LEAD TO SATISFACTION FOLLOWING A TOTAL KNEE ARTHROPLASTY: A QUALITATIVE ANALYSIS
Introduction ................................................................. 66
Methods ................................................................. 69
Results ................................................................. 74
Discussion ............................................................. 81
References .............................................................. 89
Appendix ................................................................. 91

5. DISCUSSION .............................................................. 93
Subjective Factors Leading to Satisfaction Following Total Knee Arthroplasty .............................................. 93
Objective Factors Leading to Satisfaction Following Total Knee Arthroplasty .............................................. 96
Qualitative Analysis of Factors Leading to Satisfaction Following Total Knee Arthroplasty .............................. 101
Conclusion .............................................................. 104
References .............................................................. 107
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 2</td>
<td></td>
</tr>
<tr>
<td>1. Postoperative Rehabilitation Schedule and Goals</td>
<td>29</td>
</tr>
<tr>
<td>2. Demographics by Satisfaction Status</td>
<td>31</td>
</tr>
<tr>
<td>3. KOOS Scores at the First Preoperative Visit</td>
<td>32</td>
</tr>
<tr>
<td>4. KOOS Scores at the Last Preoperative Visit</td>
<td>33</td>
</tr>
<tr>
<td>5. KOOS Score Progression from First to Last Preoperative Visit</td>
<td>33</td>
</tr>
<tr>
<td>6. Statistically Significant Contributors to the Multiple Logistic Regression Model Predicting Satisfaction</td>
<td>35</td>
</tr>
<tr>
<td>Chapter 3</td>
<td></td>
</tr>
<tr>
<td>1. Postoperative Rehabilitation Schedule and Goals</td>
<td>48</td>
</tr>
<tr>
<td>2. Demographics by Satisfaction Status</td>
<td>50</td>
</tr>
<tr>
<td>3. Range of Motion and Strength Differences at the First Physical Therapy Visit</td>
<td>51</td>
</tr>
<tr>
<td>4. Range of Motion, Strength, and TUG Test Differences at the Last Physical Therapy Visit</td>
<td>52</td>
</tr>
<tr>
<td>5. Progression in Range of Motion and Strength from the First to Last Physical Therapy Visit</td>
<td>53</td>
</tr>
<tr>
<td>6. Logistic Regression to Predict Satisfaction</td>
<td>54</td>
</tr>
<tr>
<td>7. Logistic Regression to Predict Satisfaction without TUG Test</td>
<td>56</td>
</tr>
</tbody>
</table>
Chapter 4

1. Subject Demographic Information and Satisfaction Status........................................ 70
2. Postoperative Rehabilitation Schedule and Goals................................................... 73
3. Emergent Themes – Number of References and Subjects........................................ 76
4. Exemplary Quote from the Emergent Themes....................................................... 77
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chapter 2</strong></td>
<td></td>
</tr>
<tr>
<td>1. CONSORT diagram showing study population</td>
<td>27</td>
</tr>
<tr>
<td>2. Percent of patients reaching MCID with preoperative physical therapy</td>
<td>34</td>
</tr>
<tr>
<td><strong>Chapter 3</strong></td>
<td></td>
</tr>
<tr>
<td>1. CONSORT diagram showing the formulation of the study population</td>
<td>46</td>
</tr>
<tr>
<td><strong>Chapter 4</strong></td>
<td></td>
</tr>
<tr>
<td>1. Emergent themes and subthemes</td>
<td>75</td>
</tr>
</tbody>
</table>
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 1</td>
<td></td>
</tr>
<tr>
<td>INFORMED CONSENT FORM</td>
<td>17</td>
</tr>
<tr>
<td>Chapter 4</td>
<td></td>
</tr>
<tr>
<td>INTERVIEW GUIDE</td>
<td>91</td>
</tr>
</tbody>
</table>
CHAPTER 1

SATISFACTION RATES FOLLOWING TOTAL KNEE ARTHROPLASTY

Introduction

One of the most common surgical treatment options for knee osteoarthritis is a total knee arthroplasty, which utilizes a combination of metal and plastic to resurface the damaged cartilage surfaces of the knee, leading to decreased pain and improved function for the patient.\textsuperscript{3,8,13,15} Patients electing to have a total knee arthroplasty have shown Knee Injury and Osteoarthritis Outcome Scores of 82, nearly to the level of the general healthy population for patients in the same age demographic.\textsuperscript{21,23} Postoperative success is often related to success with perioperative physical therapy. Patients who participate in formal therapy demonstrated higher quadriceps strength and better functional scores compared to those that did not.\textsuperscript{17} Despite the overall success rate and high subjective scores following surgery, many patients are left dissatisfied after surgery.\textsuperscript{6,7} A study by Bourne et al. demonstrated that nearly 20\% of patients having a primary total knee arthroplasty are dissatisfied one year after surgery.\textsuperscript{6} However, the lack of highly validated measures for satisfaction has hindered the drive to improve satisfaction.\textsuperscript{11} Goodman et al. demonstrated that there was a moderate correlation between a validated Likert scale of satisfaction and pain and function after surgery, however this does not explain why satisfaction rates can be so low at times given subjective scores are generally considered good.\textsuperscript{11,23} Many
reasons are thought to affect satisfaction rates following surgery, however there is not a general consensus as to what truly makes someone satisfied or dissatisfied.\textsuperscript{7,10,12,16}

Recent studies have pointed to both subjective and objective factors, preoperatively and postoperatively, that can lead to postoperative satisfaction.\textsuperscript{10,12,16} From a psychological standpoint, two recent studies have demonstrated the importance of preoperative communication and education on setting realistic expectations when it comes to postoperative satisfaction.\textsuperscript{10,16} Klem et al. indicated that satisfaction is related to whether or not preoperative expectations were met, thus putting more emphasis on preoperative education.\textsuperscript{16} Furthermore, preoperatively, patients with unrealistically high hopes for complete symptom resolution and restoration of normal function may want to reconsider surgery in general to avoid postoperative dissatisfaction.\textsuperscript{16} Gautreau et al. demonstrated that improved communication between the patient and surgeon can increase satisfaction rates, further indicating that proper perioperative education can help improve outcomes.\textsuperscript{10}

Objectively, satisfaction has been linked to postoperative flexion range of motion, due to being able to complete flexion related activities easier compared to those that are stiff.\textsuperscript{12} Postoperative flexion has been correlated to preoperative flexion; therefore, theoretically, patients should strive to maximize knee flexion prior to surgery.\textsuperscript{9} Benner et al. have shown that knees with varying degrees of osteoarthritis, including those that are candidates for a total knee arthroplasty, can improve flexion, therefore, some type of conservative management should be trialed before moving towards a total knee arthroplasty.\textsuperscript{4}

Knowing that preoperative physical therapy can improve the objective condition of the knee and that is known to positively affect postoperative satisfaction, having each patient trial
therapy prior to surgery can be beneficial.\textsuperscript{2, 9} Preoperative physical therapy also provides the opportunity to determine how other objective and subjective factors can positively, or negatively, affect postoperative satisfaction. Physical therapists are members of the interdisciplinary team taking care of patients around the time of surgery that typically spends the most time with the patients. In this extended time seeing the patients preoperatively, there is ample time for education regarding surgery as well as what to expect postoperatively. Preoperative education given by a physical therapist has been shown to reduce the time to reach short term, postoperative goals; however, this has not been examined in regards to long term postoperative satisfaction.\textsuperscript{17}

Theoretical Framework

An important aspect of analyzing a problem and determining ways to solve it is structuring the problem within a theoretical framework. In an article discussing the importance of developing a theoretical framework when trying to solve a problem, Gabriel Abend states “what can be known, what is worth knowing, what kind of questions can be asked, what counts as good evidence, whom are we talking to, what the social world is made of, what properties can these entities have, how they fit together, and so on.”\textsuperscript{1} An interpretation of this statement from Abend as it relates to orthopedics could read: what do we know about satisfaction rates following a total knee arthroplasty, what studies can be developed to know more, who needs these answers, what does the resolution yield, and how are these results going to be implemented into practice? Moving from the foundation and meaning of theory in the social sciences to a more practical application for an orthopedic research project, a theoretical framework to build a around is the
Assessment-Diagnosis-Treatment-Outcome (ADTO) theory. The ADTO theoretical framework was first introduced by Spratt et al. in 2002 as a way to determine why orthopedic medical research has not improved medical care despite using sound designs like randomized controlled trials.25,26

The ADTO theoretical framework specifically examines at the four aspects that make it up (assessment, diagnosis, treatment, and outcomes) simultaneously as it relates to patient care and the outcomes of interest.26 The ADTO framework is built with the assumption that the individual parts are well understood, however a link between the parts appears to be missing.26 For example, treatment and outcomes are both understood individually, however the connection between what treatment leads to better or worse outcomes is still misunderstood as it relates to the assessment and diagnosis.26 Within the literature for total knee arthroplasties, it has been documented that the overall subjective scores (outcome) after surgery are considered good due to improving measures like postoperative knee flexion (treatment), however, these results are misunderstood as satisfaction based on preoperative measures is unknown (assessment/diagnosis).6,12,23 Spratt et al. believed that looking at the results of a study in a vacuum and only assessing two aspects of the ADTO framework can lead to a misinterpretation of the results.26 His claim to this common mistake and misinterpretation of results holds true in the orthopedic community as it relates to outcomes after total knee arthroplasty due to most studies simply looking at diagnosis and outcomes, for example, determining subjective scores based on component type only without looking into objective measures.18 Developing a study utilizing this theoretical framework potentially provides a deeper meaning of the outcomes and
thus offer more meaningful clinical relevance for the practitioners counseling patients having a total knee arthroplasty.

The ADTO theoretical framework is also appropriate in orthopedic research due to the interdisciplinary nature of the field. Rarely does one orthopedic professional treat all four aspects within the ADTO framework as more realistically it is only one or two. For example, the surgeon is usually the one treating the diagnosis aspect (knee osteoarthritis), while the physical therapist is focused on treatments (strength and psychological interventions). However, everyone involved is striving for the best outcome possible, therefore, everyone must work together to increase satisfaction rates after surgery. Designing studies under this framework, of which the results can impact clinicians in multiple professions, can lead to meaningful change in orthopedics and improve outcomes by improving treatment modalities.

Goals of the Research Studies

Ultimately, the goal of research to determine factors leading to postoperative satisfaction following a total knee arthroplasty is to provide the treating clinicians with a focus of treatment and factors to address during the course of perioperative rehabilitation. After determining these factors, orthopedic surgeons and physical therapists would be able to tailor certain treatment modalities and develop goals that focus on these aspects of rehabilitation to ensure they are met. These newfound treatment modalities could include an increased focus on quadriceps strengthening exercises, ensuring symmetric extension range of motion, or working on the psychological aspect of recovery before or after surgery. There are multiple approaches to utilize
in order to determine these factors, including both retrospective and prospective research designs, as well as quantitative and qualitative analyses.

The following chapters include three studies aimed at targeting factors that are proven to lead to satisfaction after a total knee arthroplasty. The first study was a retrospective look at subjective progression before surgery and how the improvement or regression in function prior to surgery is associated with postoperative satisfaction. The second study is similar in nature, however this one looked at preoperative rehabilitation from an objective standpoint. Specifically, it assessed the association between preoperative range of motion, strength, and mobility and postoperative satisfaction. Lastly, the third study assessed these patients qualitatively to determine common themes between like patients that lead to postoperative satisfaction or dissatisfaction.

In summary, the purposes of the proposed three study manuscript dissertation are threefold: one, determine preoperative subjective factors that can positively affect postoperative satisfaction; two, determine preoperative objective factors that affect postoperative satisfaction; and three, determine how preoperative education, through a course of physical therapy, affects postoperative satisfaction.

Preview of Papers and Methodology

Study #1: Subjective Factors Leading to Satisfaction Following Total Knee Arthroplasty

Introduction

The first study for the dissertation was a retrospective cohort study that examined subjective scores before surgery in order to determine the impact they have on postoperative
satisfaction. It has been shown that preoperative patient reported outcome measures can be predictive of postoperative satisfaction, however the clinical usefulness is questioned. In a separate study assessing preoperative patient reported outcome measures and their effect on postoperative improvement, Berliner et al. found that those over a defined threshold were less likely to show meaningful improvement after surgery, meaning there appears to be a ceiling effect in place. The gap in these types of studies is the role that physical therapy can play in the preoperative process. Many patients are not seen for physical therapy prior to a total knee arthroplasty, therefore the benefits of the combination of education and exercise a physical therapist can provide are poorly understood. From the limited evidence that exists on the topic, it appears that postoperative results can benefit from preoperative education and conditioning, however long term surgical satisfaction is not currently known. Through a formal research study, the aim was to determine how preoperative physical therapy success, per patient reported outcome measures, affects postoperative satisfaction, thus allowing physical therapists and surgeons to make better preoperative healthcare decisions.

Overall, the study aimed to answer the following research question: Do preoperative gains in subjective function, through a course of physical therapy, affect postoperative satisfaction? The hypothesis was that preoperative gains in subjective function would improve the likelihood of being satisfied with surgery.

Methodology

Patients were selected from the established research database at the Shelbourne Knee Center in Indianapolis, IN. All surgical patients were consented into a longitudinal outcomes study following a total knee arthroplasty, reviewed and approved by the Institutional Review
Board of Community Health Network (IRB #201501003). An a priori power analysis revealed that the minimum number of patients needed to detect a meaningful change was 158 patients. All patients had surgery between the years 2012 and 2022. The sample size was calculated based on an effect size of 0.25 and 0.80 power, utilizing two groups. Inclusion criteria included unilateral and staged procedures, with the second surgery in the staged setting coming ≥365 days after the first surgery. All total knee arthroplasties were performed by the same surgeon at the Shelbourne Knee Center. Exclusion criteria included revision surgery, missing a satisfaction survey at a minimum one year postoperative, or having less than two physical therapy visits before surgery. Through a retrospective review of patient records, patients were separated based on their satisfaction status, taken one year postoperative. The postoperative satisfaction survey that is distributed to every patient includes a Likert scale of satisfaction including: satisfied, somewhat satisfied, and dissatisfied. Satisfaction was defined as an answer of “satisfied” on the survey whereas dissatisfaction was defined as answering either “somewhat satisfied” or “dissatisfied”. Once the groups were established, the primary outcome was preoperative patient reported outcome measures including the Knee injury and Osteoarthritis Outcome Score with the five subscales of pain, symptoms, activities of daily living, quality of life, and sport, which has proven to show relatively high validity and reliability for measuring success after a total knee arthroplasty. The Knee Injury and Osteoarthritis Outcome Score was taken from their initial visit when the diagnosis of osteoarthritis was made through their final physical therapy visit prior to surgery. Beyond assessing their score at these preoperative time points, preoperative improvement was determined and defined as the difference between their final subjective score and initial subjective score.
Statistical analysis

The mean of the patient reported outcome measures for each group was compared utilizing a standard t test or Mann-Whitney U test, depending on the normality of the data, which was determined by the Shapiro-Wilk test. For categorical data, Chi-square or Fisher’s exact test was utilized to compare frequency distributions. All continuous data were reflected as means and standard deviations while all categorical data were reflected as frequencies in the form of N and percentages. All analysis was performed using IBM SPSS version 25 (IBM; Chicago, IL) and the level of significance was set at p<0.05.

Study #2: Objective Factors Leading to Satisfaction Following Total Knee Arthroplasty

Introduction

The second study of the dissertation assessed the impact physical therapy had on postoperative satisfaction from an objective standpoint. There have been multiple reports indicating that better preoperative objective measures can improve postoperative outcomes in the short term, 6-12 weeks, however, the long term impact is unknown. Wang et al. reported that those who participated in preoperative physical therapy demonstrated better postoperative range of motion, quadriceps strength, and subjective scores following surgery. However, despite showing to have better scores after surgery, the outcomes have only been tested in the short term and long term research is needed. Through a formal research study, the aim was to determine how preoperative physical therapy success, measured by overall values and improvements in objective range of motion, strength, and gait speed, affected long term postoperative satisfaction. Determining how preoperative objective function affects long term satisfaction following total
knee arthroplasty allows for physical therapists to tailor treatment for patients prior to a total knee arthroplasty.

Overall, the study aimed to answer the following research question: How does preoperative objective function impact postoperative satisfaction? The hypothesis was that improved objective measures of range of motion, strength, and mobility taken before surgery would lead to higher levels of satisfaction after surgery.

Methodology

For this retrospective cohort study, patients were selected from the established research database at the Shelbourne Knee Center in Indianapolis, IN. All surgical patients were consented into a longitudinal outcomes study following a total knee arthroplasty, reviewed and approved by the Institutional Review Board of Community Health Network (IRB #201501003). An a priori power analysis was completed and it was demonstrated that at least 158 patients were needed. All patients had surgery between the years 2012 and 2022. The sample size was calculated based on an effect size of 0.25 and 0.80 power utilizing two groups. Inclusion criteria included primary and unilateral total knee arthroplasties performed by the same surgeon at the Shelbourne Knee Center. Exclusion criteria included missing a satisfaction survey at a minimum of 1 year postoperative or having less than two physical therapy visits before surgery. Through a retrospective review of patients in the database, patients were separated based on their satisfaction status, taken at one year postoperative. The postoperative satisfaction survey that is distributed to every patient includes a Likert scale of satisfaction including: satisfied, somewhat satisfied, and dissatisfied. Satisfaction was defined as an answer of “satisfied” on the survey whereas dissatisfaction was defined as answering either “somewhat satisfied” or “dissatisfied”.
Once the groups were established, the primary outcome was preoperative range of motion (knee flexion and extension), quadriceps strength measured isokinetically (HumacNorm, CSMI; Stoughton, MA), and gait speed via the timed up and go test. Range of motion measures were taken from the database and represented as degrees both as raw values as well as the difference between the initial visit and final visit prior to surgery. Quadriceps strength was taken from the database and represented as a percentage (involved/noninvolved, multiplied by 100) and normalized to body weight (Nm/Kg). Lastly, gait speed was extracted from the database and represented as the result of the timed up and go test, measured in seconds.

Statistical analysis

The preoperative objective measure mean of the three groups were compared utilizing standard t test or Mann-Whitney U tests, depending on the normality of the data. For categorical data, Chi-square or Fisher’s exact test were utilized to compare frequency distributions. All continuous data were reflected as means and standard deviations while all categorical data were reflected as frequencies in the form of percentages. All analysis was performed using IBM SPSS version 25 (IBM; Chicago, IL) and the level of significance was set at p<0.05.

Study #3: Factors Leading to Satisfaction Following Total Knee Arthroplasty: A Qualitative Analysis

Introduction

The aim of this study was to explore patients’ perspectives of preoperative physical therapy and its perceived influences on postoperative satisfaction. A recent study by Klem et al. suggests that patients who have unrealistically high expectations of surgery preoperatively may
want to steer away from surgery as they were found to have higher rates of dissatisfaction following a total knee arthroplasty. Postoperatively, for patients that continue to have painful symptoms, clinicians are encouraged to advise them to address modifiable negative thoughts through psychological interventions. In a separate study, it was shown that perioperative communication between the healthcare provider and the patients led to more positive outcomes after surgery. Physical therapists are in the unique position, both preoperatively and postoperatively, where they spend a large amount of time with the patient to make improvements physically and mentally. Although qualitative studies assessing outcomes after a total knee arthroplasty have been performed, specifically assessing satisfaction based on questions about their rehabilitation prior to and after surgery is currently unknown. Designing a qualitative study, including questions about perioperative rehabilitation, can provide answers that could drive physical therapy treatment for patients having a total knee arthroplasty.

Overall, the study aimed to answer the following research question: What common themes exist between patients reporting satisfaction after a total knee arthroplasty, when it comes to perioperative rehabilitation?

**Methodology**

Patients were purposefully recruited and selected from the Shelbourne Knee Center in Indianapolis, IN. Patients were consented, using the informed consent form in Appendix A, into a study that was reviewed and approved by the IRB at the institution where surgery was performed, Community Health Network (IRB #201501003). Patients were recruited until a point of data saturation was reached, indicating that no new findings came from further interviews. Satisfaction was determined based on the response of a one-year postoperative survey given to
the patient with possible answers of: satisfied, somewhat satisfied, and dissatisfied. Satisfaction was defined as an answer of “satisfied” on the survey whereas dissatisfaction was defined as answering either “somewhat satisfied” or “dissatisfied”. Patients were interviewed by the same physical therapist at the Shelbourne Knee Center, utilizing a semi-structured interview guide. The interview guide was drafted by the investigator and vetted by a panel of content experts (n=7) for relevance and clarity. Following the interview, each one was transcribed and analyzed for common themes utilizing an inductive content analysis approach.  

Statistical analysis

After the interviews were transcribed and the data was analyzed for common themes between groups utilizing Nvivo software (QSR International; Burlington, MA). In order to establish trustworthiness of the data, a qualitative research expert was used as a peer debriefer to examine the transcripts, coding sheets, and logic for aligning coded concepts into specific themes.
References


APPENDIX:

INFORMED CONSENT FORM
INFORMED CONSENT TO PARTICIPATE IN RESEARCH

PROTOCOL TITLE: Factors Associated with Long-Term Success after Total Knee Arthroplasty

PRINCIPAL INVESTIGATOR: Rodney W. Benner, MD

Sub investigator: Scot Bauman, PT, DPT

SPONSOR: Rodney W. Benner, MD

INTRODUCTION:
You are being asked to take part in a research study. Research studies include only people who choose to take part voluntarily. You may choose not to take part or may leave the study at any time. Leaving the study will not result in any penalty or loss of benefits to which you are entitled. This document is called an informed consent form. Please read this information carefully and take your time making your decision. Ask the researcher or study staff to discuss this consent form with you, please ask him/her to explain any words or information you do not clearly understand. We encourage you to talk with your family and friends before you decide to take part in this research study. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below.

You are invited to take part in a research study called: Factors Associated with Long-Term Success after Total Knee Arthroplasty

You were selected as a possible participant because you have been diagnosed with knee osteoarthritis and you either 1) are a candidate for a total or partial knee replacement, 2) have had a knee replacement surgery at Westview Hospital or Community East Hospital by the principal investigator, or 3) have had a knee replacement surgery at Methodist Hospital and were enrolled in Dr. Benner’s total knee replacement research study associated with the Institutional Review Board at IU Health.

We ask that you read this form and ask any questions you may have before agreeing to be in the study.

The person who is charge of this study is Rodney W. Benner, MD. This person is called the Principal Investigator. Other people may be involved with this study and can act on his/her behalf. If you have any questions regarding this study, you may contact Dr. Benner at Shelbourne Knee Center at Community Health Network, 1500 North Ritter Avenue, Suite 500, Indianapolis, IN. 46219, or 317-924-8636 during business hours. If you have any questions regarding your rights as a research participant, you may contact the Community Health Network Human Subjects Office at (317) 355-5675.

PURPOSE:
The purpose of this study is to determine the long-term outcomes of total knee replacement surgery when a rehabilitation program is completed before and after surgery. Specifically, we are looking for surgery and rehabilitation factors that are associated with good or less than desirable function in the long-term after surgery. The factors we intend to look at include: the amount of movement and strength your knee has before and after surgery, the amount of arthritis you had before surgery, the alignment of your knee before and after surgery, your age, your sex, and your activity level. Another purpose of this study is to determine the rate of complications after total knee replacement surgery.

NUMBER OF PEOPLE TAKING PART IN THE STUDY:
If you agree to participate, you will be one of a maximum of 400 subjects per year who will be participating in this research.

PROCEDURES:
If you agree to be in the study, you will do the following things:
• You will take part in a standard of care treatment program, including rehabilitation, before and after your surgery.
• You will return to the Shelbourne Knee Center for treatment at 1 week, 2 weeks, 1 month, 2 months, 3 months, 6 months, and 9 months after your total knee replacement surgery. This is standard of care follow-up for patients undergoing total knee replacement surgery.
• Long-term follow-up with the physician at 1, 2, 5, 7, 10, years and then every 5 years after your total knee replacement surgery is also considered standard of care. Follow-up visits with the physician at these timeframes are recommended to allow for early detection of any problems before they become symptomatic and more difficult to treat.
• The above standard-of-care services will be billed to you or your insurance provider.
• If you have been previously discharged from PT and are unable or unwilling to see the physician for long-term follow-up (1, 2, 5, 7, 10, years and then every 5 years after surgery), you may instead choose to return for a research visit at no charge. These research visits would consist of the following:
  • Your knees will be examined by a physical therapist or athletic trainer to determine knee motion, laxity, strength, and soreness.
  • You will undergo a physical test that involves about 5 seconds of maximum muscle work.
  • You will undergo an x-ray exam of your knees. You will not be charged for x-rays taken during a research visit.
  • You will fill out several surveys about your knee and the activities that you have been doing.

• Information will be abstracted from your medical record including: demographic Information, medical and surgical history. Home address and zip code will be used to obtain an area deprivation index value which will be derived by inserting that information into third party, password protected, software system designed for producing these values. This information will be used for research purposes in our data analysis. All data will be de-identified in order to maintain confidentiality.
Please note that you will not be seen by the physician if you choose to do a research-only visit. The purpose of a research visit would be to collect information about how you are doing, not to provide advice or treatment. These visits would last approximately 45-60 minutes.

A subset of patients, at minimum of one year from surgery, will be selected for a phone interview regarding their outcome from their total knee arthroplasty. The interview will be conducted over the phone by a staff member at the Shelbourne Knee Center, recorded and transcribed for accuracy, and analyzed qualitatively for common themes. The phone call is expected to last 30 minutes in duration. Questions during the interview would be related to how the surgery process went overall, how rehabilitation before and after surgery affected the outcome, and how activities are being tolerated at the current time. The transcripts would remain in a password protected file and only accessible by authorized staff members. None of the answers would be linked to any one person, instead, analyzed for themes among the group.

RISKS/DISCOMFORTS:
While on the study, the risks are

- An average risk of minor leg or knee soreness from the physical testing and examination.
- Loss of confidentiality is another possible risk that you might experience if you take part in this research study.
- Radiographic evaluation (normal x-rays) involves minimal risk of exposure to radiation. This radiation exposure is for research purposes only and is not necessary for your medical care. The average whole body radiation exposure to a person in the United States is about 360 mrem per year. The amount of radiation patients receive in this study is equivalent to a whole body exposure of less than one day of natural background radiation.
- There is a risk that you may be uncomfortable answering the questions on the surveys.

There also may be other risks, discomforts or side effects that we cannot predict.

If you are sore from the examination or testing, you will be given an ice bag to ice your knee after the examination. Upon request, your abdomen and pelvic area will be shielded with a lead apron during x-ray examinations to reduce your exposure to radiation. While completing the surveys you can tell the researcher that you feel uncomfortable or do not care to answer a particular question.

BENEFITS:
While there is no guarantee that you will benefit directly, the knowledge gained from your participation may help others.

ALTERNATIVES TO PARTICIPATION:
Instead of being in the study, you have these options: You can choose not to take part. Not taking part will not affect your future treatment.
CONFIDENTIALITY:
Efforts will be made to keep your personal information confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Your identity will be held in confidence in reports in which the study may be published and databases in which results may be stored.

Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the study investigator and his/her research associates, the Community Health Network Institutional Review Board or its designees, study sponsor, and (as allowed by law) state or federal agencies (specifically the Office for Human Research Protections (OHRP) and the Food and Drug Administration (FDA) may need to access your medical and/or research records.

COSTS:
Taking part in this study may lead to added costs to you or your insurance company. You or your insurance company will be responsible for the following costs: the cost of the knee replacement surgery and any associated hospital charges, preoperative and postoperative x-rays, the preoperative physician and physical therapy visits, and the postoperative physician and physical therapy visits. All physician visits after the 90 day global period (90 days after the date of surgery), will be charged to you or your insurance company. You will not be responsible for these study-specific costs: If you are unable or unwilling to see the physician for long-term follow-up (1, 2, 5, 7, 10 years and then every 5 years after surgery), you may instead choose to return for a research visit (therapy testing and x-rays only) at no charge.

COMPENSATION:
You will not receive compensation for time and travel associated with this study.

COMPENSATION FOR INJURY:
In the event of physical injury resulting from your participation in this research, necessary medical treatment will be provided to you and billed as part of your medical expenses. Costs not covered by your health care insurer will be your responsibility. Also, it is your responsibility to determine the extent of your health care coverage. There is no program in place for other monetary compensation for such injuries. However, you are not giving up any legal rights or benefits to which you are otherwise entitled.

CONTACTS FOR QUESTIONS OR PROBLEMS:
For questions about this study contact the researcher, Rodney Benner, MD at 317-924-8636 or 888-349-5633. After business hours, please call 317-924-8636 or 888-349-5633. This is a 24-hour telephone number.

In the event of an injury believed to be related to the study, please contact Rodney Benner, MD at 317-924-8636 or 888-349-5633.
In an emergency please contact 911 or report to an emergency department immediately. If you require emergency care, be sure to tell the emergency care provider about your participation in this study. Contact the study doctor or study staff as soon as possible.

For questions about your rights as a research participant or to discuss problems, complaints or concerns about a research study, or to obtain information, or offer input, contact the Community Health Network Human Subjects Office at (317) 355-5675.

VOLUNTARY NATURE OF STUDY:
Taking part in this study is voluntary. You may choose not to take part or may leave the study at any time. If you choose to leave the study you are required to notify an employee of the Shelbourne Knee Center of your desire to withdraw. You will not be contacted for further research follow-up. Any data that has been collected will be retained and all analysis will be done with de-identified data. Leaving the study will not result in any penalty or loss of benefits to which you are entitled. Your decision whether or not to participate in this study will not affect your current or future relations with Community Health Network. Withdrawal from the study prior to completion may pose additional risk to you. You should discuss any additional known risks with the principal investigator prior to withdrawing from this study. There may also be unknown risks associated with withdrawing from the study prior to completion. If mailed surveys and/or study correspondence are returned to the Shelbourne Knee Center due to an incorrect address, we will use an online address-locating program to find the correct address so that we can continue study follow-up. Additional methods that may be utilized to initiate study follow-up include telephone calls, US mail, email and text messaging. Text messaging would originate with the 3rd party electronic survey system used by the Community Health Network.

Your participation may be terminated by the investigator without regard to your consent at any time. This study may also be terminated by Dr. Benner at any time. You will be notified if either your participation or the study is terminated.

LEGAL RIGHTS:
You are not waiving any legal rights or releasing the hospital, your physician or the sponsor of this study from liability for negligence by signing this consent form.

VOLUNTARY CONSENT:
I certify that I have read this informed consent, or it has been read to me, that I have had the opportunity to ask questions, and that I voluntarily agree to participate in this research study.
Please keep a copy of this Informed Consent for your records.

_________________________________________________________
Patient (printed name)

Required of all patients fourteen (14) years of age and older.

_________________________________________________________
Patient Signature

Required of all patients fourteen (14) years of age and older.

_________________________________________________________
Legal Representative/ Witness (printed name) & Relationship to Patient (if applicable)

_________________________________________________________
Legal Representative/ Witness Signature (if applicable)

Date

_________________________________________________________
Printed Name of Person Obtaining Signature (Investigator or delegate)

_________________________________________________________
Signature of Person Obtaining Signature (Investigator or delegate)

Date
CHAPTER 2

SUBJECTIVE FACTORS LEADING TO SATISFACTION FOLLOWING TOTAL KNEE ARTHROPLASTY

Introduction

One of the most common surgical treatment options for knee osteoarthritis (OA) is a total knee arthroplasty (TKA).\textsuperscript{8,13} A TKA is a common surgery that utilizes a combination of metals and plastics to resurface the damaged cartilage surfaces of the knee, leading to decreased pain and improved function for the patient.\textsuperscript{1,8,15} Patients electing to have a TKA have generally shown adequate results following surgery as, in one study, the Knee Injury and Osteoarthritis Outcome Scores (KOOS) averaged 82, nearly the level of the general healthy population for patients in the same age demographic of those having surgery.\textsuperscript{19,21} Despite the overall success rate and high subjective scores following surgery, many patients are left dissatisfied after surgery.\textsuperscript{5,6} A study by Bourne et al. demonstrated that nearly 20\% of patients having a primary TKA are dissatisfied one year after surgery.\textsuperscript{5} However, the lack of highly validated measures for satisfaction has hindered the drive to improve satisfaction.\textsuperscript{10} Goodman et al. demonstrated that there was a moderate correlation between a validated Likert scale of satisfaction and pain and function after surgery, however this does not explain why dissatisfaction rates can be so high at times given that the subjective scores are generally considered good.\textsuperscript{10,21} Many reasons are thought to affect
satisfaction rates following surgery, however there is not a general consensus as to what truly makes someone satisfied or dissatisfied.\textsuperscript{5, 8, 10, 13}

Recent studies indicate both subjective and objective factors, preoperatively and postoperatively, that can lead to postoperative satisfaction.\textsuperscript{9, 12, 16} From a psychological standpoint, two recent studies have demonstrated the importance of preoperative communication and education on setting realistic expectations for postoperative satisfaction.\textsuperscript{9, 16} Klem et al. indicated that satisfaction is related to whether or not preoperative expectations were met, thus putting more emphasis on preoperative education.\textsuperscript{16} Furthermore, preoperatively, patients with unrealistically high hopes for complete symptom resolution and restoration of normal function may want to reconsider surgery in general to avoid postoperative dissatisfaction.\textsuperscript{16} Gautreau et al. demonstrated that improved communication between the patient and surgeon can increase satisfaction rates, further indicating that proper perioperative education can help improve outcomes.\textsuperscript{9}

A physical therapist seeing a patient prior to surgery puts the patient in a situation where ample communication and education can be obtained.\textsuperscript{7} Beyond providing education and communication, physical therapy can improve subjective and objective functioning of the knee which is known to positively affect postoperative outcomes, therefore, having each patient trial therapy prior to surgery can be beneficial.\textsuperscript{2, 9} Preoperative physical therapy also provides the opportunity to determine how other objective and subjective factors can positively, or negatively, affect postoperative satisfaction. Physical therapists are known members of the interdisciplinary team taking care of these patients who typically spends the most time with the patients, therefore, in this extended time seeing the patients preoperatively, there would be ample time for education
regarding surgery as well as postoperative expectations. Expectations set prior to surgery have been shown to have a direct link to postoperative satisfaction, further placing an importance on this type of education provided by a physical therapist. Preoperative education given by a physical therapist can reduce the time to reach short term postoperative goals; however, this has not been examined in regards to long term postoperative satisfaction.

The purpose of this study was to determine preoperative subjective factors that can positively affect postoperative satisfaction. Specifically, the aim was to determine if subjective progression or regression with preoperative rehabilitation leads to postoperative satisfaction or dissatisfaction following a TKA. The hypothesis was that those who reported satisfaction after surgery would have better subjective scores and a better progression in these scores throughout the course of preoperative rehabilitation when compared to those that reported dissatisfaction.

Methods

Study design

This study used a retrospective cohort design.

Patient selection

Between 2012 and 2021, 1337 patients had a primary TKA performed by a single surgeon at a knee specialty clinic. Prior to surgery, all patients gave informed consent to participate in the study, which was approved by the institutional review board at the institution where surgery was performed. Data were retrospectively collected for patients with the inclusion criteria of patients having a unilateral or staged procedure, with the second surgery in the staged setting coming ≥365 days from the first surgery (N = 1337). Patients were excluded if the
surgery being performed was a revision surgery (N = 124), were missing a satisfaction survey at a minimum one year following surgery (N = 449), or had less than two physical therapy visits prior to surgery that included the patient filling out a KOOS score (N = 561). Ultimately, 203 patients met inclusion and were used for analysis (Figure 1).

![ CONSORT diagram showing study population.](image)

*Surgical procedure*

Each participant had surgery performed by the same surgeon at the institution. The surgeon in all 203 cases utilized Zimmer components (Zimmer Biomet; Warsaw IN) comprising of the following componentry: Persona PS system (N = 142), LPS Flex (N = 47), and LCCK with constrained polyethylene (N = 4). The patella was resurfaced in 117 cases (57.6%), utilizing a polyethylene button on the patella.
Rehabilitation

Prior to surgery, each patient trialed rehabilitation with a physical therapist at the institution with the hopes of avoiding or delaying surgery. Preoperative physical therapy was standard for all participants and was aimed at maximizing range of motion (ROM) first followed by strength training, while minimizing swelling, improving function and reducing pain. Once the patient and treating physical therapist agreed that objective and subjective function was plateaued and if the patient was still having debilitating pain, the patient returned for a surgical consultation with the orthopedic surgeon. After this consultation visit, surgery was scheduled and performed at a mutually convenient time.

Following surgery, each patient followed a standard rehabilitation protocol, led by the treating physical therapist at the institution. Patients spent at least one night in the hospital and were discharged when they achieved satisfactory leg control, adequate ROM, manageable pain, and could walk independently with a walker. Upon getting home, patients followed a relative bed rest period for the first seven days following surgery, only permitted to walk to the bathroom and back, using a standard or rolling walker, in order to keep swelling to a minimum. During the first week at home, they performed five exercises: heel prop and towel stretches for knee extension, heel slides for knee flexion, and straight leg raises and quadriceps sets for leg control. The first in office visit was on postoperative day seven. Rehabilitation was first aimed at reducing swelling, maximizing ROM, and normalizing gait. Once these were normalized, the focus was placed on strengthening which was aimed at maximizing function. Patients were discharged once objective and subjective goals were met. The rehabilitation schedule and philosophy can been seen in Table 1.
<table>
<thead>
<tr>
<th>Table 1: Postoperative rehabilitation schedule and goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Postoperative time</strong></td>
</tr>
</tbody>
</table>
| **Day 1** | 1. Satisfactory leg control  
           2. Adequate ROM\(^a\)  
           3. Manageable pain  
           4. Walk independently with a walker |
| **Day 7** | 1. Knee extension to 0 degrees  
          2. Knee flexion to 90 degrees  
          3. Have the ability to perform a straight leg raise  
          4. Normal gait, with or without a walker |
| **Day 14** | 1. Maintain full extension  
           2. Progress flexion  
           3. Reduce swelling from the 1 week appointment  
           4. Normal gait with or without an assistive device |
| **1 month** | 1. Maintain extension  
             2. Progress flexion  
             3. Normal gait without assistive device  
             4. Reduce swelling from the 2 week appointment  
             5. Isokinetic and isometric strength tests: \(\geq 50\%\) LSI\(^b\) |
| **2 months** | 1. Maintain extension  
              2. Attain normal flexion per IKDC\(^c\) objective form  
              3. Reduce swelling from the 1 month appointment  
              4. Progress strength towards 90% or more with LSI |
| **4 months** | 1. Maintain ROM  
              2. Normal or nearly swelling per fluid wave test  
              3. Progress strength towards 90% or more with LSI |
| **6 months** | 1. Maintain ROM  
                2. Maintain swelling level  
                3. Progress strength towards 90% or more with LSI |
| **9 months** | 1. Maintain ROM  
                2. Maintain swelling level  
                3. Progress strength towards 90% or more with LSI |
| **1 year** | Discharge with normal ROM, swelling, and strength |

*Note:* ROM\(^a\): Range of motion  
LSI\(^b\): Limb symmetry index  
IKDC\(^c\): International Knee Documentation Committee  
Early discharge, before 1 year, occurred with normal ROM, swelling, and strength
Data collection

Patient demographics and characteristics were prospectively collected and entered into the internal database at the institution. Retrospectively, each participant was labeled as being satisfied or dissatisfied based on their response to the survey distributed at a minimum one year from surgery. The survey included a simple question asking how satisfied the patient was with surgery, listing three options: satisfied, somewhat satisfied, and dissatisfied. Satisfied was defined as those answering the survey as “satisfied” and dissatisfied was defined as those answering either “somewhat satisfied” or “dissatisfied”. The KOOS was distributed at the initial visit when the diagnosis of OA was made as well as at the last physical therapy visit before surgery. The KOOS, scored 0-100 with 100 indicating no pain and normal function, has been validated and proved reliable for the OA and TKA population.\(^{20}\) Raw values for the KOOS taken at the initial visit as well as at the last physical therapy visit were used for analysis. Furthermore, the change in KOOS score between these dates was also used with positive numbers indicating an improvement in score and negative numbers indicating a drop in score through time. Patients were further grouped based on whether or not they reached the minimum clinically important difference (MCID) of 10 points for the KOOS during their trial of preoperative physical therapy.\(^{18,20}\)

Statistical analysis

All demographic information was reported as a mean and standard deviation and frequency being reflected as a percentage. Knee Injury and Osteoarthritis Outcome Scores were reported as means and standard deviations and were compared between groups using a standard t test or Mann-Whitney U test based on data normality that was tested via the Shapiro-Wilk test.
The change in KOOS scores over time was transformed into a binary variable based on whether or not the patients reached the MCID and was associated with satisfaction using chi-square or Fishers exacts tests. A backwards stepwise logistic regression was performed to determine the odds of attaining satisfaction, while accounting for confounding variables. An a priori power analysis was performed and based on an effect size of 0.25 and 0.80 power, it was determined that a minimum of 158 patients would be needed for the study. All statistical analyses were performed using IBM SPSS version 25 (International Business Machines Corporation; Armonk, NY) and statistical significance was set at \( p<0.05 \).

Results

Demographics

Of the 203 patients that met the inclusion for the study, 182 were satisfied, while 21 were labeled as dissatisfied. The mean age was for the population was 64.6±8.3 years and had 44.8% males. Demographic information by satisfaction group can be seen in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Demographics by satisfaction status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Sex (% male)</td>
</tr>
<tr>
<td>Laterality (% left)</td>
</tr>
<tr>
<td>Height (inches)</td>
</tr>
<tr>
<td>Weight (pounds)</td>
</tr>
<tr>
<td>( BMI^a ) (Kg/m(^2))</td>
</tr>
</tbody>
</table>

Note: BMI\(^a\): Body Mass Index
Outcomes

At the first visit when the diagnosis of OA was made, satisfied patients had a KOOS score of 47.6, compared to 44.5 for the dissatisfied patients, which was not statistically significantly different, \( p=0.422 \). At the final physical therapy visit before surgery, satisfied patients had a KOOS score of 44.0, compared to 41.2 for the dissatisfied patients, which was also not statistically significantly different, \( p=0.420 \). Throughout the course of rehabilitation, the satisfied patients, on average, dropped 3.6 points on the KOOS, whereas the dissatisfied patients dropped 3.3 points, which was not statistically significantly different, \( p=0.941 \). The total KOOS score, as well as the scores for each of the five subscales for both time points and the change over time can been seen in Tables 3-5.

Table 3

KOOS Scores at the First Preoperative Visit

<table>
<thead>
<tr>
<th>Table 3: KOOS scores at the first preoperative visit</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SEM</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KOOS(^a)-Pain</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>48.2</td>
<td>17.9</td>
<td>1.3</td>
<td>0.284</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>43.9</td>
<td>14.3</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td><strong>KOOS-Symptoms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>47.3</td>
<td>18.1</td>
<td>1.3</td>
<td>0.997</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>47.3</td>
<td>16.5</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td><strong>KOOS-ADL(^b)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>53.8</td>
<td>20.2</td>
<td>1.5</td>
<td>0.731</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>52.2</td>
<td>17.1</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td><strong>KOOS-Sport</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>27.2</td>
<td>23.1</td>
<td>1.7</td>
<td>0.263</td>
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<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>21.2</td>
<td>23.0</td>
<td>5.0</td>
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</tr>
<tr>
<td><strong>KOOS-QoL(^c)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>28.3</td>
<td>22.2</td>
<td>1.6</td>
<td>0.380</td>
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<tr>
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<td>21</td>
<td>32.8</td>
<td>19.7</td>
<td>4.3</td>
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<tr>
<td><strong>KOOS-Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Satisfied</td>
<td>182</td>
<td>47.6</td>
<td>16.9</td>
<td>1.3</td>
<td>0.422</td>
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<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>44.5</td>
<td>14.6</td>
<td>3.2</td>
<td></td>
</tr>
</tbody>
</table>

*Note: KOOS\(^a\): Knee injury and Osteoarthritis Outcomes Score
ADL\(^b\): Activities of Daily Living
QoL\(^c\): Quality of Life*
Table 4
KOOS Scores at the Last Preoperative Visit

<table>
<thead>
<tr>
<th>Table 4: KOOS scores at the last preoperative visit</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SEM</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KOOS&lt;sup&gt;a&lt;/sup&gt;-Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>45.9</td>
<td>16.1</td>
<td>1.2</td>
<td>0.388</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>42.8</td>
<td>14.2</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>KOOS-Symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>45.3</td>
<td>16.6</td>
<td>1.2</td>
<td>0.969</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>45.1</td>
<td>16.2</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>KOOS-ADL&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>51.7</td>
<td>19.2</td>
<td>1.4</td>
<td>0.463</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>48.5</td>
<td>17.2</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>KOOS-Sport</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>23.3</td>
<td>20.6</td>
<td>1.5</td>
<td>0.348</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>18.8</td>
<td>20.3</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>KOOS-QoL&lt;sup&gt;c&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>25.6</td>
<td>20.0</td>
<td>1.5</td>
<td>0.419</td>
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<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>23.3</td>
<td>10.6</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>KOOS-Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>182</td>
<td>44.0</td>
<td>15.4</td>
<td>1.1</td>
<td>0.420</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>21</td>
<td>41.2</td>
<td>13.7</td>
<td>3.0</td>
<td></td>
</tr>
</tbody>
</table>

Note: KOOS<sup>a</sup>: Knee injury and Osteoarthritis Outcomes Score
ADL<sup>b</sup>: Activities of Daily Living
QoL<sup>c</sup>: Quality of Life

Table 5
KOOS Score Progression from First to Last Preoperative Visit

<table>
<thead>
<tr>
<th>Table 5: KOOS score progression from first to last preoperative visit</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SEM</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KOOS&lt;sup&gt;a&lt;/sup&gt;-Pain</td>
<td></td>
<td></td>
<td></td>
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<td>KOOS-Symptoms</td>
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<tr>
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<td>KOOS-Sport</td>
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<tr>
<td>KOOS-QoL&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>0.941</td>
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<td>-3.3</td>
<td>10.2</td>
<td>2.2</td>
<td></td>
</tr>
</tbody>
</table>

Note: KOOS<sup>a</sup>: Knee injury and Osteoarthritis Outcomes Score
ADL<sup>b</sup>: Activities of Daily Living
QoL<sup>c</sup>: Quality of Life
In the study population, 16.7% of patients were able to reach the MCID of 10 points throughout the course of preoperative rehabilitation. Of the 34 patients that were able to reach the MCID for the total KOOS score, 32 patients (94.1%) went on to be satisfied after their TKA. Of the 169 patients that failed to reach the MCID for the total KOOS score, 150 patients (88.8%) went on to be satisfied with their TKA. When comparing groups, the distribution of satisfied or dissatisfied based on reaching the MCID for the total KOOS score was not statistically significant, \( p = 0.539 \). The percentage of patients reporting satisfaction based on reaching the MCID for each of the five subscales can be seen in Figure 2. No between group differences were statistically significant.

![Figure 2: Percent of patients reaching MCID with preoperative physical therapy.](image)

In a logistic regression model used to predict postoperative satisfaction, it was found that the subscales of symptoms, ADL, and QOL, as well as the total KOOS score at the first visit...
when the diagnosis of OA was made statistically significantly factored into predicting satisfaction. Specifically, for every increase in one point for the subscales of symptoms, ADL, and QOL at the initial visit, the odds of reporting satisfaction after surgery decreased by an odds ratio of 0.937, 0.877, and 0.958, respectively. For every increase in one point in the total KOOS score at the initial visit, it increased the odds of a patient reporting satisfaction by an odds ratio of 1.284. A complete list of statistically significant variables in the final model after running the backward stepwise logistic regression with betas and odds ratios can be seen in Table 6.

Table 6

<table>
<thead>
<tr>
<th>Table 6: Statistically significant contributors to the multiple logistic regression model predicting satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable</strong></td>
</tr>
<tr>
<td>KOOS(^a)-Symptoms at first visit</td>
</tr>
<tr>
<td>KOOS-ADL(^b) at first visit</td>
</tr>
<tr>
<td>KOOS-QoL(^c) at first visit</td>
</tr>
<tr>
<td>KOOS-Total at first visit</td>
</tr>
</tbody>
</table>

**Note:** KOOS\(^a\): Knee Injury and Osteoarthritis Outcome Score  
ADL\(^b\): Activities of Daily Living  
QoL\(^c\): Quality of Life

Discussion

The current study indicates that, although patients that report being satisfied after a TKA have higher KOOS prior to surgery, there is not a statistical difference in KOOS scores based on postoperative satisfaction status. The lack of statistically significant differences between satisfied patients and dissatisfied patients held true for the early time point when the diagnosis was made.
as well as at the last physical therapy visit before surgery. Furthermore, the change in KOOS score over the course of preoperative rehabilitation was not different based on postoperative satisfaction levels. Patients that were able to reach the MCID for the KOOS through the course of preoperative rehabilitation were able to report satisfaction at a higher rate compared to those that failed to reach this level, however this higher rate was not statistically significantly different. The main finding of this study suggests that preoperative KOOS scores are not different for those reporting satisfaction and dissatisfaction after a TKA.

In a secondary analysis aimed to predict satisfaction postoperatively, increasing scores for the subscales of symptoms, ADL, and QOL decreased the odds of reporting satisfaction while increasing scores for the total KOOS increased the odds of reporting satisfaction. The secondary finding indicates that those with poor function through low scores in the subscales of symptoms, ADL, and QOL preoperatively can lead to higher satisfaction rates postoperatively. In contrast, higher total KOOS scores before surgery, measuring both function and pain, can lead to higher satisfaction rates after surgery. One possible reason behind lower subscale scores leading to higher rates of satisfaction is the relative improvement in these measures postoperatively, leading to the perception of large scale functional improvement, further emphasizing the importance of preoperative expectations.4

The current study is not the first one attempting to predict postoperative outcomes based on preoperative patient reported outcome measures (PROMs) as Berliner et al. first studied this in 2017.3 Berliner et al. discovered that patients with higher preoperative scores, above established thresholds, were less likely to experience a clinically meaningful improvement in function after TKA.3 The results of this study are in line with the findings of our current study
showing that lower KOOS subscale scores lead to higher rates of satisfaction. However, this study is in disagreement when it comes to total KOOS score as our study showed that an increase in preoperative KOOS score leads to higher rates of satisfaction. Another study attempting to predict postoperative satisfaction based on preoperative factors was by Bourne et al. who found that the presence of pain at rest before surgery led to a 2.5x greater risk of dissatisfaction after surgery. In the current study, the pain subscale by itself did not show to statistically significantly contribute to the model aimed at predicting satisfaction like other subscales. The discrepancy in these findings indicates a potential interaction between pain and function before surgery as it relates to postoperative outcomes.

A couple different studies associating postoperative satisfaction with preoperative factors discovered that worse pain and function before surgery, via the Oxford Knee Score, related to dissatisfaction following surgery. The pain subscale from our current study was not a factor in the model predicting satisfaction, indicating that preoperative pain for this population is not associated with satisfaction after surgery, unlike what has been shown in previous studies. A possible reason for the disagreement between studies could be the fact that these studies were assessing postoperative function via subjective scores (Oxford Knee Score) instead of satisfaction like in our current study. The difference between comparing pain to subjective scores and satisfaction is likely related to the result of being satisfied or dissatisfied, which is more of a perception of postoperative status compared to preoperative status. Simply put, satisfaction is tied to whether or not the patient was able to meet expectations, as was reported previously by Klem et al. Simply reporting either satisfied or dissatisfied can be much different
compared to the more granular measurement of the Oxford Knee Score which includes multiple facets of recovery including pain and function.

The findings of this study indicate that the worse function a patient may have preoperatively can lead to higher rates of satisfaction after surgery. The fact that preoperative function has an inverse relationship with satisfaction indicates that patients are generally happy with the improvement in function they get from surgery. The results of this study can be used for patient education for those deciding whether or not to have a TKA. Klem et al. states that those with unrealistic expectations, including getting back to unrealistic subjective scores, may want to reconsider surgery due to the high chance of dissatisfaction after surgery. Our study confirms this subjectively as patients with high degrees of function, measured by the KOOS subscales of symptoms, ADL, and QoL, may want to reconsider surgery and continue nonoperative treatment as they are more likely to report dissatisfaction after surgery compared to those with low functional levels.

Limitations

The current study is not without limitations. First, the study was conducted utilizing one surgeon in a single hospital system, using the same manufacturer of prostheses. Although this is a strength due to the fact that it eliminates potential confounding variables found in more heterogeneous populations, it limits the generalizability as the findings pertain only to patients that had this prosthesis and followed this standard rehabilitation protocol. Another limitation lies in the inclusion and exclusion criteria of having at least two physical therapy visits. Although the study was aimed at finding subjective factors that preoperative rehabilitation can influence, by eliminating those with less than two physical therapy visits before surgery, it limits the number
of patients that could have been involved in the study. It also eliminates the ability to determine how effective preoperative rehabilitation was in the first place as those without a true course of rehabilitation were excluded. The retrospective design and reliance on patient-reported satisfaction surveys introduce potential bias and subjectivity. Additionally, the sample size, particularly in the dissatisfied group, could impact the statistical power of the analyses. Future studies with larger and more diverse samples, as well as prospective designs, could provide further insights into the relationship between preoperative objective factors and postoperative satisfaction after TKA. Lastly, in our current study, we defined satisfied as those answering the survey as “satisfied” and dissatisfied was defined as those answering either “somewhat satisfied” or “dissatisfied”. It can be argued that the patients answering “somewhat satisfied” are just as much satisfied as they are dissatisfied. It was determined to define groups in the present way due to getting larger numbers in dissatisfied group, however further studies need to be done with a more concrete definition of satisfaction.

Conclusion

The purpose of this study was to determine preoperative subjective factors that can positively affect postoperative satisfaction. The results indicate that there are not differences between those that were satisfied or dissatisfied following a TKA for the KOOS taken at the first physical therapy visit after the diagnoses of OA was made, at the last visit before surgery, or the change in KOOS scores from the beginning to end of their course of preoperative rehabilitation. The KOOS subscales of symptoms, ADL, and QoL all had negative effects on satisfaction status after surgery, meaning that the higher the score was at the patient’s initial visit before surgery, the less likely they would become satisfied after surgery. The findings indicate that patient’s
preoperative expectations could potentially have a large effect on postoperative satisfaction, further indicating the importance of preoperative patient education.
References


CHAPTER 3

OBJECTIVE FACTORS LEADING TO SATISFACTION FOLLOWING TOTAL KNEE ARTHROPLASTY

Introduction

One of the most common surgical treatment options for knee osteoarthritis (OA) is a total knee arthroplasty (TKA). A TKA is a common surgery that utilizes a combination of metals and plastics to resurface the damaged cartilage surfaces of the knee, leading to decreased pain and improved function for the patient. Following surgery, patients generally have positive outcomes as postoperative Knee Injury and Osteoarthritis Outcome Scores (KOOS) are nearly to the level of the general healthy population for patients in the same age demographic. Postoperative success is often related to success with perioperative physical therapy as those who participated in formal therapy demonstrated higher quadriceps strength and better functional scores when compared to those that did not. However, most studies looking into preoperative physical therapy and the affect it has on postoperative outcomes fail to explain which objective measures before surgery are the cause for better outcomes after surgery.

Despite the overall success rate and high subjective scores following surgery, many patients are left dissatisfied after surgery. A study by Bourne et al. demonstrated that up to 20% of patients having a primary TKA are dissatisfied one year after surgery. However, the lack of highly validated measures for satisfaction has hindered the drive to improve satisfaction.
Goodman et al. demonstrated that there was a moderate correlation between a validated Likert scale of satisfaction and pain and function after surgery, however this does not explain why satisfaction rates can be so low at times given subjective scores are generally considered good. Many reasons are thought to affect satisfaction rates following surgery, however there is not a general consensus as to what truly makes someone satisfied or dissatisfied. Recent studies have pointed to both subjective and objective factors, preoperatively and postoperatively, that can lead to postoperative satisfaction. From a psychological standpoint, recent studies have demonstrated the importance of preoperative communication and education on setting realistic expectations when it comes to postoperative satisfaction. Due to these findings, clinicians have been placing more emphasis on preoperative education, however, this is not the only factor leading to postoperative satisfaction.

Objectively, satisfaction has been linked to postoperative flexion range of motion (ROM), due to being able to complete flexion related activities easier compared to those that are stiff. Postoperative flexion has been correlated to preoperative flexion; therefore, theoretically, patients should strive to maximize knee flexion prior to surgery to encourage positive postoperative results. Benner et al. have shown that knees with varying degrees of osteoarthritis, including those that are candidates for a TKA, can improve flexion, therefore, some type of conservative management should be trialed before moving towards a TKA.

Knowing that preoperative physical therapy can improve the objective condition of the knee and that is known to positively affect postoperative satisfaction, having each patient trial therapy prior to surgery can be beneficial. Preoperative physical therapy also provides the opportunity to determine how other objective factors can positively, or negatively, affect
postoperative satisfaction. However, to date, there are few preoperative objective factors that have been identified as being accurate predictors of postoperative success, in particular, satisfaction.\textsuperscript{12}

The purpose of this study was to determine preoperative objective factors that affect postoperative satisfaction. Specifically, the aim was to determine if knee ROM, quadriceps strength, or functional mobility before surgery is associated with postoperative satisfaction for patients having a TKA. Our hypothesis was that those who report satisfaction after a TKA would demonstrate better ROM, strength, and mobility during the course of their preoperative rehabilitation when compared to those that report dissatisfaction.

Methods

Study design

This study used a retrospective cohort design.

Patient selection

Between 2012 and 2021, 785 patients had a primary TKA performed by a single surgeon at a knee specialty clinic. Prior to surgery, all patients gave informed consent to participate in the long term study, which was approved by the institutional review board at the institution where surgery was performed. Data were retrospectively collected with the following inclusion: primary and unilateral TKA performed by the lead surgeon. Patients were excluded if they were missing a satisfaction survey at a minimum one year following surgery (N = 365) or had less than two physical therapy visits prior to surgery (N = 18). Ultimately, 402 patients met inclusion and were used for analysis (Figure 1).
Figure 1: CONSORT diagram showing the formulation of the study population.

Surgical procedure

Each participant had surgery performed by the same surgeon at the institution. The surgeon in all 402 cases utilized Zimmer components (Zimmer Biomet; Warsaw, IN) comprising of Persona PS system (N = 290), LPS Flex (N = 99), and LCCK with constrained polyethylene (N = 13). The patella was resurfaced in 187 cases (46.5%), utilizing a polyethylene button.

Rehabilitation

Prior to surgery, each patient trialed rehabilitation with a physical therapist at the institution with the hopes of avoiding or delaying surgery. Preoperative physical therapy was standard for all participants and was aimed at maximizing ROM first followed by strengthening, all while minimizing swelling in hopes of improving function and reducing pain. Once the patient and treating physical therapist agreed that objective and subjective function plateaued and
the patient continued to have debilitating pain, the patient returned for a surgical consultation with the orthopedic surgeon. After this consultation visit, surgery was scheduled and performed at a mutually convenient time.

Following surgery, each patient followed a standard rehabilitation protocol, led by the treating physical therapist at the institution. Patients spent at least one night in the hospital and were discharged when they achieved satisfactory leg control, adequate ROM, manageable pain, and could walk independently with a walker. Upon getting home, patients followed a relative bed rest period for the first seven days following surgery, only permitted to walk to the bathroom and back, using a standard or rolling walker, in order to keep swelling to a minimum. During the first week at home, they performed five exercises: heel prop and towel stretches for knee extension, heel slides for knee flexion, and straight leg raises and quadriceps sets for leg control. The first in office visit was on postoperative day seven. Postoperative rehabilitation was first aimed at reducing swelling, maximizing ROM, and normalizing gait. Once these were normalized, the focus was placed on strengthening which was aimed at maximizing function. Patients were discharged once objective and subjective goals were met. The rehabilitation schedule and philosophy can be seen in Table 1.
### Table 1: Postoperative rehabilitation schedule and goals

<table>
<thead>
<tr>
<th>Postoperative time</th>
<th>Rehabilitation goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day 1</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Satisfactory leg control</td>
</tr>
<tr>
<td></td>
<td>2. Adequate ROM(^a)</td>
</tr>
<tr>
<td></td>
<td>3. Manageable pain</td>
</tr>
<tr>
<td></td>
<td>4. Walk independently with a walker</td>
</tr>
<tr>
<td><strong>Day 7</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Knee extension to 0 degrees</td>
</tr>
<tr>
<td></td>
<td>2. Knee flexion to 90 degrees</td>
</tr>
<tr>
<td></td>
<td>3. Have the ability to perform a straight leg raise</td>
</tr>
<tr>
<td></td>
<td>4. Normal gait, with or without a walker</td>
</tr>
<tr>
<td><strong>Day 14</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Maintain full extension</td>
</tr>
<tr>
<td></td>
<td>2. Progress flexion</td>
</tr>
<tr>
<td></td>
<td>3. Reduce swelling from the 1 week appointment</td>
</tr>
<tr>
<td></td>
<td>4. Normal gait with or without an assistive device</td>
</tr>
<tr>
<td><strong>1 month</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Maintain extension</td>
</tr>
<tr>
<td></td>
<td>2. Progress flexion</td>
</tr>
<tr>
<td></td>
<td>3. Normal gait without assistive device</td>
</tr>
<tr>
<td></td>
<td>4. Reduce swelling from the 2 week appointment</td>
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<tr>
<td></td>
<td>5. Isokinetic and isometric strength tests: ≥50% LSI(^b)</td>
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<tr>
<td><strong>2 months</strong></td>
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</tr>
<tr>
<td></td>
<td>1. Maintain extension</td>
</tr>
<tr>
<td></td>
<td>2. Attain normal flexion per IKDC(^c) objective form</td>
</tr>
<tr>
<td></td>
<td>3. Reduce swelling from the 1 month appointment</td>
</tr>
<tr>
<td></td>
<td>4. Progress strength towards 90% or more with LSI</td>
</tr>
<tr>
<td><strong>4 months</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Maintain ROM</td>
</tr>
<tr>
<td></td>
<td>2. Normal or nearly swelling per fluid wave test</td>
</tr>
<tr>
<td></td>
<td>3. Progress strength towards 90% or more with LSI</td>
</tr>
<tr>
<td><strong>6 months</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Maintain ROM</td>
</tr>
<tr>
<td></td>
<td>2. Maintain swelling level</td>
</tr>
<tr>
<td></td>
<td>3. Progress strength towards 90% or more with LSI</td>
</tr>
<tr>
<td><strong>9 months</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Maintain ROM</td>
</tr>
<tr>
<td></td>
<td>2. Maintain swelling level</td>
</tr>
<tr>
<td></td>
<td>3. Progress strength towards 90% or more with LSI</td>
</tr>
<tr>
<td><strong>1 year</strong></td>
<td>Discharge with normal ROM, swelling, and strength</td>
</tr>
</tbody>
</table>

**Note:**

- ROM\(^a\)=Range of motion
- LSI\(^b\)=Limb symmetry index
- IKDC\(^c\): International Knee Documentation Committee

Early discharge, before 1 year, occurred with normal ROM, swelling, and strength
Data collection

Patient demographics and characteristics were prospectively collected and entered into the internal database at the institution. Retrospectively, each participant was labeled as being satisfied or dissatisfied based on their response to the survey distributed at a minimum one year from surgery. The survey included a simple question asking how satisfied the patient was with surgery, listing three options: satisfied, somewhat satisfied, and dissatisfied. Satisfied was defined as those answering the survey as “satisfied” and dissatisfied was defined as those answering either “somewhat satisfied” or “dissatisfied”. Objective measures were measured at the first visit when the diagnosis of OA was made as well as at the last preoperative visit, right before their TKA. Objective measures of interest included ROM, strength testing, and Timed Up and Go (TUG) testing. Range of motion testing was done by measuring flexion and extension with a goniometer while the patient was in a long sitting position and measured to the nearest degree. Knee flexion and extension were reflected as raw degrees as well as the difference between the involved knee and noninvolved knee. Strength as measured isokinetically using the HumacNorm (CSMI; Stoughton, MA) at 180°/second. Strength was reflected as limb symmetry index (LSI) which was calculated as the involved knee strength divided by the noninvolved knee strength, multiplied by 100. Strength was also reflected as value normalized to body weight in kilograms.

Statistical analysis

All demographic information was reported as a mean and standard deviation and frequency being reflected as a percentage. Knee ROM, strength, and TUG test times were reported as means and standard deviations and were compared between groups using a standard t
test or Mann-Whitney U test based on data normality that was tested via the Shapiro-Wilk test. A backwards stepwise logistic regression was performed to determine the odds of attaining satisfaction, while accounting for confounding variables. An a priori power analysis was performed and based on an effect size of 0.25 and 0.80 power, it was determined that a minimum of 158 patients would be needed to for the study. All statistical analyses were performed using IBM SPSS version 25 (International Business Machines Corporation; Armonk, NY) and statistical significance was set at p<0.05.

Results

Demographics

Of the 402 patients that met the inclusion for the study, 347 were satisfied, while 55 were labeled as dissatisfied. The mean age was for the population was 65.0±8.5 years and 49.0% were male. Demographic information by satisfaction group can be seen in Table 2. The length of time patients were in preoperative rehabilitation was not statistically significantly different between groups with satisfied patients at 29.9 months compared to 31.8 months for those reporting dissatisfaction, \( p = .741 \).

Table 2

Demographics by Satisfaction Status

<table>
<thead>
<tr>
<th></th>
<th>Satisfied (N=347)</th>
<th>Dissatisfied (N=55)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>65.1</td>
<td>64.3</td>
<td>0.515</td>
</tr>
<tr>
<td>Sex (% male)</td>
<td>47.8</td>
<td>56.4</td>
<td>0.240</td>
</tr>
<tr>
<td>Laterality (% left)</td>
<td>45.0</td>
<td>40.0</td>
<td>0.492</td>
</tr>
<tr>
<td>Height (inches)</td>
<td>66.9</td>
<td>67.6</td>
<td>0.335</td>
</tr>
<tr>
<td>Weight (pounds)</td>
<td>213.5</td>
<td>216.0</td>
<td>0.721</td>
</tr>
<tr>
<td>BMI(^a) (Kg/m(^2))</td>
<td>33.5</td>
<td>33.2</td>
<td>0.817</td>
</tr>
</tbody>
</table>

\( Note: \) BMI\(^a\): Body Mass Index
Outcomes

At the first visit when the diagnosis of OA was made, satisfied patients had nearly identical ROM when compared to dissatisfied patients. For strength measures, patients in the dissatisfied group were stronger at the first physical therapy visit, however it was not statistically significantly stronger. Timed up and go measures were not reported at this time as this measure was not routinely done at this time. Range of motion and strength measures at the first physical therapy visit can be seen in Table 3.

Table 3

Range of Motion and Strength Differences at the First Physical Therapy Visit

<table>
<thead>
<tr>
<th>Table 3: Range of motion and strength differences at the first physical therapy visit</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee extension (degrees)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>347</td>
<td>-2.3</td>
<td>5.5</td>
<td>0.899</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>55</td>
<td>-2.2</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>Knee flexion (degrees)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>346</td>
<td>119.0</td>
<td>15.3</td>
<td>0.845</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>52</td>
<td>119.5</td>
<td>18.0</td>
<td></td>
</tr>
<tr>
<td>Difference in extension (degrees)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>346</td>
<td>2.8</td>
<td>4.5</td>
<td>0.399</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>55</td>
<td>2.9</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Difference in flexion (degrees)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>341</td>
<td>8.8</td>
<td>13.3</td>
<td>0.957</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>51</td>
<td>8.9</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>Limb symmetry index (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>330</td>
<td>78.3</td>
<td>27.2</td>
<td>0.064</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>51</td>
<td>86.9</td>
<td>48.5</td>
<td></td>
</tr>
<tr>
<td>Normalized strength (Nm/Kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>330</td>
<td>.367</td>
<td>.201</td>
<td></td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>51</td>
<td>.399</td>
<td>.263</td>
<td></td>
</tr>
</tbody>
</table>

At the last visit before surgery, satisfied patients had similar ROM and strength when compared to dissatisfied patients. Patients in the dissatisfied group showed faster TUG test times at the last visit prior to surgery, $p<0.001$. Range of motion, strength, and TUG test measures at the last physical therapy visit before surgery can be seen in Table 4.
Table 4

Range of Motion, Strength, and TUG Test Differences at the Last Physical Therapy Visit

<table>
<thead>
<tr>
<th>Metric</th>
<th>Satisfied</th>
<th>Dissatisfied</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knee extension (degrees)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>346</td>
<td>55</td>
<td>0.502</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>3.0</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td><strong>Knee flexion (degrees)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>346</td>
<td>55</td>
<td>0.062</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>120.4</td>
<td>124.4</td>
<td></td>
</tr>
<tr>
<td><strong>Difference in extension (degrees)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>339</td>
<td>54</td>
<td>0.997</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>1.6</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td><strong>Difference in flexion (degrees)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>337</td>
<td>54</td>
<td>0.471</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>7.5</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td><strong>Limb symmetry index (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>322</td>
<td>51</td>
<td>0.706</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>77.2</td>
<td>78.8</td>
<td></td>
</tr>
<tr>
<td><strong>Normalized strength (Nm/Kg)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>323</td>
<td>51</td>
<td>0.156</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>.356</td>
<td>.405</td>
<td></td>
</tr>
<tr>
<td><strong>TUG&lt;sup&gt;a&lt;/sup&gt; test time (seconds)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>100</td>
<td>20</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>8.8</td>
<td>6.7</td>
<td></td>
</tr>
</tbody>
</table>

Note: TUG<sup>a</sup>: Timed Up and Go

Progress in terms of ROM from the first to last physical therapy visit was the same for both groups. For strength (LSI), those in the dissatisfied group lost roughly 8% over the course of rehabilitation compared to nearly 2% for those in the satisfied group, however this was not statistically significantly different, \( p=0.101 \). A similar trend was shown for the normalized strength metric, however again, these were not statistically significantly different at \( p=0.291 \).
Table 5

Progression in Range of Motion and Strength from the First to Last Physical Therapy Visit

<table>
<thead>
<tr>
<th></th>
<th>Satisfied</th>
<th>Mean</th>
<th>SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knee extension (degrees)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>338</td>
<td>1.2</td>
<td>3.929</td>
<td>0.816</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>54</td>
<td>1.3</td>
<td>4.596</td>
<td></td>
</tr>
<tr>
<td><strong>Knee flexion (degrees)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>332</td>
<td>1.4</td>
<td>12.204</td>
<td>0.641</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>50</td>
<td>2.3</td>
<td>14.456</td>
<td></td>
</tr>
<tr>
<td><strong>Limb symmetry index (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>321</td>
<td>-1.6</td>
<td>20.55692</td>
<td>0.101</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>51</td>
<td>-8.2</td>
<td>49.53573</td>
<td></td>
</tr>
<tr>
<td><strong>Normalized strength (Nm/Kg)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>322</td>
<td>-0.014</td>
<td>0.11805</td>
<td>0.291</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>51</td>
<td>0.007</td>
<td>0.19274</td>
<td></td>
</tr>
</tbody>
</table>

In a logistic regression model aiming to predict satisfaction following surgery based on the variables of interests, the TUG test proved to statistically contribute to the final model. Specially, for every increase in 1 second on the latest TUG test completed before surgery, the odds of being satisfied after surgery increased by an odds ratio of 1.442 at $p=0.014$. All variables from the original and final models can be seen in Table 6.
Table 6

Logistic Regression to Predict Satisfaction

<table>
<thead>
<tr>
<th>Table 6: Logistic regression to predict satisfaction N = 113</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>SE</td>
<td>Wald</td>
<td>df</td>
<td>Sig.</td>
<td>Exp(B)</td>
</tr>
<tr>
<td>-------</td>
<td>---</td>
<td>-----</td>
<td>------</td>
<td>----</td>
<td>-----</td>
<td>--------</td>
</tr>
<tr>
<td>All</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (Female)</td>
<td>.166</td>
<td>.734</td>
<td>.051</td>
<td>1</td>
<td>.821</td>
<td>1.180</td>
</tr>
<tr>
<td>BMI&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.000</td>
<td>.051</td>
<td>.000</td>
<td>1</td>
<td>.997</td>
<td>1.000</td>
</tr>
<tr>
<td>Age</td>
<td>.020</td>
<td>.042</td>
<td>.216</td>
<td>1</td>
<td>6.42</td>
<td>1.020</td>
</tr>
<tr>
<td>Knee extension, first</td>
<td>-.045</td>
<td>.127</td>
<td>.125</td>
<td>1</td>
<td>.724</td>
<td>.956</td>
</tr>
<tr>
<td>Knee flexion, first</td>
<td>.010</td>
<td>.039</td>
<td>.066</td>
<td>1</td>
<td>.797</td>
<td>1.010</td>
</tr>
<tr>
<td>Knee extension, last</td>
<td>-.057</td>
<td>.166</td>
<td>.119</td>
<td>1</td>
<td>.730</td>
<td>.944</td>
</tr>
<tr>
<td>Knee flexion, last</td>
<td>-.039</td>
<td>.042</td>
<td>.853</td>
<td>1</td>
<td>.356</td>
<td>.962</td>
</tr>
<tr>
<td>Difference in extension, first</td>
<td>.004</td>
<td>.159</td>
<td>.001</td>
<td>1</td>
<td>.980</td>
<td>1.004</td>
</tr>
<tr>
<td>Difference in flexion, fist</td>
<td>-.011</td>
<td>.040</td>
<td>.080</td>
<td>1</td>
<td>.777</td>
<td>.989</td>
</tr>
<tr>
<td>Difference in extension, first</td>
<td>.019</td>
<td>.205</td>
<td>.008</td>
<td>1</td>
<td>.928</td>
<td>1.019</td>
</tr>
<tr>
<td>Difference in flexion, first</td>
<td>.003</td>
<td>.049</td>
<td>.003</td>
<td>1</td>
<td>.958</td>
<td>1.003</td>
</tr>
<tr>
<td>LSI&lt;sup&gt;b&lt;/sup&gt;, first</td>
<td>-.027</td>
<td>.018</td>
<td>2.212</td>
<td>1</td>
<td>.137</td>
<td>.973</td>
</tr>
<tr>
<td>LSI, last</td>
<td>.026</td>
<td>.021</td>
<td>1.633</td>
<td>1</td>
<td>.201</td>
<td>1.027</td>
</tr>
<tr>
<td>Normalized strength, first</td>
<td>.878</td>
<td>1.580</td>
<td>.309</td>
<td>1</td>
<td>.578</td>
<td>2.406</td>
</tr>
<tr>
<td>Normalized strength, last</td>
<td>-2.585</td>
<td>2.316</td>
<td>1.245</td>
<td>1</td>
<td>.264</td>
<td>.075</td>
</tr>
<tr>
<td>TUG&lt;sup&gt;c&lt;/sup&gt; test time, latest</td>
<td>.232</td>
<td>.203</td>
<td>1.308</td>
<td>1</td>
<td>.253</td>
<td>1.262</td>
</tr>
<tr>
<td>Constant</td>
<td>3.008</td>
<td>5.976</td>
<td>.253</td>
<td>1</td>
<td>.615</td>
<td>20.248</td>
</tr>
<tr>
<td>Final</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee extension, latest</td>
<td>-.143</td>
<td>.074</td>
<td>3.669</td>
<td>1</td>
<td>.055</td>
<td>.867</td>
</tr>
<tr>
<td>TUG Time, latest</td>
<td>.366</td>
<td>.149</td>
<td>6.050</td>
<td>1</td>
<td>.014</td>
<td>1.442</td>
</tr>
<tr>
<td>Constant</td>
<td>1.107</td>
<td>1.058</td>
<td>1.093</td>
<td>1</td>
<td>.296</td>
<td>.331</td>
</tr>
</tbody>
</table>

Note: BMI<sup>a</sup>: Body Mass Index
LSI<sup>b</sup>: Limb Symmetry Index
TUG<sup>c</sup>: Timed Up and Go
In a secondary analysis, removing TUG test as a variable due to lower overall numbers of patients completing this test before surgery, a second model was run to determine the predictability of the other objective measures. In this model including 353 patients, the overall model was not statistically significant in being able to accurately predict satisfaction at $p=0.061$. The variable most able to predict satisfaction was normalized strength taken at the latest physical therapy visit at $p=0.058$, however this too was not statistically significant. All variables from the model without the TUG test can be seen in Table 7.
### Table 7: Logistic regression to predict satisfaction without TUG test N = 353

<table>
<thead>
<tr>
<th>Model</th>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>(\chi^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Sex (female)</td>
<td>.271</td>
<td>.406</td>
<td>.444</td>
<td>1</td>
<td>.505</td>
<td>1.311</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BMI(^a)</td>
<td>-.008</td>
<td>.030</td>
<td>.061</td>
<td>1</td>
<td>.804</td>
<td>.992</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>.021</td>
<td>.023</td>
<td>.805</td>
<td>1</td>
<td>.370</td>
<td>1.021</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knee extension, first</td>
<td>-.012</td>
<td>.066</td>
<td>.033</td>
<td>1</td>
<td>.856</td>
<td>.988</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knee flexion, first</td>
<td>.025</td>
<td>.022</td>
<td>1.371</td>
<td>1</td>
<td>.242</td>
<td>1.026</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knee extension, last</td>
<td>.012</td>
<td>.065</td>
<td>.035</td>
<td>1</td>
<td>.851</td>
<td>1.012</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knee flexion, last</td>
<td>.009</td>
<td>.021</td>
<td>.183</td>
<td>1</td>
<td>.669</td>
<td>1.009</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference in extension, first</td>
<td>.004</td>
<td>.088</td>
<td>.002</td>
<td>1</td>
<td>.966</td>
<td>1.004</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference in flexion, first</td>
<td>-.040</td>
<td>.022</td>
<td>3.136</td>
<td>1</td>
<td>.077</td>
<td>.961</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference in extension, first</td>
<td>-.033</td>
<td>.098</td>
<td>.113</td>
<td>1</td>
<td>.737</td>
<td>.967</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference in flexion, first</td>
<td>-.016</td>
<td>.027</td>
<td>.352</td>
<td>1</td>
<td>.553</td>
<td>.984</td>
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</tr>
<tr>
<td></td>
<td>LSI(^b), first</td>
<td>-.008</td>
<td>.009</td>
<td>.754</td>
<td>1</td>
<td>.385</td>
<td>.992</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LSI, last</td>
<td>.004</td>
<td>.010</td>
<td>.137</td>
<td>1</td>
<td>.711</td>
<td>1.004</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normalized strength, first</td>
<td>1.257</td>
<td>1.294</td>
<td>.944</td>
<td>1</td>
<td>.331</td>
<td>3.516</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normalized strength, last</td>
<td>-1.702</td>
<td>1.516</td>
<td>1.261</td>
<td>1</td>
<td>.261</td>
<td>.182</td>
<td></td>
</tr>
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<td>3.623</td>
<td>.733</td>
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<td>.392</td>
<td>22.25</td>
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</tr>
<tr>
<td></td>
<td>Normalized strength, last</td>
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<td>.799</td>
<td>3.600</td>
<td>1</td>
<td>.058</td>
<td>.220</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
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<td>.361</td>
<td>47.35</td>
<td>1</td>
<td>.000</td>
<td>11.96</td>
<td></td>
</tr>
</tbody>
</table>

Note: BMI\(^a\): Body Mass Index  
LSI\(^b\): Limb symmetry Index
Discussion

The findings from this current study provide insights into the relationship between preoperative objective measures and postoperative satisfaction. Despite the overall success of TKA in improving pain and function for patients with knee OA, a significant proportion of patients remain dissatisfied after surgery.\textsuperscript{3,18,20} The current study contributes to the understanding of potential factors contributing to this dissatisfaction, most notably, the TUG test. The main finding suggests that preoperative factors such as knee ROM and strength may not factor into postoperative satisfaction. Furthermore, patients that report dissatisfaction after surgery can have better flexion and strength before surgery, yet this was not found to be statistically significantly different compared to those that reported satisfaction after surgery. Results from the TUG test before surgery indicate that those who report being satisfied have slower times at 8.8 seconds, when compared to those who reported dissatisfaction who have an average time of 6.7 seconds. Additionally, TUG test performance right before surgery has the ability to predict satisfaction status with every increase in the TUG test by 1 second, the odds of being satisfied after surgery increases by an odds ratio of 1.442.

One of the main findings of this study is the association between preoperative TUG test time and postoperative satisfaction. The TUG test, which assesses functional mobility and dynamic balance, emerged as a significant predictor of postoperative satisfaction as patients who completed this test faster before surgery were more likely to report dissatisfaction after TKA. Slower times leading to postoperative satisfaction suggests that preoperative functional mobility may have an impact on a patient's overall experience and perception of surgery outcomes. Slower TUG test times may indicate greater impairment in functional mobility and addressing
this impairment through pain relief from the surgery may potentially lead to improved satisfaction following TKA. Patients that are less mobile prior to surgery may show better satisfaction after surgery due to having lower expectations, thus making them easier to be attained. Bourne et al. demonstrated that the strongest predictor of patient dissatisfaction after primary TKA were expectations not being met. More specifically, those that failed to meet expectations after surgery were 10.7 times more likely to be dissatisfied with their result. Bourne et al. was not the only study to demonstrate the importance of expectations on postoperative satisfaction as others have shown that satisfaction is closely tied to meeting patient expectations. The same logic could be the reasoning behind the result seen with the TUG test in the current study as those with slower times before surgery are likely less mobile and may have lower expectations for their outcome. After surgery, reporting satisfaction may be more likely for those with lower expectations, indicating a ceiling effect.

Another interesting aspect highlighted by this study is the role of quadriceps strength on postoperative satisfaction. Although no statistically significant differences were observed between satisfied and dissatisfied patients in terms of preoperative strength, there were instances where patients that reported dissatisfaction had better strength at the visits before surgery. At the first physical therapy visit, those who reported satisfaction had an LSI of 78% compared to 87% for the dissatisfied group, however this was not statically significantly different. The magnitude of difference was not seen as much at the last visit before surgery with the satisfied group having an LSI at 77% and the dissatisfied group at 79%, mainly due to the average reduction in LSI throughout the course of rehabilitation being higher for the dissatisfied group at -8% compared to only -2% for the satisfied group. In the model aimed at predicting satisfaction, strength as not a
statistically significant contributor to the model (Tables 6 and 7). A recent systematic review and meta-analysis from 2021 revealed that a preoperative physical therapy program has significant benefit when it comes to quadriceps strength following surgery. Dominguez-Navarro et al. showed that those participating in a preoperative strength program demonstrated greater postoperative strength at 6 weeks, however, this, along with subjective scores, stabilized and were equal between groups at 1 year. Similarly, Tungtrongjit et al. showed that a preoperative quadriceps strength program yielded superior strength and subjective scores in the short term, however stabilized in the long term. Our current study failed to show a difference in preoperative strength between those that are satisfied and dissatisfied, taken at one year, indicating that preoperative strength may not factor in to long term satisfaction following a TKA.

Lastly, our study failed to show a difference between groups when it comes to ROM for raw values or in comparison to the contralateral knee. Knee ROM between groups were nearly identical at the first visit, last visit, and the progression during the course of rehabilitation (Tables 3-5). It has been shown that those who participate in a preoperative rehabilitation program of some sort can have higher degrees of flexion postoperatively when compared to a control group. Han et al. demonstrated in a model aimed at predicting satisfaction following a TKA that having more than 130° of flexion after surgery is a positive predictor of being satisfied after surgery. However, this study was only assessing postoperative ROM, not accounting for how the patients looked before surgery like in our current study. Postoperative knee ROM has been correlated to preoperative ROM in other studies, however this study in particular did not assess this relationship. Knowing better preoperative ROM will typically yield better postoperative ROM and better ROM postoperatively will yield higher satisfaction, our
hypothesis was that those reporting postoperative satisfaction would have better ROM preoperatively. However, in our current study, we failed to see this difference between groups as ROM was nearly identical between the two for knee extension and flexion. A possible explanation for not finding a difference between groups is the equal progression of ROM between groups. It appears that, on average, most patients, regardless of group, improve through the course of preoperative rehabilitation (extension: 1°, flexion: 2°). Further study, including a control group that did not have rehabilitation, may help answer this question, however this is out of the scope of our current study. When analyzing the prediction model with all variables (Table 6), knee extension ROM was trending towards statistical significance as a contributor to predict satisfaction. In this model, knee extension was inversely related to satisfaction, meaning, as knee extension ROM improved preoperatively, the odds of a patients being satisfied decreased. Similar to the TUG test findings, this is counterintuitive as one would believe that better ROM prior to surgery would be advantageous when it comes to postoperative satisfaction. However, it in fact has a negative association, furthering the thought that preoperative expectations may affect things the most when it comes to postoperative satisfaction.

**Limitations**

It is important to acknowledge the limitations of this study. The retrospective design and reliance on patient-reported satisfaction surveys introduce potential bias and subjectivity. Additionally, the sample size, particularly in the dissatisfied group, could impact the statistical power of the analyses. Future studies with larger and more diverse samples, as well as prospective designs, could provide further insights into the relationship between preoperative objective factors and postoperative satisfaction after TKA. Another limitation to this study was
the fact that it utilized one surgeon in a single hospital system, using the same manufacturer of prostheses. Although this is a strength due to the fact that it eliminates innate confounding variables found in more heterogeneous populations, it limits the generalizability as the findings pertain only to patients that had this prosthesis and followed this standard rehabilitation protocol. Another limitation lies in the inclusion and exclusion criteria of having at least two physical therapy visits. Although the study was aimed at finding factors that preoperative rehabilitation can influence, by eliminating those with less than two physical therapy visits before surgery, it eliminates the ability to determine how effective preoperative rehabilitation was in the first place as those without a true course of rehabilitation were excluded. Another limitation is how satisfaction was defined. In our current study, we defined satisfied as those answering the survey as “satisfied” and dissatisfied was defined as those answering either “somewhat satisfied” or “dissatisfied”. It can be argued that the patients answering “somewhat satisfied” are just as much satisfied as they are dissatisfied. It was determined to define groups in the present way due to getting more numbers in dissatisfied group, however further studies need to be done with a more concrete definition of satisfaction.

**Conclusion**

In conclusion, this study contributes to the understanding of preoperative factors that may influence postoperative satisfaction following TKA. The findings suggest that preoperative functional mobility, as assessed by the TUG test, could play a role in predicting patient satisfaction, albeit the two having a statistically positive relationship with satisfaction rates increasing as preoperative TUG test time increases. Other common rehabilitation factors such as preoperative ROM and quadriceps strength failed to show predictability when it comes to
determining postoperative satisfaction. The results indicate that preoperative expectation may have a large impact on satisfaction as the findings lean towards better satisfaction with worse preoperative objective function. Further studies are needed, including ones assessing preoperative expectations along with objective functioning, in order to validate and expand upon these conclusions. Results from such studies can ultimately leading to more personalized and effective approaches to enhancing patient satisfaction and optimizing surgical outcomes following TKA.
References


CHAPTER 4

FACTORS LEADING TO SATISFACTION FOLLOWING A TOTAL KNEE ARTHROPLASTY: A QUALITATIVE ANALYSIS

Introduction

One of the most common surgical treatment options for knee osteoarthritis (OA) is a total knee arthroplasty (TKA). Following surgery, patients generally have good outcomes as most report high function and low pain, evident by scores on the Knee Injury and Osteoarthritis Outcome Scores (KOOS) being nearly to the level of the general healthy population for patients in the same age demographic. Postoperative success is often related to effective perioperative physical therapy as those who participated in formal therapy demonstrated higher quadriceps strength and better functional scores when compared to those that did not. However, most studies examining preoperative physical therapy and the effect it has on postoperative outcomes fail to explain which objective measures before surgery are the cause for better outcomes after surgery.

Despite the overall success rate and high subjective scores following surgery, many patients are left dissatisfied after surgery. A study by Bourne et al. demonstrated that up to 20% of patients having a primary TKA are dissatisfied one year after surgery. However, the lack of highly validated measures for satisfaction has hindered the drive to improve satisfaction. Goodman et al. demonstrated that there was a moderate correlation between a validated Likert
scale of satisfaction and pain and function after surgery, however this does not fully explain why satisfaction rates can be so low at times given subjective scores are generally considered good. Many reasons are thought to affect satisfaction rates following surgery, however there is not a general consensus as to what truly makes someone satisfied or dissatisfied. Recent studies have pointed to both subjective and objective factors, preoperatively and postoperatively, that can lead to postoperative satisfaction. From a psychological standpoint, recent studies have demonstrated the importance of preoperative communication and education on setting realistic expectations when it comes to postoperative satisfaction. Due to these findings, clinicians have been placing more emphasis on preoperative education, however, this is not the only factor leading to postoperative satisfaction.

Objectively, satisfaction has been linked to postoperative range of motion (ROM), which correlated to preoperative ROM; therefore, theoretically, patients should strive to maximize ROM prior to surgery to encourage positive postoperative results. Benner et al. have shown that patients with varying degrees of osteoarthritis, including those that are candidates for a TKA, can improve flexion, therefore, some type of conservative management should be trialed before moving towards a TKA.

Because preoperative physical therapy can improve the objective condition of the knee and that is known to positively affect postoperative outcomes, having each patient trial therapy prior to surgery can be beneficial. While numerous studies have examined the impact of preoperative physical therapy on postoperative outcomes, the underlying factors that contribute to success remain multifactorial and complex. What is arguably more difficult to measure is the impact physical therapy can have on the mental and psychological aspect of preoperative
preparation for a TKA. Due to the time that a physical therapist spends with the patients before surgery, in comparison to other healthcare professionals, studying this setting may provide insight into the complex reasoning why some patients are satisfied and some are not following surgery. Identifying and understanding these factors can provide valuable insights into tailoring rehabilitation programs to individual patient needs, ultimately optimizing surgical outcomes and patient satisfaction.

In order to determine these factors, the present study aimed to explore the qualitative aspects of preoperative physical therapy that contribute to postoperative success following TKA. By focusing on the experiences and perspectives of patients who underwent preoperative physical therapy, the aim was to gain an understanding of the unique elements that shape their rehabilitation process and ultimately their postoperative outcomes. This qualitative approach allowed us to explore subjective perceptions, challenges, and successes encountered during the preoperative phase, illuminating factors that extend beyond traditional subjective scores like the KOOS.

The main question behind this study was “How does preoperative physical therapy affect postoperative satisfaction?” By addressing this research question, the study intended to provide a comprehensive understanding of the factors that influence success following TKA from the patients' perspectives. The findings will not only inform healthcare professionals on the significance of preoperative physical therapy interventions, but also guide the development of patient-centered rehabilitation strategies, thus enhancing the overall quality of care for individuals undergoing TKA.
Methods

Study design

The study’s focus was to gain insight and understanding of patient’s perception and experiences, therefore, a qualitative study utilizing semi-structured interviews was selected. Qualitative research was an appropriate design due to the intent to explore how patients interpreted and attributed meaning to their experience.\textsuperscript{12}

Participants and data collection

Between 2016 and 2021, 774 patients had a TKA performed by the same surgeon at a knee specialty clinic. The patients were recruited from an internal database where they were consented into a study that was approved by the institutional review board at the institution where surgery was performed. Following surgery, each patient was recruited via a phone call and asked to participate in the qualitative study. The study recruiter selected patients that were seen postoperatively by the sub-investigator and they were called in reverse chronological order, with the most recent patients being called first, in an attempt to reduce recall issues. Once the patient agreed, a consent form, which was approved by the institutional review board at the institution where surgery was performed, was mailed to the patient where it was signed and returned. After the signed consent was received by the institution, the patient was called to schedule an interview. Before the interview was conducted, the interviewer reviewed each patient’s satisfaction status, which was retrieved from the internal database. Each participant was identified as being satisfied or dissatisfied based on their response to the survey distributed at a minimum one year from surgery. The survey included a simple question asking how satisfied the patient was with surgery, listing three options: satisfied, somewhat satisfied, and dissatisfied. The
The interview was conducted over the phone and recorded using Microsoft Teams, utilizing a semi-structured interview guide (Appendix A).

Prior to the interviews, the interview guide was vetted using a validation questionnaire aimed at measuring relevance and clarity. The validation process included the distribution of the questionnaire to six content experts who were asked to score each question based on relevance and clarity. The results of this validation process yielded scores of 100% for relevance and 96% for clarity. In total, ten patients were interviewed by the treating physical therapist and their demographics and satisfaction level can be seen in Table 1. Every participant name was changed to a pseudonym to maintain privacy.

### Table 1

Subject Demographic Information and Satisfaction Status

<table>
<thead>
<tr>
<th>Subject (Pseudonyms)</th>
<th>Age</th>
<th>Sex</th>
<th>BMI&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Component type</th>
<th>Satisfaction status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tom Par</td>
<td>65</td>
<td>Male</td>
<td>32.4</td>
<td>Persona PS&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Phil Green</td>
<td>66</td>
<td>Male</td>
<td>42.9</td>
<td>Persona PS</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Veronica Ball</td>
<td>71</td>
<td>Female</td>
<td>28.1</td>
<td>Persona PS</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Denise Sand</td>
<td>72</td>
<td>Female</td>
<td>29.4</td>
<td>Persona PS</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Beth Mulligan</td>
<td>56</td>
<td>Female</td>
<td>37.5</td>
<td>LCCK&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Somewhat satisfied</td>
</tr>
<tr>
<td>Tiffany Driver</td>
<td>52</td>
<td>Female</td>
<td>31.6</td>
<td>LPS&lt;sup&gt;d&lt;/sup&gt; Flex Mobile</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Chris Bogey</td>
<td>74</td>
<td>Male</td>
<td>30.2</td>
<td>Persona PS</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Drew Shank</td>
<td>69</td>
<td>Male</td>
<td>26.7</td>
<td>Persona PS</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Pam Ace</td>
<td>60</td>
<td>Female</td>
<td>29.7</td>
<td>Persona PS</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Nina Bird</td>
<td>61</td>
<td>Female</td>
<td>29.1</td>
<td>Persona PS</td>
<td>Satisfied</td>
</tr>
</tbody>
</table>

<sup>Note</sup>: BMI<sup>a</sup>=Body Mass Index  
PS<sup>b</sup>=Posterior Stabilized  
LCCK<sup>c</sup>=Legacy Constrained Condylar Knee  
LPS<sup>d</sup> is a mobile baring component
Surgical procedure

The surgeon in all ten cases utilized Zimmer components (Zimmer Biomet; Warsaw, IN) comprising of Persona PS system (N = 8), LPS Flex Mobile Bearing (N =1), and LCCK with constrained polyethylene (N = 1). The patella was resurfaced in four cases (40%), utilizing a polyethylene button.

Rehabilitation

Prior to surgery, each patient trialed rehabilitation with a physical therapist at the institution with the hopes of avoiding or delaying surgery. Preoperative physical therapy was standard for all participants and was aimed at maximizing ROM first followed by strengthening, all while minimizing swelling in hopes of improving function and reducing pain. Once the patient and treating physical therapist agreed that objective and subjective function plateaued and the patient continued to have debilitating pain, the patient returned for a surgical consultation with the orthopedic surgeon. After this consultation visit, surgery was scheduled and performed at a mutually convenient time.

Following surgery, each patient followed a standard rehabilitation protocol, led by the treating physical therapist at the institution. Patients spent at least one night in the hospital and were discharged when they achieved satisfactory leg control, adequate ROM, manageable pain, and could walk independently with a walker. Upon getting home, patients followed a relative bed rest period for the first seven days following surgery, only permitted to walk to the bathroom and back, using a standard or rolling walker, in order to keep swelling to a minimum. During the first week at home, they performed five exercises: heel prop and towel stretches for knee extension, heel slides for knee flexion, and straight leg raises and quadriceps sets for leg control. The first in
office visit was on postoperative day seven. Postoperative rehabilitation was first aimed at reducing swelling, maximizing ROM, and normalizing gait. Once these were normalized, the focus was placed on strengthening which was aimed at maximizing function. Patients were discharged once objective and subjective goals were met. The rehabilitation schedule and philosophy can been seen in Table 2.

**Data analysis**

All phone interviews were recorded utilizing Microsoft Teams (Microsoft; Redmond, WA). The recording was then transcribed to a word document. The textual data was analyzed using a general inductive approach. Each transcript was coded using Nvivo software (Lumivero; Denver, CO) and organized into emergent themes.

**Trustworthiness**

Data were collected until saturation of data was reached, as after ten total interviews, no new data was being obtained from the subjects. Peer debriefing was used to establish trustworthiness, as this was accomplished through a conversation between a seasoned qualitative research expert and the interviewer. Debriefing of information included an overview of the transcripts, discussion of the coding scripts, as well as ways to organize the codes and concepts into emergent themes.
**Table 2**

Postoperative Rehabilitation Schedule and Goals

<table>
<thead>
<tr>
<th>Postoperative time</th>
<th>Rehabilitation goals</th>
</tr>
</thead>
</table>
| **Day 1**          | 1. Satisfactory leg control  
                      2. Adequate ROM\(^a\)  
                      3. Manageable pain  
                      4. Walk independently with a walker |
| **Day 7**          | 1. Knee extension to 0 degrees  
                      2. Knee flexion to 90 degrees  
                      3. Have the ability to perform a straight leg raise  
                      4. Normal gait, with or without a walker |
| **Day 14**         | 1. Maintain full extension  
                      2. Progress flexion  
                      3. Reduce swelling from the 1 week appointment  
                      4. Normal gait with or without an assistive device |
| 1 month            | 1. Maintain extension  
                      2. Progress flexion  
                      3. Normal gait without assistive device  
                      4. Reduce swelling from the 2 week appointment  
                      5. Isokinetic and isometric strength tests: ≥50% LSI\(^b\) |
| 2 months           | 1. Maintain extension  
                      2. Attain normal flexion per IKDC\(^c\) objective form  
                      3. Reduce swelling from the 1 month appointment  
                      4. Progress strength towards 90% or more with LSI |
| 4 months           | 1. Maintain ROM  
                      2. Normal or nearly swelling per fluid wave test  
                      3. Progress strength towards 90% or more with LSI |
| 6 months           | 1. Maintain ROM  
                      2. Maintain swelling level  
                      3. Progress strength towards 90% or more with LSI |
| 9 months           | 1. Maintain ROM  
                      2. Maintain swelling level  
                      3. Progress strength towards 90% or more with LSI |
| 1 year             | Discharge with normal ROM, swelling, and strength |

*Note: ROM\(^a\)=Range of motion  
LSI\(^b\)=Limb symmetry index  
IKDC\(^c\): International Knee Documentation Committee  
Early discharge, before 1 year, occurred with normal ROM, swelling, and strength
Results

Demographics

The mean age for the population was 65.0 years (range, 52-74 years). All subjects had a primary TKA, four had their patellar resurfaced, one had a bilateral procedure, and three went on to have the opposite knee replaced at a later date. In terms of time spent in preoperative rehabilitation, two patients came for more than six months and eight came less than six months. Demographic information can be seen in Table 1.

Emergent themes

The following themes emerged as significant contributors to postoperative success: 1) establishing and meeting expectations, 2) having ample education about the surgery, 3) having gone through physical therapy before the surgery, and 4) being psychologically prepared for surgery. Emergent themes and subthemes are displayed in Figure 1. Table 3 presents the frequency of each coded concept as well as the number of participants from which the codes were derived. The themes of expectation and education were the top coded themes and mentioned by all ten of the subjects as important factors that led to a good outcome. Going through preoperative therapy and being psychologically prepared for surgery were mentioned by nine subjects. Codes that were prevalent, however not to the degree of some of the others, included the objective aspect of rehabilitation: ROM, strength, and mobility.
The top code, expectation, was referenced 63 times through the ten interviews. The next most common themes coded during the interviews were education at 41 times, followed by having preoperative therapy at 34 times, and psychological preparedness being referenced 28 times. Exemplary quotes from the subjects for each emergent theme can be seen in Table 4, followed by a narrative of each theme and category.
Table 3

Emergent Themes – Number of References and Subjects

<table>
<thead>
<tr>
<th>Theme</th>
<th>Number of times a code was referenced</th>
<th>Number of subjects referencing theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations</td>
<td>63</td>
<td>10</td>
</tr>
<tr>
<td>Education</td>
<td>41</td>
<td>10</td>
</tr>
<tr>
<td>Preoperative physical therapy</td>
<td>34</td>
<td>9</td>
</tr>
<tr>
<td>Psychological preparedness</td>
<td>28</td>
<td>9</td>
</tr>
<tr>
<td>Objective physical therapy measures</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Range of motion</td>
<td>26</td>
<td>9</td>
</tr>
<tr>
<td>Strength</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>Mobility</td>
<td>13</td>
<td>7</td>
</tr>
</tbody>
</table>
Table 4

Exemplary Quote from the Emergent Themes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Exemplary quotes</th>
</tr>
</thead>
</table>
| **Expectations**              | Mulligan: “Expectations is the name of the game and if you have already seen someone go through it, yeah, that can be a big part of it.”  
Driver: “You likely have people who are highly motivated and highly active that have higher expectations. But, it is all about meeting any expectation to have happy patients, right.”  
Ball: “I understood the expectations and what needed to happen and how I was going to get there.” |
| **Education**                 | Ace: “The way you explain how to do the exercises and how to get the outcome we wanted to have”  
Shank: “Everything was really informative, so you know, I was not scared at all as far as making my choice to get the surgery done.”  
Bogey: “I think the thoroughness of it all impressed me more than anything.” |
| **Preoperative physical therapy** | Mulligan: “I knew that if I did them before surgery, then it was going to make my life a little bit easier post-surgery.”  
Ball: “The preoperative therapy really played into my recovery after surgery.”  
Sand: “I feel like learning new exercises after surgery would have been a bad time to learn them, that’s why doing everything we did before surgery helped so much.” |
| **Psychological preparedness** | Par: “I mean, it makes you feel like you are doing the right thing and that your head is the right way.”  
Green: “Well, you know, with the preoperative therapy, you know there is physical therapy that treats your leg muscles and then there is another mental therapy that treats your mindset.”  
Ball: “I was confident in the decision I made.” |

**Expectations**

According to all ten subjects, setting and meeting expectations was the most important theme when determining factors that lead to postoperative satisfaction. The answers within this common theme varied as Beth Mulligan stated, “I had the full expectation that I would regain my normal function.” In contrast, in an answer to the same question regarding expectations before
surgery, Nina Bird stated “It cannot get any worse, it has to get better. So, mentally, I would have been disappointed if my knee felt the same way after surgery as it did before surgery.” In a subtheme to expectations, many patients mentioned that the knowledge of knowing someone else who went through a TKA was influential to their overall outcome. Denise Sand stated, “I had some knowledge of what it was going to be like seeing my husband go through it, which seemed to help.” Pam Ace also felt this way as she stated, “I really knew what to expect with surgery after seeing my sister go through it.” However, knowing someone could also have a negative outlook on recovery as Christopher Bogey stated, “Well, actually, I had two friends that had a knee replacement by different surgeons and in both situations they contracted an infection. For one of them, it took his life.” Nina Bird shared this thought as well as she stated, “I had a neighbor who had a knee replacement who ended up stiff. I had the fear knowing that she had this surgery and ended up experiencing this problem.” In these instances, the subject reported a rare postoperative complication, indicating the need to set more realistic expectations to ease their mind.

Education

Preoperative education was mentioned by all ten subjects as an important factor that led to a positive outcome after surgery. When asked about how preoperative education affected long term outcomes, Bird stated “You thoroughly explained every exercise, why you were doing every exercise, and why you wanted to get to this particular spot with the exercise.” A subtheme to education was communication as this was mentioned as an important aspect of recovery by eight subjects. Specifically, Phil Green stated “My therapist called me on a Saturday night just to
ask how I was doing. And the surgeon himself gave me his cell phone and if I texted him a question, he would respond. I mean, I got an answer within an hour.”

*Preoperative physical therapy*

Although it was stated by six subjects that the preoperative physical therapy did not objectively help and their knee continued to feel the same after treatment, nine subjects agreed that going through this before surgery ultimately helped their postoperative outcome. Veronica Ball stated after being asked what preoperative factors contributed to postoperative success, “I actually think that the exercises you gave me prior to surgery, I think that probably played a big part in the quick recovery after surgery because the muscles that I had neglected to use because my knee would hurt.” One aspect that kept coming up in the interviews as it related to doing the exercises before surgery was the familiarity the patients gained from doing them beforehand. Sand stated, “I feel like learning new exercises after surgery would have been a bad time to learn them, that’s why doing everything we did before surgery helped so much.” Green echoed this by stating “Confidence in the exercises before surgery and getting comfortable with the exercises.” Lastly, Tiffany Driver stated after being asked about the effectiveness of the exercise before surgery, “I think that depends on the lens. So the effectiveness of trying them to treat the knee and heal the knee, that was completely ineffective. The effectiveness of making sure that we were going down the right course of treatment, that was 100% effective.”

*Psychological preparedness*

Being psychologically prepared for surgery was noted by nine of the ten subjects as a factor that was valued and deemed important to their recovery after TKA. Tom Par stated after being asked about the psychological aspect of the rehabilitation, “I mean, it makes you feel like
you are doing the right thing and that your head is the right way.” Green stated “Well, you know, with the preoperative therapy, you know there is physical therapy that treats your leg muscles and then there is another mental therapy that treats your mindset.” The comment from Green was echoed by one from Sand who stated “I cannot stress enough about the mental preparation for surgery and how that helped me.” Again, another comment by Bird, “So going back to setting expectations and hitting them, it is perfect, it is all a mindset.” The power of developing a positive mindset was not lost on the subjects when it comes to preoperative physical therapy. Many subjects referenced this aspect of therapy more so than objective gains made by doing the exercises, thus placing added emphasis on this aspect of care delivered by the physical therapist before surgery.

Within this theme emerged a subtheme of gaining confidence in the healthcare team which appeared to positively affect their psychological preparedness. Sand stated, “I went into the procedure feeling comfortable because I felt comfortable with the staff. So I was not frightened at all and the staff was really interactive and prepared me what to expect.” Bird echoed this by stating, “I had trust in you folks and I knew I was in good hands.” Simply knowing that physical therapists typically spend the most time with the patients prior to surgery, they have the unique ability to gain this trust and confidence with the patient.

**Objective physical therapy measures: range of motion, strength, and mobility**

Throughout the interviews, the top code, expectation, was mentioned more than two times the amount of “ROM”, three times the amount of “strength”, and nearly five times more than “mobility”. However, ROM was still deemed an important factor for nine of the ten subjects, strength for eight subjects, and mobility for seven subjects. After a question about how
the exercises helped before surgery, Ball stated, “I think it helped condition them and stretched them to the point that the knee could accept the replacement and it enabled me to do the exercise afterwards and recover a lot quicker.” In a response to the effectiveness of preoperative therapy, Bogey stated, “After surgery, I began to realize the preoperative exercises built my muscles back up to where they needed to be.” Other objective measures such as leg control and swelling were rarely mentioned with these two only being mentioned by two of the ten subjects.

Discussion

The purpose of this study was to explore the qualitative aspects of preoperative physical therapy that contribute to postoperative success following TKA. The results of this study identified four factors that influenced postoperative success: 1) setting and meeting expectations, 2) preoperative education, 3) preoperative physical therapy, and 4) being psychologically prepared for surgery. Other aspects included putting a focus on ROM before surgery, having adequate strength before surgery, and improving mobility in preparation for surgery. The findings of this study underscore the importance of the caregiver who communicates well with the patient and helps them understand what to expect in the short and long term after surgery. The more traditional themes of physical therapy including ROM, strength, and mobility were interestingly not as common, or seen as important compared to themes like setting expectations, education, and being psychologically prepared for surgery. Knowing the results of this study can allow a physical therapist to drive treatment more towards education and setting expectations and possibly not as much on the traditional measures like ROM and strength.
Expectations

According to every subject, setting and meeting expectations was the most important theme when determining factors that lead to postoperative satisfaction. The impact that expectations has on recovery is not surprising as this was found to have a large impact on outcomes in a study by Klem et al.\textsuperscript{11} In the study by Klem et al., the authors demonstrated that patients with unrealistically high hopes for complete symptoms resolution and restoration of normal function may be appropriate to direct away from having a TKA due to the risk of developing low satisfaction after surgery.\textsuperscript{11} However, this study differed from the current study as the focus of the interviews in their study was not on preoperative rehabilitation, instead focused on how the patient was feeling after surgery, in terms of pain and function.\textsuperscript{11} In the current study, the interview questions asked the subjects about their expectations before surgery and if meeting this preoperative expectation seemed to have a profound impact on their postoperative satisfaction level. However, the idea of meeting expectations can be an individual perception of function and not always the most black and white measurement. The idea of individual perception of function was evident in the answers by Mulligan and Bird as they answered the same question in two very different ways, with Mulligan answering about regaining full function and Bird answering about reducing her pain. Of note, Mulligan reported being somewhat satisfied compared to Bird who reported being satisfied. Knowing a TKA is a pain relieving procedure, placing too much emphasis on regaining complete and normal function, as it was mentioned by Mulligan, may be unattainable, which was the conclusion for the study by Klem et al.\textsuperscript{11} An individual’s preoperative expectation, whatever it may be, is crucial as Bourne et al. has demonstrated as those who fail to reach their expectation after surgery are 10.7 times
more likely to report dissatisfaction after surgery. Knowing this statistic, as well as knowing the results of the current study, indicates that physical therapists need to help create and set realistic expectations for the patient before surgery.

On the topic of expectations, knowing someone who went through a TKA and using that as a frame of reference for developing postoperative expectations before surgery was evident as this was mentioned by eight of the ten subjects. Overall, it was viewed positively as a few subjects had comments similar to Sand who mentioned that knowing someone set the expectation for recovery after surgery and how having this information made everything easier. However, not all responses as part of this subtheme were positive as Bogey discussed a situation where a person he knew lost their life due to a postoperative infection. Cleary, this was a situation that would warrant increased anxiety and fear as postoperative infection is a known risk with surgery. However, proper education on the low incidence rates, of less than 1%, in this population may help ease these concerns when patients draw on past negative experiences.

Education

Preoperative education was mentioned by all ten subjects as an important factor that led to a positive outcome after surgery. Education as a factor that leads to postoperative outcomes has been assessed before, however only in the short term as it relates to readiness for discharge after surgery. In a study by Soeters et al., 63 subjects received preoperative education by a physical therapist before their joint replacement and they were compared to 63 patients who did not receive this education. The results demonstrated that those who received the preoperative education had fewer inpatient physical therapy visits and achieved readiness to discharge faster compared to the uneducated group. Although it was positive showing how education affects
patients in the short term after surgery, it failed to look at how it may affect long term outcomes, like in the current study. The current study demonstrated that even small amounts of education throughout the preoperative process can have significant impacts in the long term. One of the participants, Bird, had mentioned that education throughout the preoperative process helped in that it gave an answer to why certain things were being done. For physical therapists, answering the “why” question for patients can be something small at that time, yet have a profound impact on long term outcomes.

A large part of education is effective communication, evident by a couple studies showing the importance of communication and education when it comes to postoperative success. Overall, eight of the ten subjects mentioned that communication played a role in their ultimate outcome. Part of communication is simply being available to speak with the patient when they have questions as Green mentioned during his interview. Green spoke highly about having access to the healthcare team and how communication in this manner played into his outcome. He went on to state that since he has never gone through something like a TKA before, it was nice having the confidence to know he was on the right track by getting assurance from the healthcare team. Simply being available for a patient, especially one that has never been through an operation like a TKA, can have positive impacts on their outcome.

Preoperative physical therapy

Although it was stated by six subjects that the preoperative physical therapy did not objectively help and their knee continued to feel the same after treatment, nine subjects agreed that going through this before surgery ultimately helped their postoperative outcome. From an objective standpoint, a few studies have shown that it is possible to improve objective measures
before surgery and improved measures before surgery can lead to better outcomes after surgery.\textsuperscript{1,9,20} Comments by the subjects agreed with these studies as many times the benefits of the exercise were seen after surgery, just not always during preoperative rehabilitation, possibly due to the pain they were in. One of the subjects, Ball, mentioned that the exercises before surgery increased her muscle strength, which in turn better prepared her for surgery. Knowing patients feel like Ball did after surgery, most, if not all, patients should trial physical therapy when they are diagnosed with an arthritic knee. When performing physical therapy after being diagnosed with an arthritic knee, the best case scenario is that they avoid surgery and worst case scenario is they recover better after a TKA due to having better ROM and strength.

Additionally, what was interesting was that many comments made in regard to this common theme had more to do about being familiar with the exercises that needed to be done after surgery compared to making measurable gains in things like ROM or strength. It is important for physical therapists to encourage the continuation of the exercises prior to surgery even if they are not making measurable gains as, in this study, patients report a benefit in doing them due to gaining familiarity with them after surgery.

\textit{Psychological preparedness}

Psychological preparedness was noted by nine of the ten subjects as a factor that was valued and deemed important to their recovery after TKA. Psychological preparedness has shown up in the literature as Klem et al. demonstrated that by showing reassurance when treating the patients, it instills positive thinking in a way that promotes confidence.\textsuperscript{11} Comments about the impact of the mental side of rehabilitation appeared to be closely related to patients gaining confidence in the healthcare team as many patients had statements about how the preoperative
therapy laid the groundwork for preparing their mind for surgery. The comment from Green about the side of therapy that treats a patient’s mindset really stuck out as an important factor for postoperative success and one that physical therapists have a good chance of emphasizing, given the amount of time they spend with the patient compared to other healthcare providers. The mental strength that was gained from the physical therapist instilling confidence in the patient is something that is hard to measure, however, clearly it has a positive impact on postoperative success.

Objective physical therapy measures: range of motion, strength, and mobility

The objective measures that are typically thought of when one thinks about physical therapy are ROM, strength, and mobility. Historically, these objective measures have been the focus when it comes to determining factors that lead to success after a TKA. However, despite the emphasis placed on these factors in the rehabilitation and research setting for patients with knee OA, the results of the current study showed that many subjects do not put an emphasis on these measures compared to other factors like expectations and education. Throughout the interviews, the top code, expectation, was mentioned more than two times the amount of “ROM”, three times the amount of “strength”, and nearly five times more than “mobility”. The theme of expectation being more prevalent compared to objective measures may indicate these measures are highly individual and may not factor into success as much as previously thought. Instead, it may be more based on what level the patient can achieve compared to what they expected to achieve, independent of their objective status. The study by Bourne et al. would back this up as the strongest predictor of dissatisfaction after surgery were expectations not being met, not how they were functioning from an objective standpoint.
Although not as many subjects mentioned these objective factors compared to the top codes of expectation and education, many patients still placed an emphasis on these. Range of motion was deemed an important factor for nine of the ten subjects, strength for eight subjects, and mobility for seven subjects. Despite being mentioned many less times, many of the participants agreed that the objective measures were important. Ball and Bogey both stated that the preoperative ROM and strength exercises got their knee into a better condition, which likely helped their postoperative outcome. Other objective measures such as leg control and swelling were rarely mentioned with these two only being mentioned by two of the ten subjects. Overall, it is not to say these objective measures do not have a place in preoperative therapy, however, this study demonstrates that other tangible factors like meeting expectations and providing quality education to the patient may mean more when it comes to postoperative satisfaction.

**Limitations**

The study is not without its limitations. First, the study was completed on patients that had a TKA with the same surgeon and completed their perioperative rehabilitation with the same physical therapist. Although conducting the study in this manner reduced bias from confounding variables that get introduced from having subjects from multiple surgeons or therapists, the results may be transferable to similar contexts. In addition, the interview was conducted by the treating physical therapists in every case. Although this has positives in that the therapist knows the subject well and could likely help with memory recall, it introduces possible biases with the subject not wanting to divulge some information, if it was negative, in fear that it would upset the interviewer. With this population, there were nine subjects who reported satisfaction, one who reported being somewhat satisfied, and none reporting dissatisfaction. Only having one
patient report being somewhat satisfied and none reporting dissatisfaction limits the ability to
determine common themes that may lead to dissatisfaction. Although it was a homogeneous
population reporting satisfaction, further qualitative studies including those that report
dissatisfaction would help expand upon the findings of this study. Lastly, only one method of
determining trustworthiness, peer debriefing, was used to vet the interview guide instead of the
more standard two methods.

Conclusion

The most common themes as factors leading to success following a TKA were:

establishing and meeting expectations, having ample education about the surgery, having gone
through physical therapy before the surgery, and being psychologically prepared for surgery.

Both expectations and education were mentioned as important factors for success by all ten
subjects in the cohort. Nine of the ten subjects mentioned the next most common themes of
doing the exercise before surgery and being psychologically prepared for surgery. The results of
this study indicated that the way a clinician educates, sets expectations for a patient, and builds a
relationship with the patient prior to surgery may be more important than the overall condition of
the knee.
References


APPENDIX:

INTERVIEW GUIDE
Appendix: Semi-structured Interview Guide

1. How long were you active in physical therapy at the Shelburne Knee Center before making the decision to have a total knee arthroplasty?
2. How often were you coming to the clinic for physical therapy?
3. What exercises, or types of exercises, did you do before surgery?
   a. Which ones did you feel were helping your knee? Were there any that were hurting you or felt like they were not helping?
4. Overall, how did you feel about the effectiveness of therapy before surgery?
   a. Can you explain?
   b. Did you consider this course of physical therapy as nonoperative treatment or preoperative therapy (“prehab”)? Can you explain your answer?
5. What led to the decision to have a total knee arthroplasty?
6. Describe the education that you received from the clinic prior to surgery?
   a. Did you get all of your questions answered? If not, what were these questions about?
7. Describe any fears or concerns you had before surgery?
8. Was there anything about the rehabilitation process before surgery that made you feel at ease about surgery? If so, what?
9. On the day or days leading up to surgery, describe your overall attitude towards surgery?
   a. Were you confident that surgery was going to help your pain?
10. Tell me about your expectations for surgery?
    a. Did you expect to return to normal function?
    b. Did physical therapy prior to surgery affect your expectations? If so, how?
11. Describe the communication between yourself and the staff at the clinic?
12. Was there any part of the postoperative rehabilitation that was painful? If so, what?
13. What factors, if any, early on after surgery do you feel led to your long term outcome after surgery?
14. How do you feel physical therapy, before surgery, affected your overall outcome?
    a. Short term?
    b. Long term?
15. Is there anything else you would like us to know regarding how the preoperative physical therapy affected your postoperative satisfaction?
CHAPTER 5

DISCUSSION

Subjective Factors Leading to Satisfaction Following Total Knee Arthroplasty

Although it has been shown that subjective function after a total knee arthroplasty (TKA) is generally good for those having surgery, satisfaction rates are still relatively low.\textsuperscript{4,13,16} Furthermore, preoperative function in relation to postoperative satisfaction has not been assessed. The first study that was aimed at assessing differences in preoperative subjective function based on postoperative satisfaction status demonstrated that although patients that report being satisfied after a TKA have higher Knee Injury and Osteoarthritis Outcome Score (KOOS) prior to surgery, it was not statistically significantly different. The lack of statistically significant differences between satisfied patients and dissatisfied patients held true for the early time point when the diagnosis of osteoarthritis (OA) was made as well as at the last physical therapy visit before surgery. Additionally, the change in KOOS score over the course of preoperative rehabilitation was similar based on postoperative satisfaction levels. Patients who were able to reach the Minimal Clinically Important Difference (MCID) for the KOOS through the course of preoperative rehabilitation were able to report satisfaction at a higher rate compared to those that failed to reach this level, however this higher rate was also not statistically significantly different.
The main finding of this study suggest that preoperative KOOS scores are not different for those reporting satisfaction and dissatisfaction after a TKA.

In a secondary analysis aimed to predict satisfaction postoperatively, increasing scores for the subscales of symptoms, Activities of Daily Living (ADL), and Quality of Life (QOL) decreased the odds of reporting satisfaction while increasing scores for the total KOOS increased the odds of reporting satisfaction. The secondary finding indicates that those with poor function through low scores in the subscales of symptoms, ADL, and QOL preoperatively can lead to higher satisfaction rates postoperatively. In contrast, higher total KOOS scores before surgery, measuring both function and pain, can lead to higher satisfaction rates after surgery. One possible rationale for this finding is the relative improvement in these measures postoperatively, leading to the perception of large scale functional improvement, further emphasizing the importance of preoperative expectations.³

A study like this one, assessing postoperative outcomes based on preoperative subjective status, is not the first of its kind as Berliner et al. first studied this in 2017.² Berliner et al. discovered that patients with higher preoperative scores, above established thresholds, were less likely to experience a clinically meaningful improvement in function after TKA.² The results of this study are in line with the findings of our current study showing that lower KOOS subscale scores lead to higher rates of satisfaction.² Another study attempting to predict postoperative satisfaction based on preoperative factors was by Bourne et al. who found that the presence of pain at rest before surgery led to a 2.5x greater risk of dissatisfaction after surgery.⁴ In the subjective study, the pain subscale by itself did not show to statistically significantly contribute to the model aimed at predicting satisfaction like other subscales. The discrepancy in these
findings indicates a potential interaction between pain and function before surgery as it relates to postoperative outcomes. A couple different studies associating postoperative satisfaction with preoperative factors discovered that worse pain and function before surgery, via the Oxford Knee Score, related to dissatisfaction following surgery.\textsuperscript{9,11,17} The pain subscale from our current study was not a factor in the model predicting satisfaction, indicating that preoperative pain for this population was not associated with satisfaction after surgery, unlike what has been shown in previous studies.\textsuperscript{9,11,17} A possible reason for the disagreement between studies could be the fact that these studies were assessing postoperative function via subjective scores (Oxford Knee Score) instead of satisfaction status like in the subjective study.\textsuperscript{11,17} The difference between comparing pain to subjective scores and satisfaction is likely related to the result of being satisfied or dissatisfied, which is more of a perception of postoperative status compared to preoperative status. Simply put, satisfaction is tied to whether or not the patient was able to meet expectations, as was reported previously by Klem et al.\textsuperscript{12} Simply reporting either satisfied or dissatisfied can be much different compared to the more granular measurement of the Oxford Knee Score which includes multiple facets of recovery including pain and function.

The findings of this study indicated that the worse function a patient may have preoperatively can lead to higher rates of satisfaction after surgery. The fact that preoperative function has an inverse relationship with satisfaction indicates that patients are generally happy with the improvement in function they get from surgery. The results of this study can be used for patient education for those deciding whether or not to have a TKA. Klem et al. states that those with unrealistic expectations, including getting back to unrealistic subjective scores, may want to reconsider surgery due to the high chance of dissatisfaction after surgery.\textsuperscript{12} The above subjective
study confirms this theory as patients with high degrees of function, measured by the KOOS subscales of symptoms, ADL, and QOL, may want to reconsider surgery and continue nonoperative treatment as they are more likely to report dissatisfaction after surgery compared to those with low functional levels.

Overall, the purpose of this first study was to determine preoperative subjective factors that can positively affect postoperative satisfaction. The results indicate that there are not differences between those that were satisfied or dissatisfied following a TKA for the KOOS taken at the first physical therapy visit after the diagnoses of OA was made, at the last visit before surgery, or the change in KOOS scores from the beginning to end of their course of preoperative rehabilitation. The KOOS subscales of symptoms, ADL, and QOL all had negative effects on satisfaction status after surgery, meaning that the higher the score was at the patient’s initial visit before surgery, the less likely they would become satisfied after surgery. The findings indicate that patient’s preoperative expectations could potentially have a large effect on postoperative satisfaction, further emphasizing the importance of preoperative patient education.

Objective Factors Leading to Satisfaction Following Total Knee Arthroplasty

In the literature for those having a TKA, it has been shown that preoperative range of motion (ROM) can predict postoperative ROM and postoperative ROM can predict postoperative outcomes.\textsuperscript{1,10,15,19} Therefore, it is reasonable to trial physical therapy to improve objective factors in each patient prior to surgery. However, the impact that these objective measures before surgery has on postoperative satisfaction is currently unknown. The findings from the second study, aimed at predicting satisfaction based on preoperative objective function,
provided insights into the relationship between preoperative objective measures and postoperative satisfaction. The objective study contributes to the understanding of potential factors contributing to postoperative dissatisfaction, most notably, the TUG test. The main finding suggests that preoperative objective factors such as knee ROM and strength may not factor into postoperative satisfaction as one would think given improved postoperative objective function has shown improved subjective outcomes in previous studies. Patients that report dissatisfaction after surgery can have better flexion and strength before surgery, yet this was not found to be statistically significantly different compared to those that reported satisfaction after surgery. Results from the TUG test before surgery indicate that those who report being satisfied have slower times at 8.8 seconds, when compared to those who reported dissatisfaction who have an average time of 6.7 seconds. Additionally, TUG test performance right before surgery has the ability to predict satisfaction status with every increase in the TUG test by 1 second, the odds of being satisfied after surgery increases by an odds ratio of 1.442. The TUG test emerged as a significant predictor of postoperative satisfaction as patients who completed this test faster before surgery were more likely to report dissatisfaction after TKA. Slower times leading to postoperative satisfaction suggests that preoperative functional mobility may have an impact on a patient's overall experience and perception of surgery outcomes. Slower TUG test times may indicate greater impairment in functional mobility and addressing this impairment through pain relief from the surgery may potentially lead to improved satisfaction following TKA. Patients that are less mobile prior to surgery may show better satisfaction after surgery due to having lower expectations, thus making them easier to be attained. Bourne et al. demonstrated that the strongest predictor of patient dissatisfaction after
primary TKA were expectations not being met. More specifically, those that failed to meet expectations after surgery were 10.7 times more likely to be dissatisfied with their result. Bourne et al. was not the only study to demonstrate the importance of expectations on postoperative satisfaction as others have shown that satisfaction is closely tied to meeting patient expectations. The same rationale for the results in these studies could be the reasoning behind the result seen with the TUG test in the current study as those with slower times before surgery are likely less mobile and may have lower expectations for their outcome. After surgery, reporting satisfaction may be less likely for those with higher expectations, indicating a ceiling effect for this population.

Another interesting aspect highlighted by this study is the role of quadriceps strength on postoperative satisfaction. Although no statistically significant differences were observed between satisfied and dissatisfied patients in terms of preoperative strength, there were instances where patients that reported dissatisfaction had better strength at the visits before surgery. At the first physical therapy visit, those who reported satisfaction had a limb symmetry index (LSI) of 78% compared to 87% for the dissatisfied group, however this was not statically significantly different. The magnitude of difference was not as large at the last visit before surgery with the satisfied group having an LSI at 77% and the dissatisfied group at 79%, mainly due to the average reduction in LSI throughout the course of rehabilitation being higher for the dissatisfied group at -8% compared to only -2% for the satisfied group. In a prediction model aimed at predicting satisfaction after surgery, strength as not a statistically significant contributor, indicating it may not play a role in postoperative success. A systematic review and meta-analysis from 2021 revealed that a preoperative physical therapy program has significant benefit when it
comes to quadriceps strength following surgery. Dominguez-Navarro et al. showed that those participating in a preoperative strength program demonstrated greater postoperative strength at 6 weeks, however, this, along with subjective scores, stabilized and were equal between groups at 1 year. Similarly, Tungtrongjit et al. showed that a preoperative quadriceps strength program yielded superior strength and subjective scores in the short term, however stabilized in the long term. Our current study failed to show a difference in preoperative strength between those that are satisfied and dissatisfied, taken at one year, indicating that preoperative strength may not factor in to long term satisfaction following a TKA.

The objective study failed to show a difference between groups when it comes to ROM for raw values or in comparison to the contralateral knee. Knee ROM between satisfaction groups were nearly identical at the first visit, last visit, and the progression during the course of rehabilitation. It has been shown that those who participate in a preoperative rehabilitation program of some sort can have higher degrees of flexion postoperatively when compared to a control group. Han et al. demonstrated in a model aimed at predicting satisfaction following a TKA that having more than 130° of flexion after surgery is a positive predictor of being satisfied after surgery. However, the study by Han et al. was only assessing postoperative ROM, not accounting for how the patients looked before surgery like in the objective study. Postoperative knee ROM has been correlated to preoperative ROM in other studies as well, however the objective study did not assess this relationship. The objective study failed to follow the theory that preoperative ROM dictates postoperative ROM and better postoperative ROM leads to better postoperative outcomes, when it comes to satisfaction as the outcome. A possible explanation for this is the equal progression of ROM between groups. Most patients, regardless
of group, improve through the course of preoperative rehabilitation (extension: 1°, flexion: 2°).

Further research studies, including a control group that did not have rehabilitation, may help answer this question, however this is out of the scope of the objective study.

When analyzing the model aimed at predicting satisfaction based on objective measures, knee extension ROM was trending towards statistical significance. In this model, knee extension was inversely related to satisfaction, meaning, as knee extension ROM improved preoperatively, the odds of a patient being satisfied decreased. Similar to the TUG test findings, this is counterintuitive as one would believe that better ROM prior to surgery would be advantageous when it comes to postoperative satisfaction. However, it in fact has a negative association, furthering the thought that preoperative expectations may affect things the most when it comes to postoperative satisfaction, similar to the finding in the subjective study.

Overall, the objective study contributes to the understanding of preoperative factors that may influence postoperative satisfaction following TKA. The findings suggest that preoperative functional mobility, as assessed by the TUG test, could play a role in predicting patient satisfaction, albeit the two having a statistically positive relationship with satisfaction rates increasing as preoperative TUG test time increases. Other common rehabilitation factors such as preoperative ROM and quadriceps strength failed to show predictability when it comes to determining postoperative satisfaction. The results indicate that preoperative expectation may have a large impact on satisfaction as the findings lean towards better satisfaction with worse preoperative objective function. Further studies are needed, including ones assessing preoperative expectations along with objective functioning, in order to validate and expand upon these conclusions. Results from such studies can ultimately lead to more personalized and
effective approaches to enhancing patient satisfaction and optimizing surgical outcomes following TKA.

Qualitative Analysis of Factors Leading to Satisfaction Following Total Knee Arthroplasty

The most common themes as factors leading to success following a TKA were: establishing and meeting expectations, having ample education about the surgery, having gone through physical therapy before the surgery, and being psychologically prepared for surgery. Both expectations and education were mentioned as important factors for success by all ten subjects in the cohort. Nine of the ten subjects mentioned the next most common themes of doing the exercise before surgery and being psychologically prepared for surgery. The more common rehabilitation measures of ROM, strength, and mobility were coded much less frequently than these top themes. The results of this study indicated that the way a clinician educates, sets expectations for a patient, and builds a relationship with the patient prior to surgery may be more important than the overall objective condition of the knee.

Expectations

The theme of meeting expectation as it relates to postoperative satisfaction has been shown in previous studies by Klem et al. and Bourne et al.\textsuperscript{4,12} In these studies, meeting expectations was shown to be strongest predictor of dissatisfaction and goes on to state that those with unrealistically high expectations before surgery should reconsider going through with surgery as they are more likely to be dissatisfied after surgery.\textsuperscript{4,12} The conclusion of the study by Klem et al. seems like a bold statement, however, in one of the interviews as part of the qualitative study, a subject made a comment that would agree with the authors of the study: “It
cannot get any worse, it has to get better. So, mentally, I would have been disappointed if my knee felt the same way after surgery as it did before surgery.” The subject indicated that she would be disappointed with the surgery if she had the pain like she did prior to surgery. Knowing TKAs are a pain relieving procedure, the healthcare team was confident in reducing pain and meeting her expectations. However, functional goals are sometimes more difficult to reach. For example, a different subject stated “I had the full expectation that I would regain my normal function.” The patient that had the goal of regaining normal function was less satisfied after surgery compared to the one who wanted less pain, likely because regaining normal function after TKA is more unrealistic compared to relieving pain and according to Klem et al., this patients should have reconsidered surgery.\textsuperscript{12}

\textit{Education}

The theme of education was the second most referenced code in the qualitative study. Education and expectations seemingly go hand in hand as the more you educate a patient, the more likely it will be that the patient will develop realistic expectations. Preoperative education also goes with effective communication which is a factor proven to lead to higher satisfaction in patients having a TKA.\textsuperscript{7} In fact, eight of the ten subjects in the qualitative study agreed that effective communication was instrumental in their recovery before and after a TKA. Knowing that education plays such a pivotal role in the satisfaction of patients after surgery, physical therapists should derive a way to work this into their preoperative care plan.

\textit{Preoperative physical therapy}

The act of going through physical therapy in the sense that the patients were familiar with the exercises that they would be doing after surgery proved just as important as making objective
gains before surgery. One subject stated “I feel like learning new exercises after surgery would have been a bad time to learn them, that’s why doing everything we did before surgery helped so much”. However to contrast this, another subject believed that the exercises physically prepared her for her postoperative recover as she stated “I actually think that the exercise you gave me prior to surgery, I think that probably played a big part in the quick recovery after surgery because the muscles that I had neglected to use because my knee would hurt.” Regardless of why this them emerged as a factor that led to success after a TKA, it is noteworthy and one that should encourage all patients to trial rehabilitation prior to having a TKA.

**Psychological preparedness**

Psychological preparedness emerged as the other most pivotal and most common theme among the group interviewed. Klem et al. showed that by showing reassurance when treating the patients, it instills positive thinking in a way that promotes confidence. The finding by Klem et al. was illustrated in a response by one of the interviewees who stated “Well, you know, with the preoperative therapy, you know there is physical therapy that treats your leg muscles and then there is another mental therapy that treats your mindset.” A comment like this shows that physical therapists have the unique ability to treat patients physically and psychologically before their TKA, and both may contribute to postoperative satisfaction. The key to take advantage of this common theme is seeing the patients with an arthritic knee, before their TKA, which does not always happen. Developing a relationship with other members of the healthcare team and treating in an interdisciplinary fashion may help accomplish this goal.

**Objective physical therapy measures: range of motion, strength, and mobility**
In previous literature, the objective factors of ROM, strength, and mobility have traditionally been the focus of preoperative physical therapy as well as research variables when trying to predict postoperative outcomes.\textsuperscript{6,10,14} However, these factors were not as prevalent compared to the higher frequency codes of expectations, education, and psychological preparedness. Expectation and education emerging as more common themes compared to the more traditional physical therapy measures of ROM, strength, and mobility indicate that these measures are highly individual and may not factor into success as much as previously thought. Instead, it may be more based on what level the patient can achieve compared to what they expected to achieve, independent of their objective status. The emphasis on meeting expectations goes back to Bourne et al. who demonstrated that dissatisfaction is best predicted by expectations not being met.\textsuperscript{4}

Conclusion

To summarize the three studies performed with the goal of determining preoperative factors that will lead to postoperative satisfaction, patients that reach their expectation of surgery will generally be more satisfied compared to those that fail to reach their goals. The finding of meeting expectations appears to be independent of the patient’s preoperative objective status and is a factor that has proved important in previous studies.\textsuperscript{7,12} As a physical therapist treating patients with knee OA, before a TKA, emphasis should be placed on high quality education that sets realistic expectations for the patient to ensure a positive outcome after surgery.

Traditionally, physical therapists are treating patients with knee OA in hopes to improve their ROM, strength, and mobility.\textsuperscript{6,10,14} Approaching rehabilitation with this in mind has led to
better outcomes after surgery, however mainly with objective measures and subjective scores in the short term and these do not always translate to long term patient satisfaction.\textsuperscript{8,10,16} Determining why subjective scores are not a perfect correlation with patient satisfaction was not the aim of these studies, however, the results prove why this difference may exists.

The study assessing subjective factors leading to postoperative satisfaction demonstrated that patients that tend to score worse on the subjective exam before surgery will typically report being satisfied with surgery compared to those that report doing better before surgery. The study assessing objective factors leading to postoperative satisfaction demonstrated that the test measuring gait speed had an inverse relationship with satisfaction, meaning the worse the score was before surgery, the more likely the patient would report postoperative satisfaction. In the same study, other variables of ROM and strength also showed a similar relationship, albeit not statistically significant. Patients that had worse ROM and worse strength before surgery had higher likelihoods of reporting satisfaction after surgery. Overall, with these two studies, it was concluded that the better preoperative status a patients had, whether it be subjective or objective, the chances of them reporting being satisfied with their TKA went down. This conclusion agrees with Klem et al. who stated that patients with unrealistically high hopes for complete symptom resolution and restoration of normal function may want to reconsider surgery in general to avoid postoperative dissatisfaction.\textsuperscript{12} For the patients that are already doing well subjectively and objectively before surgery and are expecting to be even better postoperatively, it may be more difficult for them to be satisfied with surgery as the results of our study demonstrated. The results from the qualitative study agrees with this as well as it was determined that most patients
feel that meeting expectations and having ample education about the surgery are more important than the physical condition of their knee.

In putting these three studies together, the takeaway for physical therapists treating these patients before surgery is that an emphasis should be placed on providing education about surgery that sets expectations for their postoperative recovery instead of aiming for arbitrary objective measures of ROM or strength. It is still recommended to work on these aspects of rehabilitation, however, as the qualitative demonstrated, the reason for doing the exercises before surgery may in fact be that it gives the patient more confidence after surgery having done similar exercises beforehand. Efforts should be made, preoperatively, to ensure the patient knows what they are getting into for surgery and has realistic expectations for their recovery in order to give them the best chance at reporting postoperative satisfaction.
References


