

Assessment of Continuous Care Based on the Roy Adaptation Model in Patients Undergoing Total Knee Replacement: A Quasi-Experimental Study

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Abstract

BACKGROUND/AIMS: To assess the effectiveness of continuous care based on the Roy Adaptation Model (RAM) in patients undergoing total knee replacement (TKR) surgery.

MATERIALS AND METHODS: This quasi-experimental study included 83 patients in a university hospital. The intervention group was offered continuous care based on RAM. The research data were collected using a Patient Identification Form, the Western Ontario and McMaster Universities Osteoarthritis Index, and the Hospital Anxiety and Depression Scale.

RESULTS: Except for the pain score, no statistically significant difference in the pre-discharge and 3rd month was found for the patients in the intervention and control groups. It was determined that the pain scores of patients in the intervention group in the pre-discharge period were lower than those in the control group ($p=0.022$). A significant difference was found between the anxiety score averages in time in the intervention group in terms of the group time interaction ($p=0.009$). Because of further analysis, a statistically significant difference was determined that the anxiety scores of patients in the intervention group in the 3rd month were lower than those in the control group ($p=0.032$). A significant difference was found between the depression score averages in time in the intervention group in terms of the group x time interaction ($p=0.037$).

CONCLUSION: The functional status and pain of patients improve over time. In this process, continuous care based on RAM was effective in developing effective adaptation behaviors of patients, and a positive effect on pain, anxiety, and depression was determined.

Keywords: Total knee replacement, roy adaptation model, continuous care

INTRODUCTION

Osteoarthritis (OA) is a primary indication for total knee replacement (TKR) surgery. OA can develop in different joints, but it is most commonly seen in the knee joints as an outcome of the increase in the number of overweight individuals and decreases in people's social

activities.¹⁻³ Worldwide, OA is the joint most commonly affected by with an estimated prevalence of 15% in persons aged 56 to 84 years.⁴

In the United States, OA was the justification for 95% of TKA procedures performed.⁵ OA in the knees leads to limitations in movement,

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deformities, and a disruption of the knee structure, which in turn become barriers to daily living and social activities, resulting in both physical and psychosocial disability.¹⁶ TKR surgery is a successful treatment for eliminating pain and allowing recovery of movement in the joints.⁷⁻⁹ However, patients undergoing TKR surgery experience various circumstances that affect their quality of life before and after surgery. While patients hope to be relieved of their pain on the one hand, they also become fearful of becoming dependent on others. Pain, weakness, activities of daily living (ADL) limitations, becoming dependent, and a change in customary roles may result in social isolation, anxiety, and depression, especially in the early postoperative period.^{2,10-13} Successful recovery and adaptation to the prosthesis depends on the adaptation of patients to the care and rehabilitation provided, successful management of additional illnesses, and the presence of sufficient psychological and social support.^{12,14} The recent decrease in hospital stay duration has made continuous care a requirement.¹¹ Continuous care refers to the establishment of a continuous and consistent interaction between patient and caregiver.^{12,15-18} This process encompasses the period before hospitalization and after discharge and requires a multidisciplinary team equipped to handle issues arising in different areas of specialization.^{12,17} Nurses play key roles in helping patients adapt to daily life by determining patients' levels of knowledge, care, and needs and by interacting with other health professionals.^{16,19} This study used the Roy Adaptation Model (RAM) in patients undergoing TKR to enhance nurses' understanding of caregiving theories and their skills at incorporating these theories into the care they provide. Using continuous care based on RAM may provide insight into evaluating the adaptation process that patients undergo and relevant factors, and may be a useful example of providing integrated care.

Continuous Care

The concept of continuous care in healthcare services was introduced in 1960 in the United States.¹⁸ Continuous care is specifically planned for the individual patient and relates to a specific time. This period can cover as short a time as the hospitalization period of a patient or it can apply to long-term care that starts with the individual's first-line healthcare. Continuous care has three components: *informational continuity*, *relational continuity*, and *management continuity*.¹⁶ Various methods may be used in the implementation of continuous care. These methods encompass *discharge instructions*, *periodic patient follow-ups*, case conferences among team members in which patients and their families are also included, and *telephone follow-ups*.¹⁸ In the continuous care of TKR patients, emphasis is placed on the importance of a multidisciplinary team that includes a case management nurse, nurse anesthetist, occupational therapist, orthopedist, physiotherapist, dietician, and a psychiatrist when necessary. While the case management nurse is in charge of managing care, support from other healthcare disciplines is enlisted when needed.^{12,15,18,20} In this study, the researcher performed the duties of a case management nurse.

Roy Adaptation Model

Sister Callista Roy defined the model as a "continuously growing and developing adaptive system of conditions, circumstances, and influences that surround and affect the development and behavior of a person".¹⁹ Various *focal*, *contextual*, and *residual stimuli* change the environment and affect the open system of the human being. Focal stimuli are those that are extrinsic to which the individual immediately responds with the reflex of adjustment. Contextual stimuli are all those

that are not directly caused by behavior but have an effect on behavior and arise from the individual's internal and external worlds. Residual stimuli are internal or external factors that have a continuous effect on the individual but whose impact cannot be fully explained. The model describes two coping subsystems of individuals—the regulator and cognator systems—that are present at birth or later acquired. If environmental impacts are greater than what the individual can cope with, the system cannot function and a deviation from health is the result. The observable behaviors of individuals comprise the RAM's *physiological*, *self-concept*, *role function*, and *interdependence* adaptive modes. Behaviors in the physiological domain consist of functions that maintain physical integrity. Roy classified behavioral responses in the domain of adaptation as adaptive or non-adaptive. The objective of nursing is to develop adaptive responses.¹⁹

Aim

The aim of this study sought to evaluate the effects of RAM-based continuous care given to post-operative TKR patients. The hypotheses of the study were (primary outcomes): (1) The intervention group's pain, anxiety, and depression levels will be lower than the control group levels. (2) The intervention group's functional state will be higher than in the control group. (3) There is a difference between the mean scores of pain, anxiety, and functional status between the intervention and control groups, and between group x time (Baseline, Pre-discharge, 3rd month) interactions.

MATERIALS AND METHODS

Design: This study had a quasi-experimental design.

Sample: The study was completed with TKR patients treated from October 2012 to July 2014 at the orthopedic and traumatology unit of a university hospital situated in western Türkiye. A convenience sample was selected from patients admitted to the orthopedic unit for TKR surgery. The inclusion criteria were being a first-time TKR patient, age 18 or older, oriented, and able to speak and understand Turkish. The exclusion criteria included a confirmed neurological or psychiatric medical diagnosis. Eighty-three patients participated, and seven patients were excluded from the study (Figure 1). The first 44 patients were designated as the control group, and the next 39 patients were recruited into the intervention group (n=76). After the study data were collected, the data were applied to the G*power package program for power analysis. The sample size for each group was taken as an average of 36, and the two-way analysis of variance was used in the power analysis on repeated measures. The power analysis employed the mean scores for anxiety and depression, the study's dependent variables, and it was found that the power was above 80%.²¹ At the end of the study, the power was 0.86, and when the effect size was 0.37, the p values were 0.05.

Procedure: Informational booklets and telephone follow-ups provided during this period were part of the continuous care intervention. The patients were provided with education "preoperatively," "postoperatively" and "pre-discharge" based on the informational booklet drawn up by the researcher. In the follow-ups after discharge, the information was repeated according to the patients' needs (Figure 2). The educational booklet contained updated information considering evidence-based applications on: preoperative preparation with the TKR patient, difficulties that the patient may encounter postoperatively, relevant pre-discharge and post-discharge

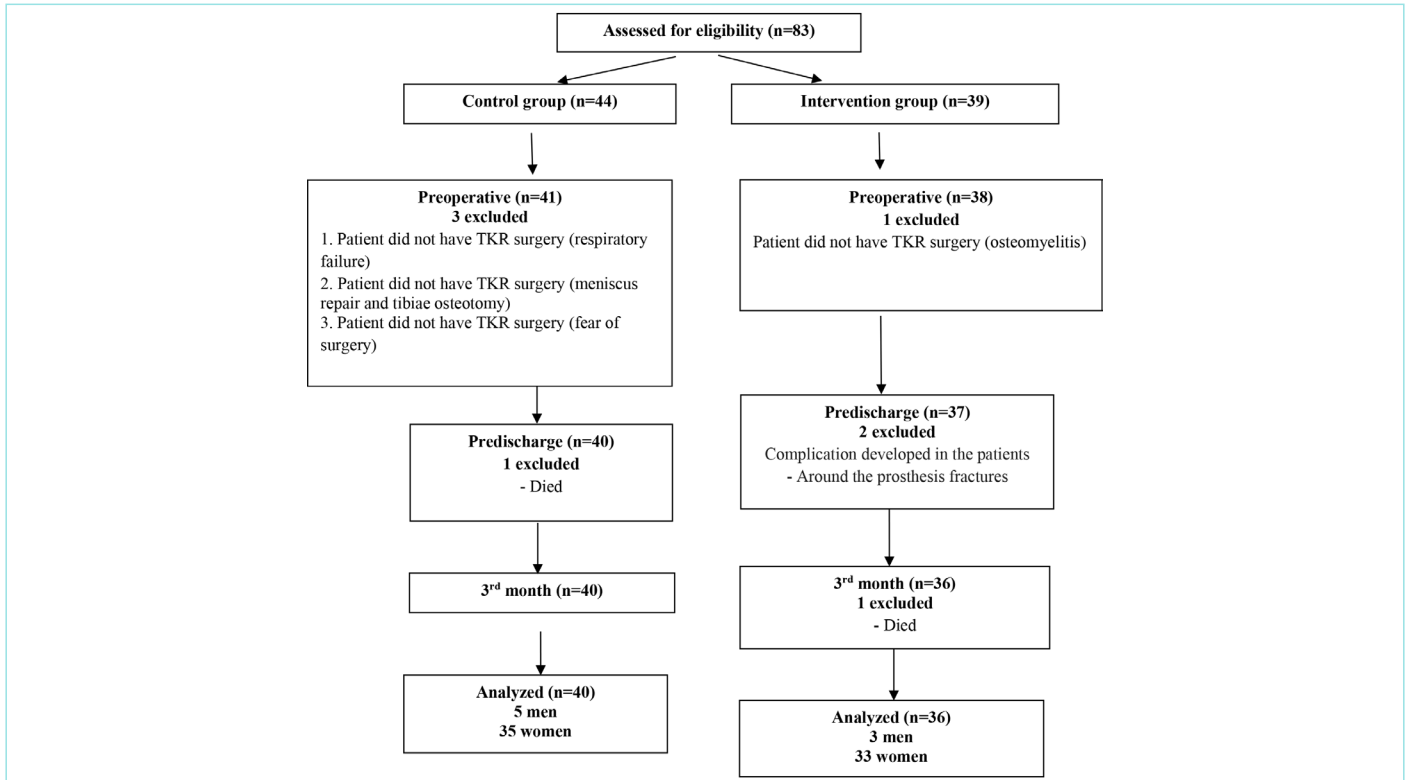


Figure 1. Sample flow diagram.

TKR: Total knee replacement.

Education period	Content	Intended to be affected RAM modes
Preoperatively 1. Interview (When the decision TKR in the outpatient clinic is taken or the first-time patient enters the clinic)	Preoperative education - Total knee replacement. - Medical instruments that may be encountered at the hospital (urinary catheter, drain, spirometer, compression socks) and how to use them. - Pain management. - Venous thromboembolism and routine thrombophilaxy. - Respiratory exercises and spirometry use. - Possible complications and initiatives to prevent. - Exercises (quadriceps strengthening exercise, foot exercise). - Changes to be made at home planned. - Questions of patients and families answered.	Physiological Self-concept Interdependence
Postoperatively Discharge 2.-3. Interviews	Postoperative education - Advancement of early mobilization (foot exercises were shown and if possible, the first experience of standing up was done together). - Discussions about home care after discharge (transition from hospital to home, rehabilitation exercises, drug use, wound care, bathing, traveling, sexual life, driving, check-in times). - Questions related to the above topics were answered and their experiences shared.	Physiological Self-concept Interdependence
First 3 months 4.-12. Interviews	Questions answered	Physiological Self-concept Role function Interdependence

Figure 2. Content of education and affected RAM* modes.

*RAM: Roy Adaptation Model.

information, and guidance for caretakers post-discharge.^{3,7,13,20,22,23} The opinions of four academic nurses, a physician, an academic physiotherapist, two orthopedic nurses, and three patients who had undergone TKR were included in the booklet. Over the study period, the patients were allowed to call the researcher whenever they wanted to ask a question and receive advice on any topic they wanted. In addition, the patients' recovery processes were assessed, and patients who needed more follow-ups were called once a week.

The control group was provided with routine care at the clinic during the study period. When TKR was planned for a patient, the physician provided the patient with information about "the diagnosis, risks of the surgery, and surgical procedure." Before discharge, patients were given informational brochures about the period after discharge. Any question that patients had throughout the process, from admittance until discharge, were answered during nursing interventions. The data for the intervention group were collected after the completion of data collection for the control group. Following the collection of initial information from the patients, the researcher implemented continuous care based on RAM (Figure 3). Data were collected from the patients "preoperatively," "pre-discharge," and in "the 3rd month." The application of instruments was completed in 20-30 min for each measurement. Phone calls lasted 20-40 minutes on average. A researcher collected the data (A.S.).

Instruments: The research data were collected using (1) a Patient Identification Form, (2) the Western Ontario and McMaster Universities Osteoarthritis Index, and reliable scale for the evaluation of pain, stiffness, and functional state in patients with OA.^{24,25} Scores are based on a scale of 20 points for pain, 8 points for stiffness, and 68 points for functional state; the higher the points, the worse the individual's condition.²⁴ The Cronbach's alpha coefficients (baseline, 1st follow-up and 2nd follow-up) were: 0.77, 0.78, 0.82, respectively for pain; 0.82, 0.96, 0.90, respectively for stiffness, and 0.93, 0.91, 0.93, respectively for functionality. The Cronbach's alpha coefficient indicates whether items measure the same characteristics and whether the items are related to what is being measured. Cronbach's alpha coefficients less than 0.40 indicate that the instrument is not reliable; coefficients between 0.40 ≤ α < 0.60 indicate low reliability, 0.60 ≤ α < 0.80 good reliability, and 0.80 ≤ α < 1.00 high reliability.²¹

The Hospital Anxiety and Depression Scale developed by Zigmond and Snaith²⁶ consists of subscales for anxiety and depression. This is a commonly used, valid, and reliable scale.²⁷ The scale is made up of 14 items: 7 symptoms of depression and 7 symptoms of anxiety. The results of the receiver operating characteristic analysis determined that the cut-off points on the Turkish questionnaire were 10 for the anxiety subscale and 7 for the depression subscale. Individuals scoring above these points are identified as a risk group.²⁷ The Cronbach's alpha coefficients (baseline, 1st follow-up, 2nd follow-up) for this study were 0.83, 0.74, 0.87 for anxiety and 0.59, 0.59, 0.70 for depression.

Ethics

Written informed consent was approved by the Dokuz Eylül University Hospital Ethical Committee (approval number: 30-GOA2011/13-09-2011). In addition, written permission was obtained from the University Hospital. The researcher obtained the patients' written and verbal consents after explaining to them the purpose of the research, the process of data collection, and the study's implementation, informing

them that they may withdraw from the study at any time and that their names would be kept confidential. The studies comply with the Declaration of Helsinki.

Statistical Analysis

The Statistical Package for the Social Services SPSS version 15.0 (SPSS®, IBM® Corp., Armonk, NY, USA) program was used in the data analysis in the second stage of the study. Data analysis included descriptive statistics of numbers (i.e. percentages, means, standard deviation), χ^2 , t-tests, a 2-factor repeated-measures analysis of variance, and a paired t-test with Bonferroni correction.

RESULTS

Sociodemographic Characteristics

Of all patients participating in the study, 89.5% (68) were women, 84.2% were married, 64.5% were housewives, 30.1% were retired, 71.1% lived with their spouses, and 15.8% lived at their children's homes. Of the patients, 69.7% had a chronic illness, 51.3% had tried physical therapy, 76.3% underwent surgery because of pain and loss of function, 31.3% had been suffering from knee pain for more than 4 years, 50.0% had bilateral surgery, and 41.8% required the support of a cane, crutches, or someone's assistance before the surgery. Of the patients, 58.2% could walk without a helping vehicle. The mean age of the intervention group was 66.77±8.3, mean body mass index (BMI) was 32.6±7.03, the average stay at the hospital was 9.5±2.9 days; in the control group, the mean age was 65.57±6.5, mean BMI was 30.5±4.71, and the average stay at the hospital was 9.2±3.2 days. The distribution of the features of the intervention and control groups is shown in Table 1.

Effects of RAM-Based Continuous Care on Pain, Stiffness and Functional State

No significant difference was found in the intervention group in pain, stiffness, and functional state scores in terms of the group time interaction (Baseline, pre-discharge, 3rd month) (Table 2). Except for the pain score, no statistically significant difference in the pre-discharge and 3rd month was found for the patients in the intervention and control groups. It was determined that the pain scores of patients in the intervention group in the pre-discharge period were lower than those in the control group ($t=2.343$, $p=0.022$). No statistically significant difference in the pre-discharge and 3rd month was found for stiffness scores for the patients in the intervention and control groups (pre-test $t=0.633$, $p=0.528$; post-test t , time 1=0.933, $p=0.354$; post-test t , time 2=0.102; $p=0.919$). No statistically significant difference in the pre-discharge and 3rd month was found between functional state scores for the patients in the intervention and control groups (pre-test $t=1.836$, $p=0.071$; post-test t , time 1=1.533, $p=0.130$; post-test t , time 2=0.178; $p=0.859$) (Table 2).

Effects of RAM-Based Continuous Care on Anxiety and Depression

A significant difference was found between the anxiety score averages in time in the intervention group in terms of the group x time interaction (Baseline, pre-discharge, 3rd month) ($F=4.892$) ($p=0.009$) (Table 3). Because of further analysis, a statistically significant difference was determined that the anxiety scores of patients in the intervention group in the 3rd month were lower than those in the control group ($t=2.201$; $p=0.032$). No statistically significant difference was determined between

Domains of Adaptation	Evaluating Stimuli Focal stimulus: Osteoarthritis, TDP Continuous Care Interventions	Nursing Diagnoses	Continuous Care Nursing Interventions	Evaluation	
Pre-operative	Physiological mode Contextual stimuli: - Severity of osteoarthritis - Weakness of knee muscles and tendons - Additional illnesses - Obesity Residual stimuli: - Genetic characteristics - Sedentary life	*Pain, *Reduced physical activity *Disruption of sleep patterns *Loss of positive body image	Management: - Taking the patient's detailed history - Determining the patient's capabilities with regard to managing additional illnesses - Creating a healthcare program jointly with other healthcare disciplines - Determining the patient's needs - Controlling pain (the patient's methods of coping with pain are queried, appropriate nonpharmacological methods are taught, patient is informed about the use of analgesics, etc.) - Ascertaining the patient's functionality, determining and controlling the factors causing the reduction in physical activity, supporting the patient in exercising - Evaluating the patient's sleep patterns, reviewing how the patient copes with any changes in sleep patterns and ensuring effective coping - Evaluating the patient's perception of his/her own body, developing strategies to cope with the change in body image - Determining the causes and the level of the patient's anxiety, ensuring that this anxiety is expressed and eradicated - Determining the patient's coping strategies, giving support in the use of those that are effective - Evaluating the patient's self-esteem and improving reduced self-esteem - Ascertaining how the patient has been affected by the role change - Evaluating the capacity of the patient to carry out ADL - Evaluating the opinions and expectations of the patient and the patient's family members regarding prostheses - Making arrangements at home (ergonomic arrangements appropriate to the prosthesis) - Preventing infections (guiding the patient into treatment if there is infection) - Eliminating the fears and anxieties of the patient and family - Determining risk factors related to social isolation and taking the necessary precautions Information-based: - Sharing information gathered from the patient with the doctor, physiotherapist and dietician - Evaluating the treatment methods and their effectiveness prior to the surgery	Effective adaptive behavior: - Effectively managing additional illnesses - Effective pain management - Doing the recommended exercises to strengthen knee muscles and tendons - Having the patient confirm that he/she gets enough sleep and is not tired - Having the patient express an acceptance of the change in body image or confirm a positive body image - Having patient be aware of the reasons for his/her anxiety and be able to define his/her emotional state - Having the patient use coping strategies that will eliminate/solve issues - Paying attention to the diet plan - Losing weight - No finding related to infection - Making the necessary arrangements at home - Building up realistic expectations - Being willing to fulfill life's roles - Making an effort to carry out ADL - Moving about feeling safe and without a fear of falling - The patient's accepting the present situation and that there will be a need for someone else's support during the recovery period and then gradually reducing the use of this support - Gaining independence steadily and being strong enough to live one's life - Socializing appropriate to the patient's condition and participating in activities	
	Self-concept mode Contextual stimuli: - Being dependent on someone else - Fear (fear of surgery, fear of becoming disabled) - Unrealistic expectations - Negative experiences - Anxiety about becoming dependent Residual stimuli: - Postponement of surgery - Feeling of being a burden on caregivers	*Weakness *Anxiety *Ineffective individual coping *Reduced self-esteem			
	Role function mode Contextual stimuli: - Reduced physical activity - Insecurity - Being dependent on someone else - Not engaging in ADL Residual stimuli: - Postponement of surgery - Losing control over life decisions	*Loss of role/function *Not engaging in ADL			
	Interdependency mode Contextual stimuli: - Weakness, - Being dependent on someone else Residual stimuli: - Losing control over life decisions - Feeling of being a burden on caregivers	*Inadequacy in coping within the family *Social isolation			
			- Cooperating with the doctor, physiotherapist and nurses to inform the patient and family about the different prostheses, the treatment applied and the exercise protocol Relational: - Cooperating with the dietician to set up an appropriate scheme for weight loss - Cooperating with the doctor to develop realistic expectations about the different prostheses and treatment - Cooperating with the physiotherapist with regard to setting up appropriate exercises recommended to strengthen knee muscles and tendons	Ineffective adaptive behavior: - Continuing to be obese - Developing an infection - Building up high expectations - Experiencing anxiety - Experiencing pain - Steady increase of functional limitations/strain - Existence of/continued sleep problems - Patient feeling weak - Continuing to live out the role of passive or dependent patient/Being dependent on others - Not exercising regularly/avoiding exercising - Unwilling to carry out ADL/Waiting for or wanting someone else to do the activities - Experiencing social isolation - Not consulting health professionals when there is a problem - Negative sense of self-esteem	
Post-operative (early stage)	Physiological mode Contextual stimuli: - Pain/Inadequate pain control - Other effects of surgery (weakness, loss of appetite, constipation) - Edema/swelling - Weakness of knee muscles and tendons - Fear (fear of falling) - Additional illnesses - Anesthesia - Narcotic analgesics - Bilateral application of prostheses, etc. - Insufficient knowledge Residual stimuli: - Intraoperative process - Obesity - Not being ready for replacement surgery	*Pain *Reduced tissue perfusion *Restricted movement *Loss of appetite *Constipation *Activity intolerance *Disruption of sleep patterns *Hypovolemia *Dehydration risk *Risk of peripheral neurovascular function disorder	Management: - Creating a healthcare program jointly with other healthcare disciplines - Determining the patient's needs - Eliminating the fears and anxieties of the patient and family - Preparing for the surgery - Continuing with treatment and care - Ensuring that ADL are carried out - Ensuring pain control - Ensuring that the patient's additional illnesses are under control - Preventing infection - Ensuring/encouraging early mobilization - Ensuring eating plan is appropriate to body needs - Improving activity tolerance - Restoring sleep patterns - Preventing constipation - Preventing dehydration - Determining and managing needs related to restricted movement - Setting up a discharge plan - Supporting the patient's caregivers - Ensuring that the patient achieves the planned range of joint motion - Supporting and restoring the ability to achieve personal hygiene - Ensuring that the patient is able to express and effectively cope with weakness, anxiety, despair, lowered self-esteem, dependency, being a burden and being afraid	Effective adaptive behavior: Having normal vital signs, all systems functioning appropriate to the recovery process, stabilization of neurovascular condition, able to tolerate food as much as is needed, sufficient sleep, rest, looking relaxed, no complications (infections, bleeding, DVT, fluid-electrolyte imbalance, etc.), able to breathe deeply--able to use a spirometer--and adapt to rehabilitation exercises, early mobilization, normal intestinal sounds/no elimination problems, effective pain management, ensuring preparedness for discharge, reaching at least a 90- (110 if possible) degree joint range of motion, able to tend to personal hygiene, cooperating with the team in the care stage, willing to take on the responsibility of own care, having a positive body image, effective role integration in response to role changes, taking responsibility in the context of roles, able to express emotions and cope with feeling weak, anxious, despair, reduced self-esteem, feelings of dependency, being a burden and being fearful	
	Self-concept mode Contextual stimuli: - Fear (fear of harming the prosthesis) - Fear (fear of becoming disabled) - Being dependent on someone else - Feeling of being a burden on caregivers - Unrealistic expectations Residual stimuli: - Losing control over life decisions	*Weakness, *Anxiety *Despair *Ineffective individual coping, *Reduced self-esteem			
	Role function mode Contextual stimuli: *Restricted movement - Being dependent on someone else Residual stimuli: - Prolonging of recovery period	*Inability to fulfill roles *Inability to practice personal hygiene			Ineffective adaptive behavior: Disruptions in system functions, surgery-related tissue damage and anesthesia-related reduced arteriovenous circulation, loss of appetite, constipation, numbness of fingertips, feeling cold, reduced movement, insomnia, loss of knee joint function, activity intolerance, pain, late mobilization, developing complications (bleeding, infection, DVT, fluid-electrolyte imbalance), lack of personal hygiene, reduced self-esteem, weakness, anxiety, not being able to fulfill sexual and adult rules, not being able to return to work, social isolation, disruption of the family routine, inadequacy in support systems, feeling like a burden, fear of falling or becoming disabled, prolonging of recovery period, increased dependency on another person in the post-operative period
	Interdependency mode Contextual stimuli: - Being dependent on someone else - Feeling of being a burden on caregivers Residual stimuli: - Losing control over life decisions - Prolonging of recovery period	*Interruption of family processes *Inadequacy in coping within the family		Information-based: - Sharing of the information obtained from the patient by doctors, physiotherapists and other nurses in the clinic with the anesthesiologist Relational:	
			- Cooperating with the physiotherapist to increase and encourage the performance of rehabilitation exercises - Achieving effective pain control through cooperation with the doctor and anesthesiologist		

Figure 3. Continuous care interventions based on the RAM. Nursing diagnoses and continuous care interventions according to RAM domains and evaluation of effective-ineffective adaptive behaviors.

RAM: Roy Adaptation Model, ADL: Activities of daily living

Figure 3. Continued

Post-discharge (late period)	Physiological mode	<p>Contextual stimuli:</p> <ul style="list-style-type: none"> - Pain - Weakness of knee muscles and tendons - Fear (fear of falling) - Additional illnesses - Restricted movement - Bilateral application of prostheses, etc. <p>Residual stimuli:</p> <ul style="list-style-type: none"> - Obesity 	<p>*Pain</p> <ul style="list-style-type: none"> *Constipation *Activity intolerance *Disruption of sleep patterns *Risk of developing complications (infections, DVT, etc.) 	<p>Management:</p> <ul style="list-style-type: none"> - Creating a healthcare program jointly with other healthcare disciplines - Providing information and continuing with advisory services (telephone monitoring, polyclinic controls) - Determining the patient's needs - Ensuring pain control - Improving activity tolerance - Making arrangements at home (ergonomic arrangements appropriate to the prosthesis) - Assessing the symptoms of possible complications - Preventing constipation - Preventing infection - Preventing DVT - Restoring sleep patterns - Eliminating the fears and anxieties of the patient and family - Determining the patient's home care needs, preparing and educating the patient for discharge 	<p>Effective adaptive behavior:</p> <p>Performing rehabilitation exercises and continuing the joint range of motion with the prosthesis, avoiding complications, becoming less and less dependent on others in activities of daily life, effectively keeping pain under control, being willing to be engaged in social activities, resuming interrupted roles, making arrangements at home to suit new situation, living life without fear or anxiety</p> <p>Ineffective adaptive behavior:</p> <p>- Symptoms and findings of complications inability to continue joint range of motion that had been reached with the prosthesis, being unwilling to perform the rehabilitation exercises, avoiding activity, fear of falling, prolonging of dependency period, social isolation, increasing responsibility on part of caregivers, disruption in familial relations</p>
	Self-concept mode	<p>Contextual stimuli:</p> <ul style="list-style-type: none"> - Fear of harming prosthesis - Being dependent on someone else - Unrealistic expectations - Fear (fear of falling) - Being discharged without being ready - Feeling of being a burden on caregivers <p>Residual stimuli:</p> <ul style="list-style-type: none"> - Prolonging of recovery period 	<p>*Weakness</p> <ul style="list-style-type: none"> *Fear of falling *Ineffective individual coping *Reduced self-esteem 	<p>Information-based:</p> <ul style="list-style-type: none"> - Sharing information gathered from the patient with the doctor, physiotherapist 	
	Role function mode	<p>Contextual stimuli:</p> <ul style="list-style-type: none"> - Restricted movement - Being dependent on someone else <p>Residual stimuli:</p> <ul style="list-style-type: none"> - Prolonging of recovery period 	<p>*Inability to fulfill roles</p>	<p>Relational:</p> <ul style="list-style-type: none"> - Ensuring that the patient is able to get in contact when he/she has a need - Cooperating with the physiotherapist with regard to setting up appropriate exercises recommended to strengthen knee muscles and tendons - Cooperating with the doctor to guide patient with regard to complications that may develop - Directing the patient to a psychologist when there is a need for psychological support 	
	Interdependency mode	<p>Contextual stimuli:</p> <ul style="list-style-type: none"> - Being dependent on someone else - Feeling of being a burden on caregivers <p>Residual stimuli:</p> <ul style="list-style-type: none"> - Fear (fear of falling) 	<p>*Inadequacy in coping within the family</p> <ul style="list-style-type: none"> *Losing one's job *Inadequate in resuming social responsibilities *Social isolation 		

Figure 3. Continuous care interventions based on the RAM. Nursing diagnoses and continuous care interventions according to RAM domains and evaluation of effective-ineffective adaptive behaviors.

RAM: Roy Adaptation Model, ADL: Activities of daily living

Table 1. Demographic and clinical features of the patients

Clinical features	Intervention group, (n=36)	Control group, (n=40)	Test	p*
Age (X [†] ± SD [‡])	6.77±8.3	65.57±6.5	t [§] =0.703	0.484
BMI (X [†] ± SD [‡])	32.6±7.03	30.5±4.71	t [§] =1.503	0.138
Gender				
Female	33 (91.7)	35 (87.5)	-	0.715
Male	3 (8.3)	5 (12.5)		
Duration of stay				
(X [†] ± SD [‡])	9.5±2.9	9.2±3.2	t [§] =0.465	0.643
Chronic disease				
Yes	24 (66.7)	29 (72.5)	χ ^{2†} =0.092	0.762
No	12 (33.3)	11 (27.5)		
Receiving physical therapy				
Yes	18 (50.0)	19 (47.5)	χ ^{2†} =0.000	1.000
No	18 (50.0)	21 (52.5)		
Reason for the surgery				
Pain	5 (13.9)	8 (20.0)	χ ^{2†} =2.565	0.277
Function loss	4 (11.1)	1 (2.5)		
Pain + function loss	27 (75.0)	31 (77.5)		
When the problem began				
Less than a year ago	10 (27.8)	3 (7.5)	χ ^{2†} =8.081	0.18
1-3 years ago	13 (36.1)	11 (27.5)		
4 years ago or more	13 (36.1)	26 (65.0)		
Surgery site				
The right knee	14 (38.9)	7 (17.5)	χ ^{2†} =5.988	0.50
The left knee	9 (25.0)	8 (20.0)		
The bilateral knee	13 (36.1)	25 (62.5)		
Needing assistance in walking				
Someone's help	4 (11.1)	2 (5.0)	χ ^{2†} =3.061	0.382
Cane	8 (22.2)	10 (25.0)		
Crutches/walker	5 (13.9)	2 (5.0)		
On his/her own	19 (52.8)	26 (65.0)		

*: P-value, †: Mean, ‡: Standard deviation, §: T-test for independent samples, ||Chronic disease: Hypertension, diabetes mellitus, hypo/hyperthyroidism, chronic heart disease, asthma, chronic obstructive pulmonary disease, osteoporosis, hyperlipidemia, ††: Chi-square test.

Table 2. Comparison of patients' WOMAC[®] scores

WOMAC	Baseline ($\bar{X} \pm SD^{\ddagger}$)		Pre-discharge ($\bar{X} \pm SD^{\ddagger}$)		3 rd month ($\bar{X} \pm SD^{\ddagger}$)		Group/time effects	
	The intervention group, (n=36)	The control group, (n=40)	The intervention group, (n=36)	The control group, (n=40)	The intervention group, (n=36)	The control group, (n=40)	F [§]	p
Pain	14.41±4.76	13.75±3.09	4.17±2.51	5.6±3.13	2.1±2.36	2.3±2.37	1.175	0.312
t [†]	0.715		2.343		0.378			
p	0.478		0.022		0.707			
Stiffness	5.05±2.26	4.72±2.27	1.33±1.72	1.70±1.69	0.47±1.02	0.45±0.87	0.858	0.426
t [†]	0.633		0.933		0.102			
p	0.528		0.354		0.919			
Functional state	48.38±13.72	43.35±9.59	21.69±9.14	8	8.38±6.70	8.12±6.20	1.936	0.148
t [†]	1.836		1.533		0.178			
p	0.071		0.130		0.859			

[†]: Western Ontario and McMaster Universities Osteoarthritis Index, [‡]: Mean, [§]: Standard deviation, [§]: Repeated-measures ANOVA with two between-group factors, ^{||}: P-value, [†]: T-test for independent samples.

Table 3. Comparison of patients' HAD[®] scores by group and time

HAD [®]	Baseline ($\bar{X} \pm SD^{\ddagger}$)		Pre-discharge ($\bar{X} \pm SD^{\ddagger}$)		3 rd month ($\bar{X} \pm SD^{\ddagger}$)		Group time interaction effects	
	The intervention group, (n=36)	The control group, (n=40)	The intervention group, (n=36)	The control group, (n=40)	The intervention group, (n=36)	The control group, (n=40)	F [§]	p
Anxiety	9.30±5.13	7.97±3.72	7.38±3.39	8.00±3.44	4.91±4.68	6.30±3.25	4.892	0.009
t [†]	1.055		1.532		2.201			
p	0.259		0.130		0.032			
Depression	7.52±4.00	6.87±2.94	6.19±2.79	6.22±2.89	4.97±4.28	6.12±3.16	3.359	0.037
t [†]	0.815		0.047		1.322			
p	0.418		0.963		0.191			

[†]: Hospital Anxiety and Depression Scale, [‡]: Mean, [§]: Standard deviation, [§]: Repeated-measures ANOVA with two between-group factors, ^{||}: P-value, [†]: T-test for independent samples.

pre-test ($t=1.355$; $p=0.259$) and post-test t , time 1 ($t=1.532$; $p=0.130$). A significant difference was found between the depression score averages in time in the intervention group in terms of the group time interaction (Baseline, Pre-discharge, 3rd month). ($F=3.359$) ($p=0.037$). As a result of further analysis, no statistically significant difference in the pre-discharge and 3rd month depression scores was found between the patients in the intervention and control groups (pre-test $t=0.815$, $p=0.418$; post-test t , time 1= 0.047 , $p=0.963$; post-test t , time 2= 1.322 , $p=0.191$) (Table 3).

DISCUSSION

Total knee surgery is a choice that leads to a welcomed increased quality of life. The improvement in the postoperative pain-stiffness-functionality variables of all patients was consistent with the literature. Reduced pain, decreased stiffness, improved functioning, and an increased quality of life are the most fundamental outcomes of TKR surgery.^{9,22,28} Another study with female patients undergoing TKR surgery reported reduced pain along with improved functioning.²⁹ In long-term studies that followed up on patients, pain and functionality were reported to be good.^{8,9,30} However, orthopedic surgery can cause serious pain in the early postoperative period.^{31,32} One study determined that among patients undergoing TKR surgery, 12% experienced severe pain in the early postoperative period.³ In this study, it was determined that the pain scores of patients in the intervention group in the pre-

discharge period were lower than those in the control group. This result was related to effective pain control in the intervention group. The results of this study may be considered effective adaptive behaviors in the physiological adaptation domain. In particular, the fact that the pain scores were better in the intervention group may be associated with how the patients in the intervention group developed effective adaptive behavior to cope with pain, which was included in the self-concept adaptation domain.

The tendency toward anxiety and depression decreased with time in the intervention group compared with the control group. At the same time, the anxiety scores in the intervention group in the 3rd month were significantly lower than those in the control group. All of these findings are consistent with the literature. Before the operation, the pain associated with the condition generally leads to increasing restrictions in movement as well as to deformities and instabilities, which impede ADL, make adaptation to home and work life difficult, and cause the patient to feel handicapped.^{2,6} Because surgical prosthesis is an elective procedure, these interventions are postponed because of patients' experience with severe pain. This causes fear and avoidance of chronic pain and leads to patients adopting negative thought patterns. With fear comes hypervigilance or avoidance.¹⁰ On the other hand, while patients undergoing TKR surgery hope that they will be relieved of their pain and will be able to prevent their immobility, they also live in fear that their problems will increase.^{28,33} In the early postoperative period, patients

are faced with pain and other adverse effects of the surgery, additional illnesses, anesthesia, narcotic analgesics, fear (i.e. falling, becoming handicapped, becoming a burden), and other factors.¹³ Following discharge from the hospital, patients face pain, restricted movement, and fears (i.e. of falling, of hurting the prosthesis, of dependency, of being discharged before being fully prepared, of a lack of information, and of being a burden). Throughout the process, patients have to cope with social isolation, weakness, anxiety, an inability to cope, an inability to fulfill one's role, and a loss of self-respect, among other negative factors.^{2,11} In a study, 41.5% of patients undergoing orthopedic surgery experienced psychological changes in the post-operative period. These changes were feeling discouraged, feeling ill and handicapped, crying, feeling low, apathy, changes in sleep patterns, fatigue, irritability, nervousness and despair, and helplessness.¹⁷ In another study, 20% of patients undergoing TKR were found to experience a sizable amount of post-operative stress in the first and third months.¹⁰ However, postoperatively, patients may be confronted with symptoms such as a lack of energy, a loss of balance, and a fear of falling.²⁸ In our study, patients said that they felt crippled in the early period and were anxious that they would never walk again. At the same time, the patients experienced a fear of falling and perceived themselves as dependents that were a burden on their families. A study reported that 21% of their patients felt the need for some sort of social or psychological support.¹⁷ In another study, also reported that telephone follow-ups were effective because this method provided the opportunity to evaluate the patient's environmental factors and support systems.³⁴ The low anxiety and depression scores in the patients in our intervention group indicated that individuals were able to display effective adaptive behavior in the self-concept, interdependency, and role function adaptation domains.

Patients are faced with many problems after TKR surgery. Education and follow-up protocols have been devised to improve TKR surgery outcomes and to help patients adapt to life with prostheses.^{35,36} Education and subsequent follow-ups are of great importance because patients have to spend more time recovering at home due to shortened hospital stays.¹⁴ Follow-ups are particularly important for evaluating the condition of patients who do not come in for routine visits.³⁷ In our study, it was found that patients, especially those living in other provinces, had difficulty coming in for their check-ups and were happy with telephone follow-ups. On the other hand, it is recommended that the topics covered in the education of patients are repeated because patients may be sleepy, irritated, in pain, stressed, and may not be able to concentrate on the information given to them pre-discharge.^{8,37} A study discovered that patients and their families who were provided with a brief education did not learn much. Therefore, patients encountered problems at home because of gaps in their knowledge and had no opportunity to ask questions.³⁸ In another study where 207 patients with total joint prostheses were followed over the course of a year, it was found that patients were able to feel free to ask any questions they might have.¹⁴

Study Limitations

The lack of randomization in the study was one of its limitations. In addition, because a large majority of the patients lived in different cities, their coming in for a checkup and being examined by the same healthcare professionals was problematic. This was a limitation because maintaining continuity in caregivers is an important factor in continuous care. Another limitation was that the patients' health insurance did not cover their additional rehabilitation needs.

Moreover, the system of working on a multidisciplinary platform is a structure that has not yet become well established in the Turkish healthcare system. The researcher acted as a bridge between disciplines to facilitate continuous care interventions. The study's foundation on a nursing model is a strength of the research. The use of a nursing model not only helped to generate new knowledge for nursing research but also facilitated a holistic approach to the patient/individual/group and provided the means to determine realistic goals that were tailored to consider individual differences and ensure the maintenance of continuous care. The model acts as a bridge between theory and practice in the nursing profession and contributes to the evaluation of care.

CONCLUSION

Evaluation in RAM depends on the question, "Did the individual adapt?" This requires analyzing and deciding whether the targeted behavioral change was achieved. When the nurse evaluates the adaptation of patients with TKR, the change processes must be assessed, and it must be determined whether there has been effective adaptation. Changes in pain, stiffness, and functional status of patients affect their physiological, self-concept, and role function adaptive modes according to RAM. Anxiety and depression situations affect their self-concept, role function, and interdependence adaptive modes according to RAM. Moreover, all these adaptive modes affect each other. The lower levels of pain, anxiety, and depression in the patients in the intervention group indicated that they were better at showing more effective adaptive behavior. The outcome revealed that RAM-based continuous care prepared patients for better adaptation to living life with their prosthesis.

Relevance to Clinical Practice

In our study, as in the literature, the patients experienced stress for many reasons preoperatively, postoperatively, at pre-discharge, and at home, and for this reason sought support. RAM-based continuous care prepared patients for the process with education, advice, and telephone follow-ups; offered them the chance to become familiar with and adapt to their prosthesis, express their distress, identify problems at an early stage, and be encouraged to participate in social activities. Continuous care enables early identification and prevention of possible complications, thereby increasing the success of TKR surgery and easing the economic burden caused by revision surgery and other costs. Continuous care based on a model may provide integrated care that will serve as a guide for nursing interventions. Continuous care structured around RAM, which will be used in orthopedic nursing in TKR patients for the first time, will serve as a guide for nursing regarding patient care, carrying the dimensions of care to another level and enabling a more humanistic and holistic approach.

MAIN POINTS

- This study used the Roy Adaptation Model in patients undergoing total knee replacement surgery to enhance nurses' understanding of caregiving theories and their skills at incorporating these theories into the care they provide.
- Basing the continuous care provided to patients undergoing knee replacement surgery on the RAM may provide insight into evaluating the adaptation process patients go through and influencing factors, and it may be a useful example of integrated care.

- The use of a nursing model in this study contributed to strengthening the philosophy of nursing science.

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ETHICS

Ethics Committee Approval: Written informed consent was approved by the Dokuz Eylül Hospital Ethical Committee (approval number: 30-GOA2011/13-09-2011).

Informed Consent: The researcher obtained the patients' written and verbal consents after explaining to them the purpose of the research, the process of data collection, and the study's implementation, informing them that they may withdraw from the study at any time and that their names would be kept confidential.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: A.S., Ö.B., Design: A.S., Ö.B., Supervision: Ö.B., Resources: A.S., Materials: A.S., Ö.B., Data Collection and/or Processing: A.S., Analysis and/or Interpretation: A.S., Ö.B., Literature Search: A.S., Writing: A.S., Critical Review: Ö.B.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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