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ORIGINAL RESEARCH

Prevention of Periprosthetic Infection After Orthopedic Knee Replacement Based on 5E Rehabilitation Nursing Model

Huiying Weng, MM; QiangHua Zhang, MM; LiYing Ding, MM; JiaMin Shen, MM; DanDan Shen, MM; PingPing Xiong, MM; YeQi He, MD

ABSTRACT

Context • Periprosthetic joint infections (PJIs) are a rare but highly destructive complication after total knee arthroplasty (TKA). Nursing plays an important role in preventing postoperative infections in patients, but different nursing modes have different rates of postoperative infections.

Objective • The study intended to explore the effects of "encouragement, education, exercise, employment, and evaluation" (5E) rehabilitation nursing on the prevention of periprosthetic joint infections (PJIs) after TKA.

Design • The research team conducted a randomized controlled trial.

Setting • The study took place at the First People's Hospital of Huzhou in Huzhou, China.

Participants • Participants were 80 TKA postoperative patients at the hospital between January 2023 and July 2023.

Interventions • The research randomly divided participants into two groups: (1) the intervention group, the 5E group, with 40 participants and (2) the control group, with 40 participants. The control group received routine nursing, while the 5E group received 5E rehabilitation nursing.

Outcome Measures • The research team examined: (1) the prosthesis' location; (2) wound healing; (3) score for knee joint function, using the Berg Balance Scale (BBS) and the Hospital Score for Special Surgery (HSS) of the knee joint; (4) postoperative level of inflammatory factors, using levels of C-reactive protein (CRP); (5) infection occurrence; (6) length of hospital stay; and (7) nursing satisfaction.

Results • The prosthesis was well positioned in both groups. Compared to the control group, the 5E group's: (1) wound healing was significantly better ($P < .001$); (2) at 7 days after surgery, HSS score ($P < .001$) and BBS score ($P < .001$) were significantly higher; (3) C-reactive protein (CRP) levels were significantly lower ($P < .001$); (4) at 90 days after surgery, incidence of postoperative periprosthetic joint infection (PJI) was significantly lower ($P < .001$); (5) length of hospital stay was significantly shorter ($P = .0013$); and (7) nursing satisfaction was significantly higher ($P = .0338$).

Conclusions • The 5E rehabilitation nursing for patients after TKA was helpful in promoting wound recovery, supporting the recovery of knee-joint function, reducing the incidence of PJIs, shortening the length of hospital stay, and improving patients' nursing satisfaction. (*Altern Ther Health Med.* 2024;30(12):92-99).

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The development and improvement of total knee arthroplasty (TKA) has brought hope to patients with serious knee diseases.[1] TKA can play an important role in relieving patients' pain and promoting the reconstruction of knee-joint function, which greatly improves patients' prognoses.[2] However, a series of complications can occur after TKA.[3] Among them, periprosthetic joint infections (PJIs) are a rare but highly destructive complication after TKA.[4,5]

Periprosthetic Joint Infections

PJIs are the main cause of TKA failure[6] and can occur within the 3 months after the surgery.[7] About 0.4% to 5.6% of patients have PJIs after TKA,[8] and they have become the most common reason for revision surgery.[9] Although surgical revision is an effective means to treat PJIs,[10] Lichstein et al found that the risk of acute kidney injury after patients undergo surgical revision can increase dramatically.[11]

The harm from PJIs for patients is multifaceted,[12] and they can have a lasting impact on patients.[13] The common symptoms of PJIs include inflammation, severe pain, loss of function, fever, and nausea.[14] In addition, PJIs can also lead to prolonged, surgical-wound healing time and prolonged hospital stays for patients.[15]

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PJIs can not only cause patients physical pain for a long time[16] but also can increase patients' risk of death.[17] Premkumar et al found that the five-year mortality rate for patients with PJIs is even higher than that for some malignant tumors.[18] Taking effective measures to prevent PJI is crucial to avoid serious consequences for patients.[19]

At the same time, the economic burden from PJIs for patients has also steadily increased.[20] With the rise in the quantity of individuals receiving TKA surgery, there is a corresponding surge in patients encountering postoperative PJI.[21] The current management of PJIs is extremely challenging for medical staff,[22] and this leads to prevention remaining the ultimate goal.[23]

Risk Factors

The risk factors for PJI after TKA include obesity, rheumatoid arthritis, operation time, urinary tract infections, blood transfusions, and diabetes.[24] The clinical manifestations of PJI depend on multiple factors, such as pathogen virulence, mode of initiation of the infection, the host's immune response, and the patient's soft tissue structure.[25]

Nursing Care

Nursing plays an important role in preventing postoperative infections in patients.[26] However, under different nursing modes, patients have different rates of postoperative infections.[27] For example, Zhang et al found that 5E rehabilitation nursing, with "encouragement, education, exercise, employment, and evaluation" as the main content, can help prevent postoperative infections for patients.[28] However, no studies have occurred on the preventive effects of 5E rehabilitation nursing on PJI after TKA.

Current Study

The current study intended to explore the effects of 5E rehabilitation nursing on the prevention of PJIs after TKA.

METHODS

Participants

The research team conducted a randomized controlled trial, which took place at the First People's Hospital of Huzhou in Huzhou, China. Potential participants were TKA postoperative patients at the hospital between January 2023 and July 2023. The objective of this study is to identify individuals who have undergone TKA surgery within a specific timeframe. Qualified patients will be sequentially assigned a distinct identifier according to their visit order, and they will be randomly allocated into 5E group with a the control group, utilizing a randomization technique. Subsequent to the allocation, distinct interventions will be administered based on the assigned cohorts. Subsequently, the patient's attending physician and designated nurse will assess and appraise the efficacy of the interventions using diverse forms of communication, such as follow-up phone calls, home visits, hospital revisits by the patients, and email correspondences.

The study included potential participants if they: (1) had received a diagnosis of severe knee osteoarthritis, (2) met the indications for total knee arthroplasty and could withstand surgical treatment, and (3) could communicate normally.

The study excluded potential participants if they: (1) had a recent history of heavy alcohol consumption; (2) used other drugs that could affect the study's results, such as glucocorticoids; (3) had severe mental illness; (4) had chronic systemic diseases; or (5) had coagulation dysfunction;(6) Refinement: The transfer of patients to another facility or the modification of the care plan based on the progression of their condition.

All patients and their families signed informed consent forms. The Ethics Committee of Huzhou First Peoples Hospital reviewed and approved the study's protocols. This study has been duly registered in the Clinical Trials Registry and conforms to the pertinent ethical tenets outlined within the Helsinki Declaration. (Ethics approval number: 2023KYLL001).

Procedures

Interventions. The research randomly divided participants into two groups: (1) the intervention group, the 5E group, and (2) the control group. The control group was administered conventional care, whereas the 5E group received a combined approach of conventional care along with 5E rehabilitative treatment. The team gave patients numbers according to the order of admission and randomly divided them into groups using the random number method.

Surgical method. The two groups received treatment with the same surgical method, general anesthesia. The surgeon: (1) applied a pneumatic tourniquet at the root of the patient's thigh and made a median anterior knee incision; (2) incised the joint capsule using the medial parapatellar approach and everted the patella; (3) removed osteophyte proliferation with a bone knife and excised the hyperplastic synovium, anterior cruciate ligament, and meniscus to expose the tibial plateau; (4) installed the tibial extramedullary positioning rod and tilted the tibial platform back 5° to cut the bone; (5) preserved the posterior cruciate ligament (PCL) by cutting an arc at the PCL stop point with a bone knife; (6) transposed the vertical mechanical axis of the distal femur 5° to 7° to cut the bone; (7) performed a lateral-rotation 3° osteotomy according to the femur's transcondylar and posterior condylar lines; (8) removed and denervated the osteophyte around the patella; (9) after completing the osteotomy, washed the wound, removed the bone fragments, and installed a test mold to check the joint's range of motion and stability, the lower limb's force line, and the patella's locus; (10) checked the PCL's tightness using the pull-out lift-off (POLO) test.

The protocol for POLO test encompasses the subsequent measures: throughout the surgical operation, the evaluator shall secure the individual's feet, grasping the afflicted side of the knee with one hand to impede any motion, while positioning the other hand at the proximal extremity of the lower limb. Initially, a traction force is applied anteriorly, succeeded by a posterior push from the upper end of the lower limb.

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If there exists anteroposterior tibial translation, it signifies the presence of laxity in the anterior cruciate ligament (ACL) as well as the PCL. If the patient demonstrates positive tibial movements, the trial component should be reinstated and reassessed.

Then, the surgeon fixes the prosthesis with bone cement, places the drainage tube, sutures the joint capsule at 90° flexion, and sutures the subcutaneous and skin at 30°-40° flexion.

Outcome measures. The research team examined: (1) the prosthesis' location; (2) wound healing; (3) score for knee joint function, using the Berg Balance Scale (BBS)[29] and the Hospital Score for Special Surgery (HSS)[30] of the knee joint; (4) postoperative level of inflammatory factors, using levels of C-reactive protein (CRP); (5) infection occurrence; (6) length of hospital stay; and (7) nursing satisfaction.

Interventions

Control group. The control group received routine nursing. The nursing staff provided basic rehabilitation-nursing measures, such as health education, precautions guidance, psychological counseling, diet care, and complication prevention with routine procedures. After surgery, the specialized nurses instructed patients to rest in bed and ensured that patients could consciously tolerate pain before starting to guide them to carry out rehabilitation exercises.

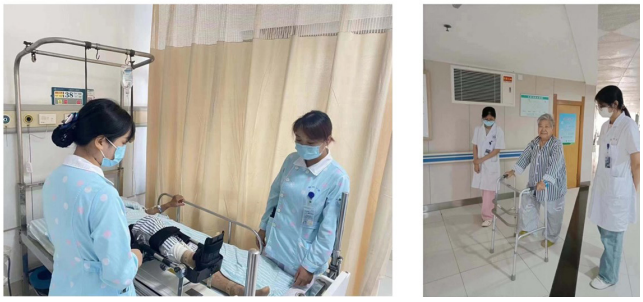
5E group. Individuals within the 5E cohort are provided with customary nursing attention integrated with rehabilitative nursing within the confines of the 5E ward and also provided: (1) encouragement, (2) education, (3) exercise, (4) employment, and (5) evaluation.

Encouragement. The nursing staff took the initiative: (1) to communicate with patients after surgery, (2) to work to understand patients' questions, (3) to give targeted guidance and solutions, and (4) to encourage patients to face the postsurgical effects with a positive attitude and introduce successful cases of previous treatment to them, thus significantly improving their confidence in postoperative rehabilitation and increasing their enthusiasm for postoperative functional exercise.

Education. By combining text, pictures, and videos, the nursing staff strengthened the health education that patients received and helped patients improve their knowledge of functional exercise and other related knowledge after TKA, so that they could master the relevant matters for attention after surgery. In addition, the research team formulated personalized health-education programs according to such factors as the patient's age, education level, and lifestyle, focusing on the self-adjustment methods of the patient's postoperative psychological status and correct daily lifestyle. The team also assessed a patient's degree of mastery after health education.

Exercise. Lei et al found that exercise after TKA can be beneficial to the improvement of the patient's knee joint function.[31] According to a patient's postoperative recovery status and psychological status, the nursing staff formulated the patient' postoperative rehabilitation plan, guided the patient to correct training methods. To ensure the preservation of an optimal exercise level for patients and avert the risk of physical harm during training, we recommend patients to temporarily abstain from utilizing analgesics prior to engaging in exercise and gave guidance to patients regarding training methods (Figure 1).

Figure 1. Nursing Staff's Training Guidance for the 5E Group



Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation.

Before patients' discharge, the nursing staff informed patients of the preventive measures for complications such as infections and told them to avoid movements that can cause excessive joint activity within the following 3 months, such as avoiding running, climbing, jumping, and other sports and to have family members accompany them when exercising.

Employment. To promote the patient's eventual reintegration into their familial and societal circles, caregivers offer tailored guidance according to the patient's progress, coaching them in everyday activities including dishwashing and culinary tasks. when dressing, first on the affected side and then on the healthy side. In addition, the staff told patients to avoid training and performing activities in daily life alone to prevent falls.

Evaluation. The research team carried out an evaluation of the postoperative complications, joint function, and training compliance of patients, to adjust the postoperative training content accordingly.

Outcome Measures

Prosthesis' location. Participants received a full-length, posterior-anterior X-ray of the affected limb at 90d after surgery to observe the prosthesis' location.

Wound healing. The research team evaluated participants' wound healing postintervention. The healing criteria were as follows: grade A = good wound healing with no adverse reactions; grade B = average wound healing with adverse reactions, such as redness, swelling, and rupture; and grade C = poor wound healing with adverse reactions such as suppuration.

Knee joint function. The research team evaluated participants' changes in knee joint function between baseline preoperatively and at 7 days after surgery, using the HSS[30] of the knee joint and the BBS.[29] The total score for the HSS is 100, and the higher the score, the better the participant's knee joint function. The total score for the BBS scale is 56, and the higher the score, the better the participant's knee-balance ability.

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Serum levels of inflammatory factors. Clinicians often use serum CRP, a commonly used clinical indicator of infections, to screen for PJIs.[32] The research team collected 3mL of fasting venous blood from participants preoperatively and at 7 days after surgery and evaluated the CRP levels, using an enzyme-linked immunosorbent assay (ELISA).

Postoperative PJIs. The research team followed participants for up to 90 d after surgery by phone, Wechat, and re-examination at the hospital. The team formulated According to the diagnostic criteria for PJI established by the Musculoskeletal Infection Society (MSIS) in the United States, patients are diagnosed with PJI.[33] I during treatment the nursing staff found fistulas in the affected hip or knee related to the joint, the patient had a joint infection.

Also, the participants had a joint infection if during treatment the nursing staff found two or more of the following issues: (1) revision had affected the hip's or knee's joint fluid or the intraoperative tissue samples sent to the clinical laboratory at the hospital were positive for bacterial culture; (2) the number of neutrophils in the tissue samples had significantly increased; (3) the participant's clinical symptoms, such as general fever or joint pain; laboratory tests, such as a blood routine, interleukin 6 (IL-6) content, or hypersensitive CRP content; or radioautography, such as X-rays, computed tomography (CT), or magnetic resonance imaging (MRI) examination, supported the diagnosis of infection.

Length of stay and nursing satisfaction. The research team counted participants' length of hospital stay and evaluated nursing satisfaction. Employing a satisfaction survey tailored for this study, an examination was carried out to assess patients' contentment with nursing care. The survey has a top score of 100, with ratings from 0 to 60 reflecting discontent, 61 to 80 signifying moderate contentment, and 81 to 100 denoting exceedingly high satisfaction.[34]

Statistical Analysis

The research team processed and analyzed the data using the SPSS 23.0 software (IBM, Almonk, New York, USA) and conducted graphing using GraphPad Prism 9.0 software (GraphPad, San Diego, California, USA). The team: (1) expressed continuous data as means ± standard deviations (SDs) and compared the groups using *t* tests, and (2) expressed categorical data as numbers (N) and percentages (%s) and compared the groups using the chi-square (χ^2) test. $P < .05$ indicated a statistically significant difference.

RESULTS

Participants

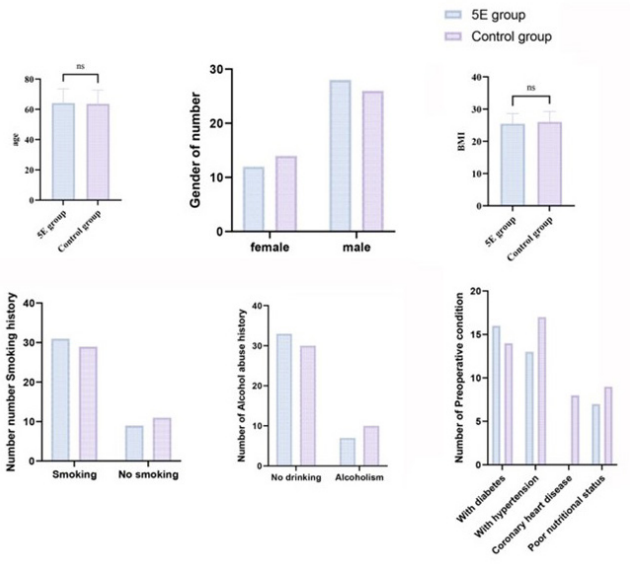
The research team included and analyzed the data of 80 participants, 40 in each group (Table 1, Figure 2). The 5E group included 28 males (70.00%) and 12 females (30.00%) with a mean age of 64.25 ± 9.39 y, a mean body mass index (BMI) of 25.48 ± 3.17 kg/m2, and a mean surgical time of 1.51 ± 0.42 hrs. Of the 40 participants: (1) 31 had a smoking history (77.50%) and nine did not (22.50%); (2) seven had an alcohol-abuse history (17.50%) and 33 did not (82.50%); (3)

Table 1. Participants' Demographic and Clinical Characteristics at Baseline (N=80)

Characteristics	5E Group n=40 Mean ± SD n (%)	Control Group n=40 Mean ± SD n (%)	t/χ^2 Value	*P* value
Age, y	64.25 ± 9.39	63.80 ± 8.97	0.2192	.8271
Gender			0.2279	.6331
Males	28 (70.00%)	26 (65.00%)		
Females	12 (30.00%)	14 (35.00%)		
BMI, Kg/m^2	25.48 ± 3.17	26.05 ± 3.24	0.7953	.4288
Smoking History			0.1067	.7439
Yes	31 (77.50)	29 (72.50)		
No	9 (22.50)	11 (27.50)		
Alcohol Abuse History			0.6723	.4123
Yes	7 (17.50)	10 ((25.00)		
No	33 (82.50)	30 (75.00)		
Diabetes			0.2133	.6442
Yes	16 (40.00)	14 (35.00)		
No	24 (60.00)	26 (65.00)		
Hypertension			0.8533	.3556
Yes	13 (32.50)	17 (42.50)		
No	27 (67.50)	23 (57.50)		
Coronary Artery Disease			0.3125	.5762
Yes	7 (17.50)	9 (22.50)		
No	33 (82.50)	31 (77.50)		
Poor Nutritional Status			1.4545	.2278
Yes	10 (25.00)	15 (37.50)		
No	30 (75.00)	25 (62.50)		
Surgical Time, hrs	1.51 ± 0.42	1.53 ± 0.37	0.2260	.8218
Blood Transfusions			0.2632	.6079
Yes	1 (2.50)	3 (7.50)		
No	39 (97.50)	37 (92.50)		
Urinary Tract Infections			0.5128	.4739
Yes	1 (2.50)	1 (2.50)		
No	39 (97.50)	39 (97.50)		

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation; BMI, body mass index

Figure 2. Participants' Demographic and Clinical Characteristics at Baseline (N=80). Compared to the control group, the 5E group: (1) had more male patients, more patients with a history of smoking, and more patients with diabetes and (2) had fewer patients with a history of alcohol abuse or with hypertension, coronary heart disease or with a poor nutritional status. However, no significant differences existed for any demographic or clinical characteristic.



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16 had diabetes (40.00%) and 24 did not (60.00%); (4) 13 had hypertension (32.50%) and 27 did not (67.50%); (5) seven had coronary artery disease (17.50%) and 33 did not (82.50%); (6) 10 had a poor nutritional status (25.00%) and 30 did not (75.00%); (7) one had a blood transfusion (2.50%) and 39 did not (97.50%); and (8) one had a urinary tract infection (2.50%) and 39 did not (97.50%).

The control group included 26 males (65.00%) and 14 females (35.00%), with a mean age of 63.80 ± 8.97 y, a mean body mass index (BMI) of 26.05 ± 3.24 kg/m2, and a mean surgical time of 1.53 ± 0.37 hrs. Of the 40 participants: (1) 29 had a smoking history (72.50%) and 11 did not (27.50%); (2) 10 had an alcohol-abuse history (25.00%) and 30 did not (75.00%); (3) 14 had diabetes (35.00%) and 26 did not (65.00%); (4) 17 had hypertension (42.50%) and 23 did not (57.50%); (5) nine had coronary artery disease (22.50%) and 31 did not (77.50%); (6) 15 had a poor nutritional status (37.50%) and 25 did not (62.50%); (7) three had a blood transfusion (7.50%) and 37 did not (92.50%); and (8) one had a urinary tract infection (2.50%) and 39 did not (97.50%).

No significant difference existed between the groups in any demographic or clinical characteristic at baseline ($P > .05$).

Prosthesis' Position

The X-ray examination showed that the prosthesis was in a good position, without loosening or sinking, at 90d and 180d after surgery got both groups (Figure 3)

Wound Healing

Table 2 and Figure 4 show that postintervention all 40 participants in the 5E group had Grade A healing (100.00%), while in the control group 28 had Grade A healing (70.00%), nine had Grade B healing (22.50%), and three had Grade C healing (7.50%).

The 5E group's wound healing was significantly better than that of the control group ($P < .001$).

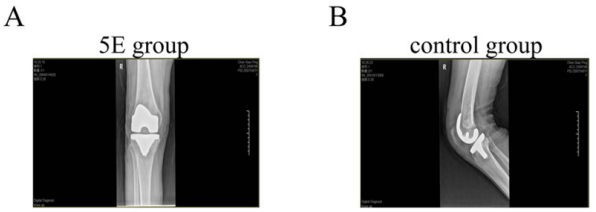
Knee Joint Function

Table 3 and Figure 5 show that no significant differences existed between the groups in the HSS or BBS scores at baseline preoperatively ($P > .05$). The 5E group's HSS ($P < .001$) and BBS ($P < .001$) scores and the control group's HSS ($P < .001$) and BBS ($P < .001$) scores significantly increased between baseline and 7d after surgery. The 5E group's HSS ($P < .001$) and BBS ($P < .001$) scores were significantly higher than those of the control group.

Serum Inflammatory Factors

Table 4 and Figure 6 show that no significant difference existed between the groups in the preoperative CRP levels ($P > .05$). Between baseline and 7 days after surgery, CRP levels in the 5E and control groups significantly increase, at $P < .001$ and $P < .001$, respectively. The 5E group's CRP level was significantly lower than that of the control group at 7 days after surgery ($P < .001$).

Figure 3. Prosthesis' Position at 90 Days After Surgery. Figure 3 A shows an X-ray film used to assess the position for the 5E group, and Figure 3B shows an X-ray film used to assess the position for the control group.



Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation.

Table 2. Comparison of Wound Healing Between the 5E and Control Groups (N=80)

Groups	Grade A Healing n (%)	Grade B Healing n (%)	Grade C Healing n (%)
5E group, n=40	40 (100.00)	0 (0.00)	0 (0.00)
Control group, n=40	28 (70.00)	9 (22.50)	3 (7.50)
χ^2 value	14.1176		
P value	<.001		

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation

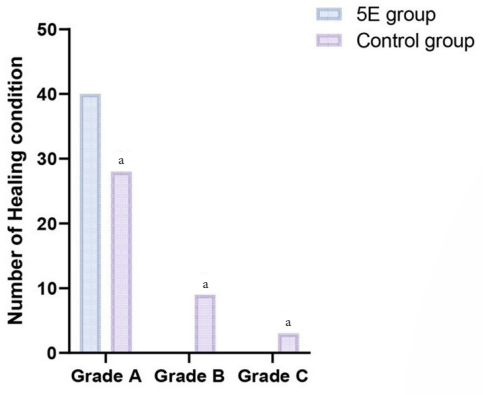
Table 3. Comparison of Changes in Knee Joint Function Between Baseline and Seven Days Postoperatively for the 5E and Control Groups and Comparison Between the Groups (N=80)

Groups	Preoperative HSS Score Mean ± SD	7d After Surgery HSS Score Mean ± SD	Between Baseline and 7d After Surgery *t* value	Between Baseline and 7d After Surgery *P* value	Preoperative BBS Score Mean ± SD	7d After Surgery BBS Score Mean ± SD	Between Baseline and 7d After Surgery *t* value	Between Baseline and 7d After Surgery *P* value
5E Group, n=40	42.37 ± 6.14	79.41 ± 8.55	22.2550	<.001[a]	5.16 ± 0.79	16.28 ± 2.32	28.6962	<.001[a]
Control Group, n=40	43.25 ± 6.18	67.68 ± 8.21	15.0359	<.001[a]	5.24 ± 0.67	10.31 ± 1.73	17.2840	<.001[a]
t value	0.6389	6.2586			0.4885	13.0468		
P value	.5248	<.001[b]			.6266	<.001[b]		

*$P < .05$, indicating that both groups' HSS and BSS scores increased significantly between baseline and seven days postoperatively
#$P < .05$, indicating that the 5E group's HSS and BSS scores were significantly higher than those of the control group at seven days postoperatively

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation; BBS, Berg Balance Scale; HSS, hospital score for special surgery

Figure 4. Comparison of Wound Healing Between the 5E and Control Groups Postintervention (N=80)



*$P < .05$, indicating that the 5E group's wound healing at the incision site was significantly better than that of the control group.

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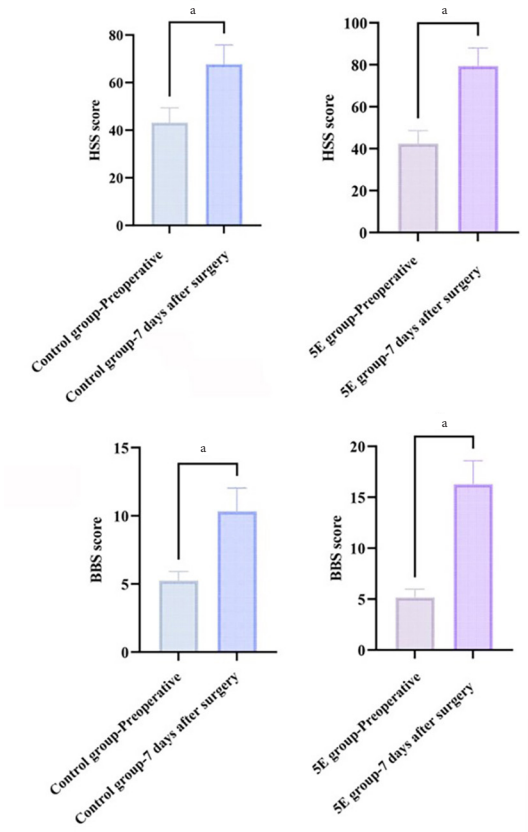
Figure 5. Comparison of Changes in Knee Joint Function Between Baseline and Seven Days Postoperatively for the 5E and Control Groups (N=80)



[a]*P* < .05, indicating that both groups' HSS and BSS scores increased significantly between baseline and seven days postoperatively

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation; BBS, Berg Balance Scale; HSS, hospital score for special surgery.

Table 4. Comparison of Changes in CRP Levels Between Baseline and Seven Days Postoperatively for the 5E and Control Groups and Comparison Between the Groups (N=80)

Groups	Preoperative mg/L Mean ± SD	7d after surgery mg/L Mean ± SD	Between Baseline and 7d after surgery *t* value	*P* value
5E group, n=40	3.47 ± 0.53	15.19 ± 1.82	39.1031	<.001[a]
Control group, n=40	3.30 ± 0.59	24.45 ± 2.14	60.2585	<.001[a]
t value	1.3557	20.8472		
P value	.1791	<.001[#]		

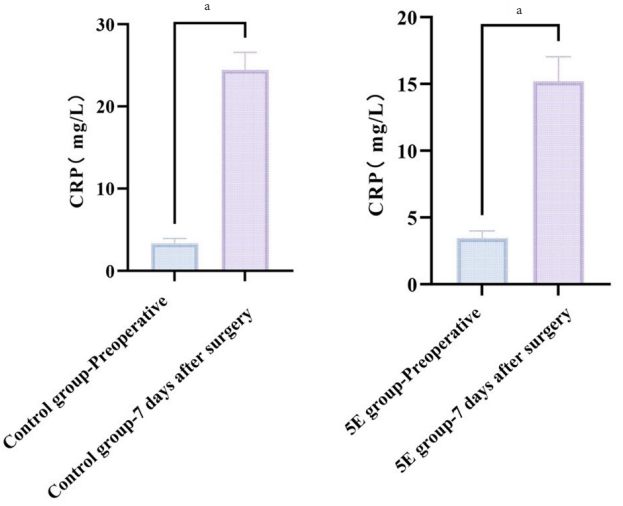
*$P < .05$, indicating that both groups' CRP levels increased significantly between baseline and seven days postoperatively
#$P < .05$, indicating that the 5E group's CRP levels were significantly lower than those of the control group at seven days postoperatively

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation; CRP, C-reactive protein.

PJI Incidence After 90 Days

No PJIs occurred within 90 days of surgery for the 5E group (100.00%), so the incidence was 0.00% (Table 5 and Figure 7). In the control group, 7 participants had PJIs within 90 days, with the incidence being 17.50%. The 5E group's incidence of PJIs was significantly lower than that of the control group.($P = .0176$)

Figure 6. Comparison of Changes in CRP Levels Between Baseline and Seven Days Postoperatively for the 5E and Control Groups (N=80)



[a]*P* < .05, indicating that both groups' CRP levels increased significantly between baseline and seven days postoperatively

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation; CRP, C-reactive protein.

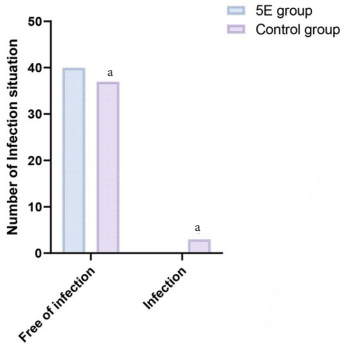
Table 5. Comparison of PJI Incidence at 90 Days Postoperatively for the 5E and Control Groups (N=80)

Groups	No PJI occurred n (%)	PJI occurred n (%)
5E group, n=40	40 (100.00)	0 (0.00)
Control group, n=40	33 (82.50)	7 (17.50)
χ^2 value		5.6360
P value		.0176[a]

[a]*P* < .05, indicating that the 5E group's incidence of PJIs was significantly lower than that the control group

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation; PJI, periprosthetic joint infection.

Figure 7. Comparison of PJI Incidence at 90 Days Postoperatively for the 5E and Control Groups (N=80)



[a]*P* < .05, indicating that the 5E group's incidence of PJIs was significantly lower than that of the control group

Abbreviations: 5E, encouragement, education, exercise, employment, and evaluation; PJI, periprosthetic joint infection.

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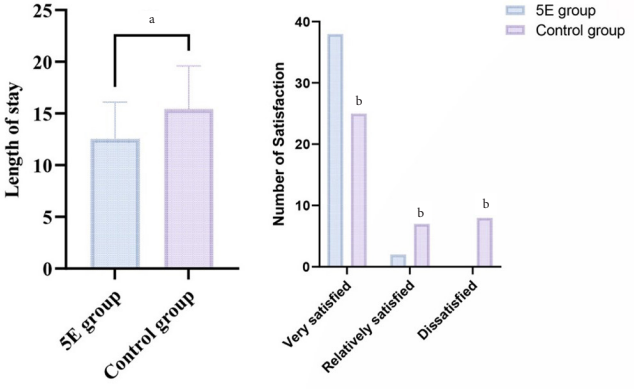
Table 6. Comparison of Hospital Stay and Nursing Satisfaction Between the 5E and Control Groups (N=80)

Groups	Length of Stay, days	Very Satisfied	Relatively Satisfied	Dissatisfied	Total Satisfaction
5E group, n=40	12.55 ± 3.54	37 (92.50)	2 (5.00)	1 (2.50)	39 (97.50)
Control group, n=40	15.43 ± 4.17	25 (62.50)	7 (17.50)	8 (20.0)	32 (80.00)
t/χ^2 Value	3.3300	.0338[a]			4.5070
P value	.0013[b]				

[a]$P < .05$, indicating that the 5E group's nursing satisfaction was significantly greater than that of the control group
[b]$P < .05$, indicating that the 5E group's length of hospital stay was significantly shorter than that of the control group

Figure 8. Comparison of Hospital Stay and Nursing Satisfaction Between the 5E and Control Groups (N=80)



[a]$P < .05$, indicating that the 5E group's nursing satisfaction was significantly greater than that of the control group
[b]$P < .05$, indicating that the 5E group's length of hospital stay was significantly shorter than that of the control group

Hospital Stay and Nursing Satisfaction

The 5E group's length of stay was 12.55 ± 3.54 days, and the control group's length was 15.43 ± 4.17 days (Table 6 and Figure 8). The 5E group's length of stay was significantly shorter than that of the control group ($P = .0013$).

Of the 40 participants in the 5E group, 37 were very satisfied (92.50%), two were relatively satisfied (5.00%), and one was dissatisfied (2.50%), with the total satisfaction rate being 97.50% for 39 participants. Of the 40 participants in the control group, 25 were very satisfied (62.50%), seven were relatively satisfied (17.50%), and eight were dissatisfied (20.00%), with the total satisfaction rate being 80.00% for 32 participants.

The 5E group's total nursing satisfaction was significantly greater than that of the control group ($P = .0338$).

DISCUSSION

The prevention of PJI is of paramount importance, as it is considered one of the most severe complications following TKA.[35] Effective nursing interventions play an essential role in the management of PJI patients.[36] This study revealed that post-TKA patients undergoing 5E rehabilitation nursing demonstrated significant improvements in wound and knee joint function recovery, a reduced incidence of PJI, and shorter hospital stays, while concurrently enhancing patient satisfaction with care.

The healing of post-TKA patients' wounds is closely linked to the occurrence of PJI or postoperative complications.[37] Enhancing wound healing and the overall condition of patients' wounds can effectively mitigate the risk of PJI.[38] The provision of encouragement during the nursing process is believed to have a profound impact in promoting wound healing and improving the condition of the wounds.[39] Moreover, exercise is considered a potent non-pharmacological approach to enhance wound healing.[40] This study revealed that post-5E rehabilitation nursing, patients who received encouragement and various exercises exhibited significantly better wound healing conditions compared to those receiving routine care. This underscores the substantial impact of 5E rehabilitation nursing in improving post-TKA patients' wound healing, consistent with He et al.'s findings that appropriate nursing interventions can enhance postoperative wound recovery.[41]

Following TKA, the implementation of a specific level of rehabilitation intervention significantly enhances patients' normal knee joint function.[42] This is mainly attributed to the improvement in patients' strength, physical capabilities, balance, and walking abilities through exercises during the rehabilitation process.[43] As a form of rehabilitation nursing, 5E rehabilitation nursing encompasses a substantial amount of exercise-based rehabilitation interventions. The study found that patients who received 5E rehabilitation nursing demonstrated significant improvement in knee joint function, aligning with Hsieh et al.'s conclusion that rehabilitation can enhance knee joint function in post-TKA patients.[44]

Nursing plays a pivotal role in preventing infections, especially under high-quality nursing models, where nursing staff are more attentive to their responsibilities, ensuring the provision of professional and efficient nursing services, ultimately improving the quality of nursing work and the effectiveness of nursing interventions.[45,46] Moreover, through multi-dimensional interventions during the nursing process, nursing can mitigate the risk factors of PJI.[47] In this study, patients receiving 5E rehabilitation nursing interventions, including encouragement and various exercises, along with various postoperative care instructions, exhibited significantly lower CRP levels and a noticeable decrease in the incidence of PJI, compared to patients receiving routine care. This underscores the significant effectiveness of 5E rehabilitation nursing in reducing the occurrence of PJI in post-TKA patients, consistent with Zhao et al.'s conclusion that high-quality nursing can reduce the incidence of postoperative infections.[48]

Additionally, the occurrence of PJI also results in prolonged hospital stays and decreased patient satisfaction with care.[49,50] Patient satisfaction with care is a crucial measure of healthcare quality.[51] In this study, patients who underwent 5E rehabilitation nursing experienced reduced hospital stays and a notable improvement in patient satisfaction with care, highlighting the significant role of 5E rehabilitation nursing in shortening the hospitalization of post-TKA patients and increasing their satisfaction with care.

In conclusion, the implementation of 5E rehabilitation nursing for post-TKA patients is beneficial in promoting wound recovery, enhancing knee joint function recovery,

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reducing the incidence of PJI, shortening hospital stays, and improving patient satisfaction with care. This presents a novel approach for the clinical prevention of PJI and warrants further investigation in subsequent clinical studies.

CONCLUSIONS

The 5E rehabilitation nursing for patients after TKA was helpful in promoting wound healing, supporting the recovery of knee joint function, reducing the incidence of PJIs, shortening the length of hospital stay, and improving patients' nursing satisfaction.

AUTHORS' DISCLOSURE STATEMENT

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