

Efficacy of Preoperative Nursing Education with Kinesio Taping Application on Functional Outcomes of Patients Undergoing Total Knee Arthroplasty

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Abstract

Total knee arthroplasty (TKA) is a successful therapeutic option that can improve function, reduce discomfort, and enhance quality of life for those with symptomatic osteoarthritis. Effective Preoperative patient education combined with Kinesio taping is crucial to speed up recuperation following TKA. **The study aimed** to evaluate the efficacy of preoperative nursing education with Kinesio taping application on functional outcomes of patients undergoing TKA. Quasi-experimental **research design:** was used. The orthopedic departments at Mansoura University Hospital and New General Mansoura Hospital, Egypt served as the **study setting**. **Sample:** 80 patients were enrolled to conduct the study. **Tools:** Demographic characteristics, clinical data, and the knowledge assessment questionnaire (**Tool I**), Patient's practices following TKA surgery checklist (**Tool II**), and the Knee Outcome Survey Activities of Daily Living Scale (**Tool III**). **Results:** Showed a statistically significant improvement in the intervention group's total mean knowledge scores compared to the control group both immediately after the educational intervention (51.35 ± 12.49 , 30.88 ± 11.17) and two months later (49.15 ± 12.76 , 30.30 ± 10.19). In addition, the intervention group's overall mean practice scores following TKA and after the application of educational intervention and Kinesio tape (8.63 ± 3.04) were considerably better than those of the control group (5.25 ± 2.23). Furthermore, after applying educational intervention and Kinesio tape, the intervention group's overall mean scores of the KOS-ADLS improved statistically significantly (to 51.28 ± 8.89) compared to preoperatively (44.53 ± 8.38). **Conclusion:** The application of preoperative nursing education with Kinesio taping significantly improved the functional outcomes of patients undergoing TKA. **Recommendations:** Application of TKA preoperative nursing education and Kinesio taping by staff nurses working in orthopedic departments.

Keywords: *Functional Outcomes, Kinesio Taping, Patients Undergoing Total Knee Arthroplasty & Preoperative Nursing Education.*

Introduction

Knee Osteoarthritis (KOA) is the most prevalent form of chronic articular disease that comprises part of the aging process. Along with synovial inflammation, it is characterized by articular cartilage loss and degradation, which results in stiffness, swelling, and decreased mobility in the joints (Coaccioli et al., 2022). Advanced KOA is characterized by ongoing discomfort, limited range of motion in the joints, quadriceps muscle weakness, and impaired knee functionality (Gränicher et al., 2020). Total knee arthroplasty is an elective surgical procedure, widely acknowledged as the sole viable treatment option for advanced knee osteoarthritis in individuals who have failed nonoperative therapy (Carlson et al., 2022).

Total knee arthroplasty (TKA) had an annual average incidence rate that rose with age. The prevalence of TKA increased between the ages of 50–54 to 90–94, when it averaged yearly 920 cases per 10,000 persons. (Bager et al., 2019). Worldwide, the

frequency of TKA use is sharply rising due to the increase in knee osteoarthritis cases. It is possible that by 2030, eighty-five percent of patients would be primary TKA patients (Sloan, et al., 2018). By 2040 and 2060, the rise for TKA is anticipated to reach 139% and 469 %, respectively (Shichman et al., 2023).

While total knee arthroplasty (TKA) is the most important and successful operation to improve functional recovery and minimize pain, concerns have been raised about patients' post-operative discomfort and recovery after surgery (Li et al., 2019; Ho et al., 2022). Patients undergoing TKA benefit from preoperative rehabilitation as it enhances their self-confidence and compliance with postoperative rehabilitation. This minimizes early pain and maximizes early joint function recovery (Qi et al., 2019; Zheng et al., 2022). So, it is important to educate patients in order to speed their recuperation following TKA. The how, why, and what to do about

pain and activity following TKA should be explained to patients by nurses (Kim & Kim, 2023).

Additionally, the use of Kinesio Taping (KT) during the immediate post-TKA recovery period reduces pain and swelling while improving functional performance (Yuksel et al., 2022). Kinesio Taping is a secure technique that supports the treatment of knee joints through an elastic thin, cotton, porous fabric with acrylic adhesive. It can be used every day and even in the first few days following TKA surgery (Jarecki et al., 2021).

A professional nurse's assessment, patient education, and skilled care both before and after total knee arthroplasty (TKA) significantly improve surgical outcomes and patient satisfaction. Orthopedic-trained clinical nurse specialists can be an invaluable resource in providing patients undergoing TKA with high-quality, evidence-based nursing care (Sharma et al., 2020). Nurses are essential to a patient's care from the moment of surgery scheduling; they help the patient through the pre-admission process and provide education about what to expect during the hospital stay and recovery process, which will facilitate a speedy and safe recovery. They also manage pain, start mobilization, and adhere to guidelines for preventing postoperative complications (Copanitsanou & Santy-Tomlinson, 2021; Nazon et al., 2023).

Significance of the study

According to earlier studies, patients scheduled for joint replacement surgery are becoming more and more in need of preoperative education. Preoperative education has been shown through research to enhance patient outcomes and satisfaction with the surgical procedure (Berton et al., 2020; Jones et al., 2022). Preoperative rehabilitation may significantly reduce hospital stays and improve patient outcomes. Therefore, in-depth, high-quality research should be done to verify the effectiveness of preoperative rehabilitation in total knee arthroplasty patients (Su et al., 2022).

Effective preoperative preparation can significantly reduce patients' pain after total knee arthroplasty (TKA) surgery and improve the functionality of their knee joints. Additionally, it can help patients get the best recovery possible, which can increase their level of hospitalization satisfaction and the quality of their medical care (Zheng et al., 2022). Nevertheless, there is a lack of evidence to support the efficacy of preoperative nursing education combined with Kinesio taping application on the functional outcomes of patients undergoing TKA surgery. Hence, the purpose of this study was to assess the efficacy of this combination on the functional outcomes of patients undergoing TKA.

Aim of the study

The study aimed to evaluate the efficacy of preoperative nursing education with Kinesio taping application on functional outcomes of patients undergoing total knee arthroplasty.

Research hypothesis:

- Patients who will receive preoperative nursing education will have better knowledge about total knee arthroplasty.
- Patients who will receive preoperative nursing education with Kinesio taping application will exhibit a significant improvement in their overall practice scores following total knee arthroplasty surgery.
- Patients who will receive preoperative nursing education with Kinesio taping application will exhibit a significant improvement in their functional outcomes following total knee arthroplasty surgery.

Operational definitions:

- **Preoperative nursing education** is an educational intervention delivered before the total knee arthroplasty surgery in the form of theoretical and practical sessions to improve patients' knowledge and practice about preoperative preparation, home preparation, and postoperative health instruction.
- **Kinesio Taping** is a safe and non-invasive method, that can be used soon after total knee arthroplasty surgery to improve knee flexion, ease pain, and reduce swelling in the early postoperative period.
- **Functional Outcomes** include assessment of the functional health status of patients undergoing total knee arthroplasty surgery and involve asking patients concerning how their knee symptoms influence their ability to perform general daily activities as well as how their knee condition affects their ability to perform specific functional tasks through The Knee Outcome Survey Activities of Daily Living Scale.

Subjects and Method

Research design

Quasi-experimental research design was employed in this study.

Setting

The study was carried out at the Orthopedic departments and orthopedic outpatient clinics at Mansoura University Hospital, as well as, New General Mansoura Hospital, Egypt.

Subjects

A Purposive sample of eighty male and female patients undergoing total knee arthroplasty surgery and attending the previously mentioned setting who met the **following criteria for inclusion:**

- Adult (20-<60 years) and elderly (≥ 60 years) patients who could communicate.

- Willing to participate in the study, were available when the data was being collected, and permitted telephone access.

Patients were excluded based on the following:

- Individuals with prior knee surgery.
- History of lower extremity or back problems (fractures, tumors, disc herniation, etc.).
- Individuals with obvious visual or auditory impairments.
- Severe organ failure (heart, lung, liver, or terminal illness), or serious medical conditions (uncontrolled angina, severe cardiomyopathy, etc.) that could be major contraindications to exercise.

Sample calculation:

The G*Power 3.1.9.7 software was used to calculate the sample size. Assuming that the WOMAC functional mean score of the intervention group who was exposed to preoperative rehabilitation was (23.7±9.0) before TKA surgery and became (16.2±9.9) one month after the surgery. The effect size was calculated to be (0.7927525) with an Alpha error probability of 0.05 and 95% power of the study. The calculated sample size was 72 patients and added 10% because of dropouts to 80 patients who were then divided randomly into two groups, a control group (40 patients) and an intervention group (40 patients).

Data collection tools:

Three tools were used to collect the necessary data and achieve the study's aim:

Tool I: Structured Interview Questionnaire:

This tool was developed by the researchers and includes three parts:

Part I: Demographic Characteristics of patients such as age, sex, marital status, level of education, occupation, residence, and income.

Part II: Clinical Data Sheet of patients such as cause of knee arthroplasty, Body mass index (BMI), family history of knee arthroplasty, and preoperative physiotherapy.

Part III: Knowledge Assessment Questionnaire about total knee arthroplasty:

In order to evaluate the knowledge of patients undergoing total knee arthroplasty surgery, researchers designed it based on a review of related relevant national and international literature (Konnyu et al., 2021; Jarecki et al., 2021; Zhou et al., 2022; Wang et al., 2022; Kim & Kim, 2023; De Klerk et al., 2023). It comprised sixteen questions about total knee arthroplasty:

Knowledge Questions	Patients' Knowledge about total knee arthroplasty
Questions 1 & 2	Total knee arthroplasty and its benefits.
Question 3	Instructions to follow the first day of surgery.
Question 4	When to start walking gradually after surgery?
Question 5	Objectives to meet before leaving the hospital.
Question 6	How to make the house safer to return to afterward?
Question 7	Manifestations that call for consulting the doctor.
Question 8	What exercises are required following surgery to strengthen the muscles surrounding the knee and the entire leg?
Question 9	Uses of Kinesio taping after surgery.
Question 10	Activities that are prohibited following surgery.
Question 11	Which could put undue strain on the newly prosthetic joint?
Question 12	Factors that affect the durability of the artificial joint.
Question 13	The time frame within which the prosthetic knee joint functions following surgery.
Question 14 - 16	Common postoperative complications and how to detect them.

Scoring system:

Every question had a set of possible answers and could include one or more right answers. Each right answer received one degree, while a missed, incorrect, or unknown answer received zero. The total score for the patient's knowledge of total knee arthroplasty was calculated by adding the scores for each question, with a total score of 66 degrees. The patients' knowledge of total knee arthroplasty surgery was divided into three categories: patients obtained less than 50% (< 33 degrees) had poor knowledge, patients obtained 50% to less than 75% (33-49 degrees) had fair knowledge, and patients with 75% or more (50-66 degrees) had good knowledge (Eldesoky & Awad, 2020).

Tool II: Patient's practices following Total Knee Arthroplasty surgery checklist:

It was developed by the researchers based on reviewing related recent national and international literature (Capin et al., 2022; Kondo et al., 2022; Wang et al., 2023) to assess patient's practices following total knee arthroplasty surgery. It consisted of 13 items, divided into two parts:

Checklist items	Patients' practices following total knee arthroplasty surgery
Part I: Immediate postoperative practices	
Item 1	Breathing exercises “decrease the risk of chest complications”
Item 2	Circulation exercises “improve blood flow to the feet and leg, which is crucial in avoiding blood clots”.
Item 3	Ankle circles “strengthening the muscles”
Item 4	Swelling control of the knee by elevating the leg above the heart level for 20 minutes, 2-3 times per day.
Item 5	Intermittent ice pack application to the operated leg.
Part II: Practices before discharge	
Item 6	Sit to stand exercise.
Item 7	Start with walking short distances in the hospital.
Item 8	On discharge, gradually increase walking within tolerance.
Item 9	Walking using a walker in the sequence; walker, operated leg, then non-operated leg.
Item 10	Practice going upstairs using crutches in the sequence; hold the handrail with one hand and a crutch in the other, step the non-operated leg up first, then bring the operated leg and the crutch up onto the step.
Item 11	Practice going downstairs using crutches in the sequence; hold the handrail with one hand and a crutch in the other, step down with the operated leg, along with the crutch, then step down with the non-operated leg.
Item 12	Eating a well-balanced diet.
Item 13	Home preparation for discharge.

Scoring system:

Each point on the checklist had two possible answers (done correctly - not done/incomplete), with one grade for done correctly and zero for not done or incomplete. The sum of the scores was 13 degrees, which was then translated to a percentage. If a patient received less than 60% (1-7 degrees), their practices were deemed inadequate; if they obtained 60% (8-13 degrees) or more, their practices were deemed adequate (Eldesoky & Awad, 2020).

Tool (III): The Knee Outcome Survey Activities of Daily Living Scale (KOS-ADLS):

It was developed by (Irrgang et al., 1998). KOS-ADLS comprises 14 items arranged in a self-administered questionnaire design with six possible responses for each item. Queries patients concerning

how their knee symptoms influence their ability to perform general daily activities (6 items) as well as how their knee condition affects their ability to perform specific functional tasks (8 items) (Algarni et al., 2017). It is used for patients undergoing a variety of orthopedic knee procedures and young athletic subjects as well as the elderly (McHugh et al., 2020). It has consisted of two sections:

The knee outcome survey activities of daily living scale (KOS-ADLS) items:

Section (I): Symptoms: to what degree does each of the following symptoms affect your level of daily activity?

Item 1	Pain.
Item 2	Stiffness.
Item 3	Swelling.
Item 4	Giving Way, Buckling or Shifting of Knee.
Item 5	Weakness.
Item 6	Limping.

Section (II): Functional Limitations with Activities of Daily Living: how does your knee affect your ability to.....

Item 7	Walk.
Item 8	Going upstairs.
Item 9	Going downstairs.
Item 10	Stand.
Item 11	Kneel on the front of your knee.
Item 12	Squat.
Item 13	Sit with your knee bent.
Item 14	Rise from a chair.

Scoring system

Using a numerical ordinal scale

- Each item is graded from 0 to 5 ranging from maximum severity of a specific symptom or complete inability to do certain maneuvers to symptom-free level or having full capability to do a target activity.
- The first six items are formulated to investigate the level of knee symptomatology, while the last eight questions are designed to address the knee functional performance with the highest possible score is 70.

Validity and reliability of the study tools:

The validity of the study tools was evaluated by six specialists in the fields of medical surgical nursing and gerontological nursing, and a specialist professor of orthopedic surgery to judge their clarity, relevance, understandability, and practicality. In light of that, the necessary modifications were made. Additionally, the consistency with which the research tools' scores varied while being used was examined in order to evaluate their reliability by using Spearman's correlation coefficient. The study tools' respective values of 0.90, 0.86, and 0.89 ensured reliability.

Pilot study:

Ten percent (8 patients) of the study subjects were used in a pilot study using the aforementioned tools to evaluate the clarity, feasibility, accuracy, and usefulness of the research tools in the previously described settings. Minor modifications were implemented for tools I and II based on the findings from the pilot research. Therefore, the study sample did not include any patients who took part in the pilot trial.

Ethical considerations

The Faculty of Nursing, Mansoura University, Egypt's Research Ethics Committee gave its authorization to the study (Ref. No. P.0527). Signed agreements from the studied patients were obtained after they were informed about the study objectives and reassured that the information gathered would only be used for research. The researchers emphasized that participation is entirely optional. Throughout the study period, confidentiality, privacy, safety, and anonymity were guaranteed. All data was coded, and all documents were kept in a locked cabinet to protect participants' confidentiality. Furthermore, all participants were made aware that their refusal to take part in the study would not affect their care.

Procedure

- The research ethics committee of the faculty of Nursing at Mansoura University in Egypt provided ethical permission, along an approval number was issued (Ref. No. P.0527).
- Formal administrative approval from the aforementioned setting was obtained before the study commenced. The general director of Mansoura University Hospital and New General Mansoura Hospital in Egypt granted permission. The goal of the study, the date, and the time when the data collection began were communicated to the heads of the Orthopedic departments.
- Tool I (demographic and clinical data sheet, as well as knowledge assessment questionnaire about total knee arthroplasty) and tool II (patient's practices following total knee arthroplasty surgery checklist) were developed by the researchers after reviewing the recent related national and international literature. Tool III (The Knee Outcome Survey Activities of Daily Living Scale) was adopted. After that, the final version of the study tools was translated into Arabic language by the researchers. The accuracy of the translation was verified by an English language specialist from Mansoura University's Faculty of Education. Finally, the translated final version of the tool was ready for data collection.
- Data were gathered by the researchers between September 2023 and March 2024.

- The data were collected through the following phases:

- **Assessment phase:** During this phase, the researchers recruited the patients who fulfilled the inclusion criteria from the previously mentioned settings, then introduced themselves to each patient and explained the aim and nature of the study for each patient. Consent approval was obtained from each patient. Initial assessment was carried out preoperatively to collect baseline data for both control and intervention groups using tools I & tool III.
- **Planning phase:** The goal and expected outcomes were developed based on patients' assessments including raising patients' awareness about total knee arthroplasty surgery and improving patients' practices and functional outcomes following the surgery.
- During the planning phase, the researchers bought the Kinesio Taping and designed a preoperative educational booklet based on a wide literature review and the information from the pretest study.
- The preoperative educational booklet was written in simple Arabic language and supported with different illustrated pictures to enhance the learning process and facilitate patients' understanding. It consisted of four units. **The first unit** included information about the normal knee joint, causes of knee joint damage, concept of total knee arthroplasty, indications for total knee arthroplasty surgery, and benefits of total knee arthroplasty surgery. **The second unit** included knowledge about total knee arthroplasty surgery, preoperative preparation, and exercises, how to use Kinesio tape, and general preparation for patients preoperatively. **The third unit** included information about what to do the first day after surgery, instructions after the first day of surgery, diet, objectives that must be achieved before leaving the hospital, and how to go up and down stairs. **The fourth unit** was about going back home after surgery, how to prepare the house to return to after leaving the hospital, post-operative exercises to strengthen the muscles surrounding the knee and entire leg, activities that are prohibited following surgery, which could put undue strain on the newly prosthetic joint, factors that affect the durability of the artificial joint, and complications of total knee arthroplasty surgery.

Implementation phase:

- **For the intervention group:** the researchers scheduled the educational sessions' time and duration with each patient after illustrating the objectives of the educational sessions. Four educational sessions were implemented in the form of 2 theoretical and 2 practical sessions to cover all information addressed in the preoperative

educational booklet. The educational method was in the form of interactive lectures and discussions between the researchers and the patients through questions and answers to ensure understanding of each patient and answer any question. Educational sessions were varied according to the level of understanding of each patient and the content of each session. Additionally, lectures were supported with videos. Each patient received a copy of the preoperative educational booklet. Moreover, videos about the usage of Kinesio Taping following knee arthroplasty were shown to patients.

- Kinesio Taping was applied to each patient in the intervention group on the third day postoperatively because the patients started walking as; 10 mm of the tape was applied in the shape of a fan to the side of the calf. The proximal points (the base of the tape) were located loosely at the level of the hollow of the knee next to the lymph nodes, the head of the fibula, and the medial part of the knee. The tapes were located laterally and medially and close to the downward end. The distal points, or tails, were stretched from the lateral malleolus and medial tibia. The patients were instructed to remove the tapes maximally after 5 days because, after five days, the tapes usually come unstuck and lose their function.
- **For the control group:** no intervention was implemented neither preoperative education nor Kinesio taping application. The patients in this group receive only routine hospital care.
- **Evaluation phase:** this phase focused on evaluating the efficacy of preoperative nursing education with Kinesio taping application on functional outcomes of patients undergoing total knee arthroplasty (TKA) surgery. Patients in the study and intervention groups were assessed immediately after preoperative education using tool I (part III) to assess knowledge (posttest). Then, they were assessed before patients' discharge from hospital using tool II to assess practices following TKA, and after 2 months using tool I (part III) to assess knowledge (Follow-up) and tool III to assess functional outcomes following TKA.

Statistical analysis:

Data was collected, revised, tabulated, and statistically analyzed using IBM SPSS Statistics version 27. The mean and standard deviation were used to display the quantitative data, while qualitative data was displayed through numbers and percentages. The normality of data distribution was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests before any calculations to verify whether the data was normally distributed and determine the suitable statistical test. The Chi-Square test was used to

compare between two groups having qualitative variables. For normally distributed data, the F-test (One-way ANOVA) was used to compare more than two groups, and the t-test (Independent samples t-test) was utilized to compare between two groups. For abnormally distributed data, the U-test (Mann-Whitney test) was used to compare between two groups (Mishra et al. 2019). The Pearson's coefficient (r) was used to determine the correlation between study variables. The Significance of the study results was determined at the 5% level ($P \leq 0.05$), while $P \leq 0.001$ indicates highly statistically significant results.

Results

Table (1): Comparison between control and intervention groups according to their demographic characteristics (N = 80):

Demographic data	Control Group (N=40)		Intervention Group (N=40)		Test of Significance	P-Value
	N	%	N	%		
Age						
- 45-<55	6	15.0	5	12.5	X ² = 0.222	0.895
- 55-<65	23	57.5	25	62.5		
- 65-72	11	27.5	10	25.0		
Mean ± SD	59.55±6.61		59.80±6.12		t = -0.176	0.861
Sex						
- Male	15	37.5	17	42.5	X ² = 0.846	0.648
- Female	25	62.5	23	57.5		
Marital status						
- Married	29	72.5	31	77.5	X ² = 0.333	0.846
- Divorced	3	7.5	2	5.0		
- Widow	8	20.0	7	17.5		
Educational level						
- Illiterate	3	7.5	2	5.0	X ² = 0.354	0.950
- Primary	17	42.5	18	45		
- Secondary	15	37.5	14	35.0		
- University	5	12.5	6	15.0		
Work						
- No	19	47.5	23	57.5	X ² = 3.434	0.180
- Need physical exertion	13	32.5	6	15.0		
- Not need physical exertion	8	20.0	11	27.5		
Residence						
- With others	40	100.0	40	100.0	-	-
Income						
- Enough	28	70.0	25	62.5	X ² =0.503	0.478
- Not enough	12	30.0	15	37.5		

X²: Chi-square test

t: Independent samples t-test

*Significant at P ≤ 0.05

Primary educational level: Read & write, preparatory, and primary school.

Table (2): Comparison between control and intervention groups according to their clinical data (N = 80):

Clinical Data	Control Group (N=40)		Intervention Group (N=40)		Test of Significance	P-Value
	N	%	N	%		
Causes of TKA						
-Rheumatoid arthritis	20	50.0	19	47.5	X ² = 0.050	0.823
- Knee Osteoarthritis	20	50.0	21	52.5		
BMI						
-Normal (18.5-<25)	5	12.5	5	12.5	X ² = 0.068	0.967
-Overweight (25-<30)	10	25.0	11	27.5		
-Obesity (≥30)	25	62.5	24	60.0		
Family history of TKA						
-No	37	92.5	39	97.5	X ² =1.053	0.305
-Yes	3	7.5	1	2.5		
Preoperative Physiotherapy						
-Yes	40	100.0	40	100.0	-	-

X²: Chi-square test

*Significant at P ≤ 0.05

Table (3): Comparison between control and intervention groups regarding their total mean knowledge score during the study periods (N = 80):

Total mean Knowledge scores	Control Group (N=40)	Intervention Group (N=40)	T	P-Value
	Mean ± SD	Mean ± SD		
- Before educational intervention	29.43±9.34	26.05±9.62	t= 1.591	0.116
- Immediately after educational intervention	30.88±11.17	51.35±12.49	t=-7.727	<0.001*
- 2 months following educational intervention	30.30±10.19	49.15±12.76	t=-7.302	<0.001*

t: Independent samples t-test

*Significant at P ≤ 0.05

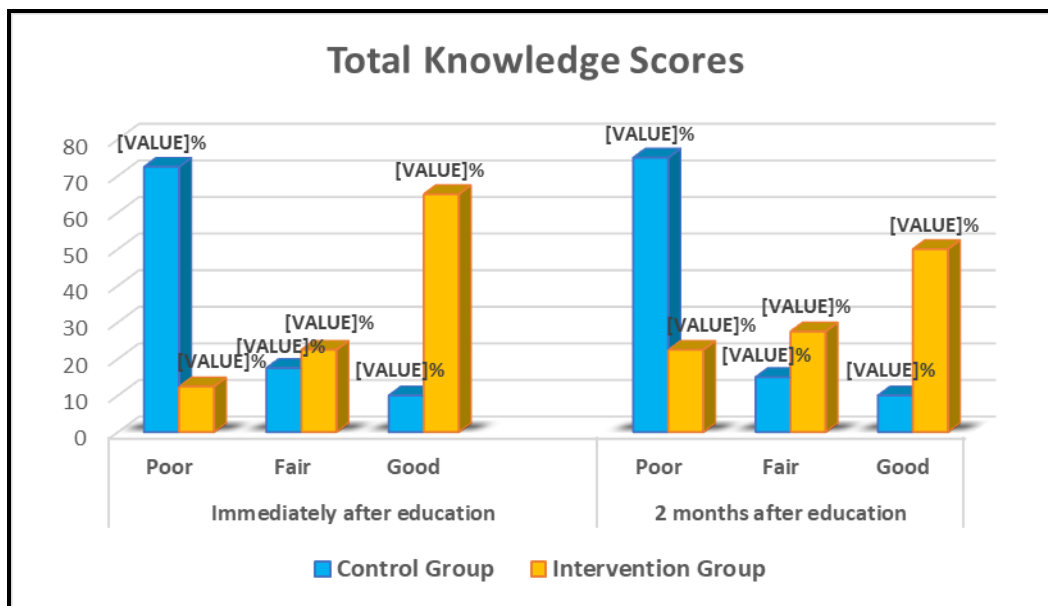


Figure (1): Percentage distributions of the total knowledge scores of the control and intervention groups immediately and 2 months after educational intervention.

Table (4): Comparison between control and intervention groups according to their practices following total knee arthroplasty surgery (N =80):

Patients' practices following TKA	Control Group (N=40)		Intervention Group (N=40)		Test of significance	P-Value
	N	%	N	%		
I. Immediate postoperative practices (IPP)						
1. Breathing exercises to prevent chest complications.						
No	31	77.5	22	55.0	X ² = 4.528	0.03*
Yes	9	22.5	18	45.0		
2. Circulation exercises to improve blood flow to the feet and leg.						
Yes	40	100.0	40	100.0	-	-
3. Ankle circles to strengthen the muscles.						
No	29	72.5	8	20.0	X ² = 22.175	<0.001**
Yes	11	27.5	32	80.0		
4. Swelling control of the knee by elevating the leg above the heart level for 20 minutes, 2-3 times per day						
No	14	35.0	0	0.0	X ² = 16.970	<0.001**
Yes	26	65.0	40	100.0		
5. Intermittent ice pack application to the operated leg.						
No	40	100.0	19	47.5	X ² = 28.475	<0.001**
Yes	0	0.0	21	52.5		
Mean ±SD (IPP)	2.15±1.14		3.78±1.23		t= -6.117	<0.001**

Patients' practices following TKA	Control Group (N=40)		Intervention Group (N=40)		Test of significance	P-Value
	N	%	N	%		
II. Practices before discharge (PBD)						
6. Sit to stand exercise.						
No	24	60.0	8	20.0	X ² = 13.333	<0.001**
Yes	16	40.0	32	80.0		
7. Start with walking short distances in the hospital.						
Yes	40	100.0	40	100.0	-	-
8. On discharge, gradually increase walking within tolerance.						
No	21	52.5	9	22.5	X ² = 7.680	0.006*
Yes	19	47.5	31	77.5		
9. Walking using a walker in sequence; walker, operated leg, then non-operated leg.						
Yes	40	100.0	40	100.0	-	-
10. Practice going upstairs using crutches in sequence; hold the handrail with one hand and a crutch in the other, step the non-operated leg up first, then bring the operated leg and the crutch up onto the step.						
No	40	100.0	28	70.0	X ² = 14.118	<0.001**
Yes	0	0.0	12	30.0		
11. Practice going downstairs using crutches in the sequence; hold the handrail with one hand and crutch in the other, step down with the operated leg, along with the crutch, then step down with the non-operated leg.						
No	40	100.0	28	70.0	X ² = 14.118	<0.001**
Yes	0	0.0	12	30.0		
12. Eating a well-balanced diet.						
No	31	77.5	22	55.0	X ² = 4.528	0.033*
Yes	9	22.5	18	45.0		
13. Home preparation for discharge.						
No	40	100.0	31	77.5	X ² = 10.141	0.001*
Yes	0	0.0	9	22.5		
Mean±SD (PBD)	3.10±1.15		4.85±1.96		t= -4.879	<0.001**
Overall practices	5.25±2.23		8.63±3.04		t= -5.659	<0.001**

X²: Chi-square test t: Independent samples t-test *Significant at P ≤ 0.05 **Highly Significant at P ≤ 0.001

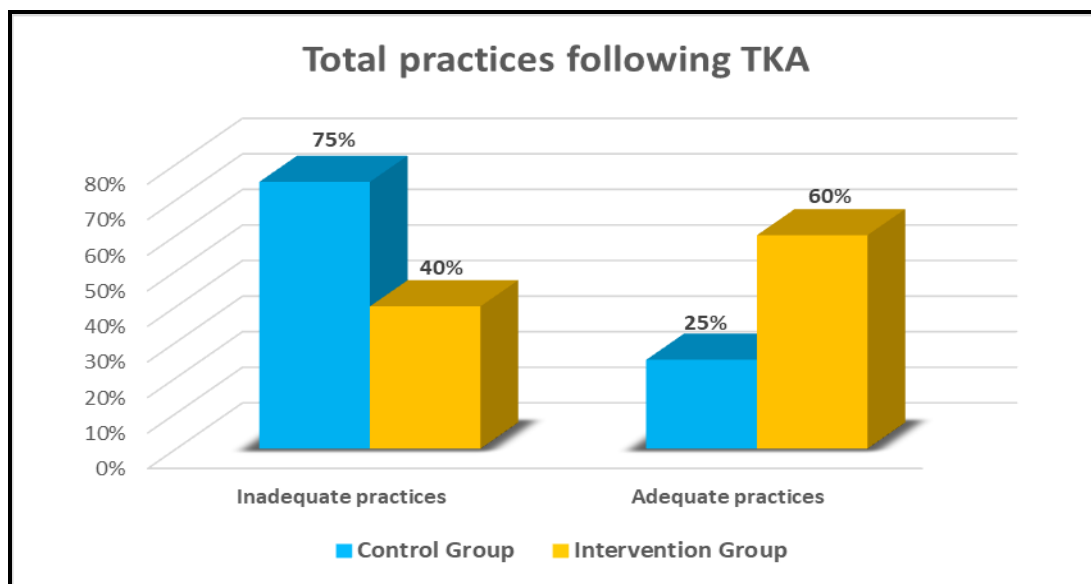


Figure (2): Percentage distributions of the total practice scores of the control and intervention groups following total knee arthroplasty surgery

Table (5): Comparison between the study groups regarding Knee Outcome Survey Activities of Daily Living (KOS-ADLs) scores preoperatively and 2 months postoperatively (N = 80):

KOS-ADLs mean scores	Preoperative		2 months Postoperative	
	Control Group (N=40)	Intervention Group (N=40)	Control Group (N=40)	Intervention Group (N=40)
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Symptoms: to what degree does each of the following symptoms affect your level of daily activity?				
1. Pain	0.63±1.08	0.58±1.08	2.00±0.93	3.03±1.03
U(p)	763.00 (0.677)		382.50 (<0.001**)	
2. Stiffness	0.35±0.48	0.23±0.42	4.25±0.71	4.47±0.75
U(p)	700.00 (0.220)		647.00 (0.105)	
3. Swelling	1.50±0.75	1.43±0.50	2.93±0.80	3.68±0.92
U(p)	791.00 (0.920)		455.00 (<0.001**)	
4. Giving Way, Buckling, or Shifting of Knee	0.43±0.64	0.55±0.71	3.95±0.45	4.45±0.75
U(p)	730.50 (0.439)		451.00 (<0.001**)	
5. Weakness	1.40±0.71	1.43±0.71	3.38±0.59	3.70±0.72
U(p)	782.50 (0.832)		603.00 (0.032*)	
6. Limping	1.15±0.36	1.18±0.38	3.73±0.64	4.15±0.77
U(p)	780 (0.763)		554.50 (0.011*)	
Total symptoms	5.45±3.65	5.38±3.22	20.23±3.61	23.48±3.97
U(p)	686.50 (0.246)		434.00 (<0.001**)	
Functional Limitations with Activities of Daily Living: how does your knee affect your ability to.....				
7. Walk	1.50±0.72	1.58±0.75	3.50±0.51	3.75±0.49
8. U(p)	757.50 (0.640)		590.00 (0.016*)	
9. Going upstairs	0.90±0.84	0.95±0.81	2.85±0.80	3.25±0.78
10.U(p)	772.00 (0.775)		584.00 (0.027*)	
11.Going downstairs	1.13±0.88	1.18±0.96	3.00±0.88	3.48±0.82
12.U(p)	779.00 (0.832)		562.50 (0.012*)	
13.Stand	1.48±1.01	1.50±1.01	3.03±1.14	3.63±1.05
14. U(p)	782.50 (0.860)		561.00 (0.017*)	
15.Kneel on the front of your knee	0.53±0.64	0.55±0.64	2.88±0.72	3.30±0.72
16. U(p)	781.50 (0.481)		553.00 (0.011*)	
17.Squat	0.45±0.55	0.48±0.60	2.60±0.78	3.08±0.97
18. U(p)	791.50 (0.925)		577.50 (0.024*)	
19.Sit with your knee bent	0.68±0.94	0.73±0.96	3.05±0.68	3.43±0.68
20. U(p)	776.50 (0.801)		576.00 (0.018*)	
21.Rise from a chair	1.38±1.00	1.40±0.87	3.40±0.50	3.90±0.59
22. U(p)	770.00 (0.758)		460.00 (<0.001**)	
Total Functional limitation with ADLs	8.03±6.18	8.35±5.69	24.30±5.26	27.80±5.16
U(p)	766.00 (0.742)		493.50 (0.003*)	
Overall KOS-ADLs	13.48±9.64	13.73±8.55	44.53±8.38	51.28±8.89
U(p)	737.00 (0.542)		471.00 (0.001*)	

U: Mann-Whitney test

*Significant at $P \leq 0.05$ **Highly Significant at $P \leq 0.001$

Table (6): Relationship between knowledge and demographic characteristics among both control and intervention groups during the study periods (N= 80):

Demographic data	Control Group (N=40)			Intervention Group (N=40)		
	Before	Immediately after	After 2 months	Before	Immediately after	After 2 months
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Age						
- 45-<55	44.17±9.24	50.67±9.91	47.83±7.57	45.00±5.57	66.00±0.00	62.80±1.92
- 55-<65	28.61±6.78	29.30±7.18	29.13±7.13	25.04±6.09	52.56±8.92	50.52±10.38
- 65-72	23.09±4.55	23.36±4.63	23.18±4.56	19.10±5.76	41.00±14.89	38.90±13.82
F(p)	19.797 (<0.001**)	30.428 (<0.001**)	27.907 (<0.001**)	32.492 (<0.001**)	10.334 (<0.001**)	8.690 (<0.001**)
Sex						
- Male	36.87±9.69	40.60±11.49	39.13±10.05	31.88±10.90	59.59±9.14	56.59±9.84
- Female	24.96±5.64	25.04±5.59	25.00±5.63	21.74±5.67	45.26±11.16	43.65±11.99
t(p)	4.932 (<0.001**)	5.761 (<0.001**)	5.722 (<0.001**)	3.826 (<0.001**)	4.324 (<0.001**)	3.632 (<0.001**)
Marital status						
- Married	31.34±9.95	33.31±11.95	32.55±10.79	28.68±9.30	55.39±9.47	53.58±10.02
- Divorced	31.00±1.00	31.00±1.00	31.00±1.00	18.50±0.71	40.00±0.00	31.50±0.71
- Widow	21.88±2.90	22.00±3.02	21.88±3.14	16.57±3.26	36.71±13.74	34.57±10.16
F(p)	3.721 (0.034*)	3.650 (0.036*)	3.980 (0.027*)	6.658 (0.003*)	10.948 (<0.001**)	13.860 (<0.001**)
Educational level						
- Illiterate	18.00±1.00	18.33±1.15	18.33±1.15	13.00±1.41	27.00±2.83	27.00±2.83
- Primary	23.82±4.41	24.18±4.85	24.12±4.91	23.11±5.45	46.56±11.14	45.28±11.79
- Secondary	32.40±4.76	33.53±5.05	33.20±5.21	24.43±6.84	55.14±8.86	52.50±11.18
- University	46.40±8.32	53.20±8.64	49.80±6.53	43.00±6.99	65.00±2.45	60.33±6.28
F(p)	33.046 (<0.001**)	44.408 (<0.001**)	39.676 (<0.001**)	19.924 (<0.001**)	11.063 (<0.001**)	6.182 (0.002*)
Work						
- No	24.89±5.98	25.00±5.92	24.95±5.97	21.30±5.37	46.26±12.21	44.04±12.73
- Need physical exertion	27.54±4.14	28.85±5.46	28.46±5.27	26.83±9.09	55.33±13.68	54.83±13.88
- Not need physical exertion	43.25±9.19	48.13±10.63	46.00±8.55	35.55±10.27	59.82±6.24	56.73±6.31
F(p)	25.239 (<0.001**)	32.139 (<0.001**)	31.870 (<0.001**)	13.318 (<0.001**)	5.944 (0.006*)	5.354 (0.009*)
Residence						
- With others	29.43±9.34	30.88±11.17	30.30±10.19	26.05±9.63	51.35±12.49	49.15±12.76
(p)	-	-	-	-	-	-
Income						
- Enough	32.86±8.74	34.89±10.73	34.11±9.50	28.48±10.41	54.36±10.31	51.96±11.23
- Not enough	21.42±4.72	21.50±4.78	21.42±4.81	22.00±6.65	46.33±14.47	44.47±14.14
t(p)	4.256 (<0.001**)	4.127 (<0.001**)	4.369 (<0.001**)	2.155 (0.038*)	2.046 (0.048*)	1.853 (0.072)

F: One-Way ANOVA

*Significant at $P \leq 0.05$

t: Independent samples t-test

**Highly Significant at $P \leq 0.001$

Table (7): Correlation between study variables following Total Knee Arthroplasty (TKA) surgery (N = 80):

Study variables	Control group (N=40)			Intervention group (N=40)		
	K	P	KOS-ADLs	K	P	KOS-ADLs
	r (p)	r (p)	r (p)	r (p)	r (p)	r (p)
K	1 -	0.849 (<0.001**)	0.852 (<0.001**)	1 -	0.797 (<0.001**)	0.782 (<0.001**)
P	0.849 (<0.001**)	1 -	0.905 (<0.001**)	0.797 (<0.001**)	1 -	0.810 (<0.001**)

r: Pearson coefficient

p: ** Significant at the 0.01 level (2-tailed).

K → Total knowledge scores immediately after education.

P → Total practice scores following TKA.

KOS-ADLs → postoperative Knee Outcome Survey Activities of Daily Living scores.

Table (1): Demonstrates that for all demographic characteristics, there were no statistically significant differences between both control and intervention groups. In addition, the majority of patients in the control and intervention groups were aged 55 years or older with corresponding mean ages of 59.55 ± 6.61 and 59.80 ± 6.12 . Furthermore, male and married patients were predominating among both groups. Moreover, patients with primary educational levels constitute more than two-fifths (42.5% & 45%) of both control and intervention groups. In relation to work, approximately half (47.5% & 57.5%) of both control and intervention groups don't work. Additionally, all patients in both control and intervention groups were residing with others, and about two-thirds of them (70% & 62.5%) had enough income.

Table (2): Displays no statistically significant differences between control and intervention groups concerning their clinical data. roughly half of both control and intervention groups (50% & 52.5%) were undergoing total knee arthroplasty (TKA) because of knee osteoarthritis. Additionally, 62.5% and 60%, respectively of control and intervention groups were obese. Furthermore, most (92.5% & 97.5%) of both control and intervention groups didn't have a family history of TKA and every one of them underwent preoperative physiotherapy.

Table (3): Illustrates that before educational intervention, there were no statistically significant variations in the total mean knowledge scores between the control and intervention groups. However, there were differences, which are statistically significant in the total mean knowledge scores between the control and intervention groups immediately after educational intervention (30.88 ± 11.17 & 51.35 ± 12.49) and two months later (30.30 ± 10.19 & 49.15 ± 12.76).

Figure (1): Displays that just 10% of patients in the control group had good knowledge scores about total knee arthroplasty (TKA) surgery immediately

following preoperative nursing education, compared to 65% of patients in the intervention group. Furthermore, two months later, only 10% of patients in the control group had good knowledge scores about TKA surgery, compared to half (50%) of patients in the intervention group.

Table (4): Illustrates that patients in the control group had lower overall mean practice scores (5.25 ± 2.23) following total knee arthroplasty (TKA) surgery, which is statistically significant when compared to the intervention group's overall mean practice scores (8.63 ± 3.04).

Figure (2): Shows that there was a statistically significant difference in the overall practice scores between the control and intervention groups as just one quarter (25%) of patients in the control group had adequate practices, compared to approximately two-thirds (60%) of patients in the intervention group.

Table (5): Displays that there was a significant difference in the postoperative overall mean scores of Knee Outcome Survey Activities of Daily Living (KOS-ADLs) between the control and intervention groups. Specifically, patients in the control group had lower overall KOS-ADLs mean scores (44.53 ± 8.38) than patients in the intervention group (51.28 ± 8.89). Nevertheless, the preoperative overall KOS-ADLs mean scores of both groups prior to preoperative nurse education and Kinesio-taping application did not differ in a way that was statistically significant.

Table (6): Reveals that for both the control and intervention groups, there were statistically significant relationships between the knowledge scores regarding total knee arthroplasty (TKA) surgery before, immediately after, and two months following education about TKA. For instance, patients with higher mean knowledge scores were male, in the (45-<55) age group, married, obtaining higher educational levels, working in an occupation that doesn't require physical exertion, and having enough income.

Table (7): Indicates that for both control and intervention groups, there was a strong positive correlation between the study variables. Specifically, the total knowledge scores about total knee arthroplasty (TKA) surgery immediately after preoperative nursing education showed a strong positive correlation with both the overall practice scores following TKA ($r= 0.849$ & $r= 0.797$) and the postoperative overall Knee Outcome Survey Activities of Daily Living (KOS-ADLs) scores ($r= 0.852$ & $r= 0.782$) for the control and intervention groups, respectively suggesting that patients with higher knowledge scores had higher practices and higher KOS-ADLs scores. Additionally, there was a strong positive correlation between the overall practice scores following TKA and the postoperative overall KOS-ADLs scores ($r= 0.905$ & $r= 0.810$) for the control and intervention groups correspondingly. This suggests that patients with higher practice scores had higher KOS-ADLs scores.

Discussion

Total knee arthroplasty (TKA) is a well-established therapeutic alternative for individuals experiencing knee pain due to osteoarthritis who have not responded to conservative therapy options. Pain alleviation and improved functional status are achieved through this effective procedure (Adie et al., 2019). Preoperative nursing education can enhance patients' health-related habits, knowledge, and functional outcomes (Jones et al., 2022). Furthermore, several safe noninvasive techniques, such as Kinesio taping, can aid in enhancing clinical results in the early postoperative period by minimizing swelling and pain following surgery and enhancing the recovery of knee range of motion following TKA (Jarecki et al., 2021).

Regarding the demographic characteristics of the control and intervention groups, there were no statistically significant differences found in the study results. In a similar vein, Ho et al. (2022)'s investigation into the effect of a patient-specific integrated education program on pain, perioperative anxiety, and functional recovery after total knee replacement revealed no statistically significant differences in any of the demographic variables between the intervention and control groups.

Furthermore, with respect to mean ages, the study's findings showed that most patients in the control and intervention groups were fifty-five years of age or older. Similarly, Fawzy et al. (2020), an Egyptian study assessing the biopsychosocial demands of patients following total knee arthroplasty surgery, found that the analyzed patient's mean age was fifty-nine, with a range of forty-one to seventy-two years. From the researchers' point of view, this could be

explained by the aging-related alterations in joint tissues that can aggravate osteoarthritis in the knee, the primary condition that requires total knee arthroplasty surgery.

The results of the study also showed that the majority of patients in both the control and intervention groups were males and married. This is consistent with an Egyptian study by Mohammed et al. (2022) titled "Effect of Application Cold Compresses on Range of Motion, Activity Daily Living and Pain Control Among Patients with Total Knee Replacement," which discovered that the study and control groups were primarily composed of males and married patients. Liao & Xu (2022) found, on the other hand, that a majority of the patients in both the control and study groups were female. This could be explained by the unique nature of the research environment.

In terms of educational attainment, the current study found that over two-fifths of patients in both control and intervention groups only attained primary educational levels. This is consistent with Chen et al. (2020)'s finding that primary education was attained by about two-fifths of patients in the intervention and control groups. Furthermore, Chang et al. (2022) discovered that approximately half of the patients under study had only completed elementary school.

According to the current study, roughly half of patients in the control and intervention groups do not work. In addition, every patient in the control and intervention groups shared a residence with others. It is confirmed by Hiraga et al. (2022) that the majority of participants in the control and intervention groups are non-workers. Furthermore, most patients in the control and study groups were living with their families, according to Taha & Ibrahim's (2021) findings.

In terms of clinical data, the current study found no statistically significant differences between the intervention and control groups. Comparing the medical data of the study and control groups, Mohammed et al. (2022) could not discover any statistically significant changes. Rittharomya et al. (2020) also found that there were no statistically significant variations in the health information between the experimental and control groups.

Furthermore, roughly two-thirds of patients in the control and intervention groups were obese. Similar findings were obtained by Mandour et al. (2022) in their Egyptian study titled "Quality of life for patients after knee replacement surgery," which revealed that about two-thirds of the patients they examined were obese. Steinbeck et al. (2023) also reported that almost half of the patients in the intervention and control groups were obese.

Concerning the efficacy of preoperative nursing education on patients' knowledge, the present

research discovered that there were no statistically significant differences in the total mean knowledge scores between the control and intervention groups prior to preoperative educational intervention. Nonetheless, there were statistically significant variations in the control and intervention groups' overall mean knowledge scores both immediately after the educational intervention and two months later. This is in line with a study conducted in Egypt by **Ali et al. (2020)** titled "The effect of implementing intervention protocol on self-efficacy of patients' post knee joint replacement." The study found that the patients under investigation had significantly different overall mean knowledge scores following the implementation of the intervention protocol compared to before it was implemented.

The current study also found that, in contrast to two-thirds of patients in the intervention group, only ten percent of patients in the control group had good knowledge scores about total knee arthroplasty (TKA) surgery immediately after preoperative nursing education. This is consistent with an Egyptian study by **Abozead et al. (2022)**, which found that following nursing instruction for total knee replacement surgery, the majority of study group patients had good knowledge scores when compared to the control group. Furthermore, based on conducting a thorough scientific research analysis, **Longo et al. (2023)** emphasize the critical role preoperative education plays in the trajectory of orthopedic patients in their systematic review study about the impact of preoperative education on Knee Replacement.

Regarding the efficacy of preoperative nursing education and Kinesio taping application on patients' practices and functional outcomes following total knee arthroplasty, the current study revealed that patients in the control group had lower overall mean practices scores following total knee arthroplasty (TKA) surgery, which is statistically significant when compared to the intervention group's overall mean practices scores. Also, there was a significant difference in the postoperative overall mean scores of Knee Outcome Survey Activities of Daily Living (KOS-ADLs) between the control and intervention groups. Specifically, patients in the control group had lower overall KOS-ADLs mean scores than patients in the intervention group.

These findings are consistent with a study by **Oktas & Vergili (2018)** titled "The effect of intensive exercise program and Kinesio taping following total knee arthroplasty on functional recovery of patients," which discovered that both preoperative education and Kinesio taping applications were beneficial in improving patients' practices of daily living activities and reducing pain and swelling, thus increasing the

functional performance following total knee arthroplasty. In addition, **Jones et al. (2022)** found statistically significant differences in the postoperative outcomes following TKA in patients who attended a preoperative educational class compared with those who did not attend.

Furthermore, **Ho et al. (2022)** discovered that the intervention group, which was exposed to the integrated education program, had an average WOMAC score that was considerably higher than that of the control group, which was not exposed, when using the WOMAC scale to evaluate the functional outcomes following TKA. Additionally, **jones et al. (2022)** concluded that preoperative education is effective in improving functional outcomes and reducing the cost of knee arthroplasties. Plus, **SULMAN et al. (2020)** found a significant difference in the mean score of the Lysholm Knee Scoring Scale between the experimental and control groups in their study titled "Effectiveness of Kinesio Taping on Pain and Function after Total Knee Arthroplasty." More specifically, compared to patients in the experimental group, the control group's mean Lysholm Knee Scoring Scale score was lower. Also, **Taha & Ibrahim (2021)** in their study about the effect of educational program on nurses' knowledge, practices, and patients' outcomes post TKA found a statistically significant difference between the study and control group with a better outcome in the study group patients than the control.

With respect to the relationship between patient knowledge and demographic data, the present study demonstrated that knowledge scores concerning total knee arthroplasty (TKA) surgery before, immediately after, and two months after TKA education exhibited statistically significant relationships for both the control and intervention groups. Patients in the forty-five to fifty-five years old age range who were married, had completed more education, worked in a physically demanding job, and had sufficient income, for example, had stronger mean knowledge scores. **Ali et al. (2020)** found similar results, reporting a statistically significant relationship between the studied sample's total knowledge before and after the intervention protocol was implemented. The patients with the highest mean knowledge scores were married, between the ages of fifty and sixty, and had completed more education.

In summary, the current study showed that, in comparison to patients in the control group, patients in the intervention group knew more about total knee arthroplasty. Furthermore, following total knee arthroplasty surgery, patients in the intervention group showed improvements in their practices and functional outcomes, which fully supports the study hypothesis.

Conclusion

The study concluded that the application of preoperative nursing education with Kinesio taping significantly improved the functional outcomes of patients undergoing total knee arthroplasty surgery.

Recommendations

These recommendations are made considering the study's findings:

- The utilization of TKA preoperative nursing education and Kinesio taping by staff nurses working in orthopedic departments is highly recommended.
- Enhancing nursing practices' proficiency in total knee arthroplasty (TKA) care is essential to guaranteeing patients' best possible outcomes and recuperation, which in turn supports TKA's ongoing viability as a medical intervention.

Acknowledgments

We are grateful to the staff members who worked in the study setting and all the patients who were granted permission to participate in this study for their cooperation.

Financial support:

There was no funding obtained.

Conflict of interest:

No conflict of interest

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