Effect of Physical Exercises Rehabilitation Program on Knee Function for Patients with End-stage Knee Osteoarthritis Undergoing Arthroplasty.

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Abstract

Background: When knee osteoarthritis worsens and conservative measures are ineffective in reducing pain and improving function, total knee arthroplasty becomes the preferred course of action, necessitating a postoperative rehabilitation program. Aim: To investigate effect of physical exercises rehabilitation program on knee function for patients with end-stage osteoarthritis undergoing knee arthroplasty. Design: This study employed a quasi-experimental research design. Settings: The trauma unit, outpatient orthopedic clinic, and orthopedic surgery department of Assiut University Hospital served as the study's locations. Sample: A sixty a (60) patients who were scheduled to underwent knee arthroplasty were included in this study after they were randomly divided into the study and control groups, (30) patients each. Tools: I: Structured Patient Interview Sheet, Tool II: Knowledge assessment sheet, Tool III, Knee Osteoarthritis Western Ontario, and McMaster Arthritis Index (WOMAC). Results: While there was improvement in patient function and knee ability to specific activity for patients undergoing knee arthroplasty during the program phases, the current study found a statistically significant difference in knowledge between the study and control groups following program implementation. Conclusion: Following knee arthroplasty, the patient's knowledge, function, and knee ability to perform particular tasks were significantly enhanced by the application of an exercise program. Recommendations: Applying physical exercise program as mandatory clinical pathway for patient undergoing arthroplasty.

Keywords: End-stage Osteoarthritis, Knee Arthroplasty, Knee Function, Physical Rehabilitation Exercises.

Introduction

The progressive and multifactorial illness known as osteoarthritis (OA) is characterized by the deterioration of the hyaline cartilage and surrounding tissue within the joint. The knee is the joint most impacted by osteoarthritis (OA), the most prevalent joint disease in humans. When knee OA reaches a severe end-stage and conservative measures are unable to alleviate the patient's pain or restore their functional abilities, total knee replacement becomes the preferred course of treatment **(Cui et al., 2020).**

The most prevalent joint condition in the world, osteoarthritis of the knee has a major influence on musculoskeletal pain, disability, and socioeconomic consequences both personally and collectively. Osteoarthritis in the knee limits a patient's ability to do daily activities due to discomfort and a reduction in muscular strength and endurance. A frequent age-related clinical illness that significantly impairs function and independence is knee osteoarthritis. Symptoms include difficulty walking, climbing stairs, getting up from a seated or prone position, and performing home duties **(Hashizaki et al., 2023)**.

Ageing changes in the matrix, such as the formation of advanced glycation end-products that alter the mechanical properties of joint tissues, and cell senescence, which results in the development of the senescent secretory phenotype, are two factors that age joint tissues and contribute to the development of osteoarthritis (OA) **(Jamali et al., 2020)**

The World Health Organization (WHO) estimates that osteoarthritis (OA) affects 10% of those over 65 and is one of the major causes of disability globally. Over 130 million people globally are predicted to be impacted by OA by the year 2050 as a result of rising obesity rates and an older population **(BaKaa, 2020)**.

End-stage knee joint illnesses, such as rheumatoid arthritis and osteoarthritis, can be effectively treated by total knee arthroplasty (TKA), sometimes referred to as total knee resurfacing. In order to lessen pain and increase mobility, surgery involves replacing the knee joint's weight-bearing surface with artificial implants. (**Zheng et al., 2022)** Since total knee arthroplasty has been demonstrated to lessen pain and enable a gradual return of patients to activities of daily life, it is commonly used to treat advanced knee osteoarthritis **(Hashizaki et al., 2023)**.

A knee joint arthroplasty is a surgical operation used to treat deformities, lessen discomfort, enhance function, and enhance quality of life in relation to health. Historically, knee arthroplasty has been performed largely on older patients, although it is becoming more common as the population ages. Walking and functional exercises increase blood flow and help people restore their capacity to carry out daily tasks including sitting, standing, and climbing stairs (**Ackerman et al., 2019)**

Programs for postoperative rehabilitation are therefore crucial because they can enhance patients' mobility, function, and results following total knee arthroplasty. These programs incorporate fitness components that include joint and muscle exercises for range of motion, strength, walking, function, endurance, and balance. Regaining full range of motion (ROM) is crucial to restoring the body's innate ability to move, which enables complete muscular contraction and helps the muscles grow stronger again **(Hashizaki et al., 2023)**.

However, research has indicated that physical function diminishes following total knee

replacement for osteoarthritis in the knee, necessitating prolonged durations of conventional physical therapy to restore function. After surgery, the quadriceps' muscle strength momentarily declines and takes three months to return to preoperative levels; it takes around a year for the operated side's quadriceps' muscle strength to recover to the same level as the healthy side's **(Hashizaki et al., 2023)** recuperation after A complete recovery requires knee joint arthroplasty surgery.

Nurses possess a unique opportunity to execute rehabilitation programs that have the potential to boost patient compliance and suitably equip patients for post-hospital self-care at home. The role of the nurse is crucial to the patient's healing and advancement; without skilled nursing care, the rehabilitation may not be successful. A preoperative training regimen can improve quadriceps strength, which aids in pain relief and postoperative functional recovery. Because postoperative rehabilitation programs can enhance function, outcome, and mobility in patients following total knee arthroplasty (TKA), they are crucial **(BaKaa, 2020)**

Through teaching and providing patients with instructions on how to complete range of motion exercises, weight bearing limit, ambulation with the use of crutches, and activity limits, nursing is regarded a cornerstone in the healing and progression of a patient's condition. The primary goals of the nurse are to lessen knee discomfort and swelling, restore normal joint motion, strengthen the muscles surrounding the knee, look for any indications of complications or issues, and establish post-operative follow-up plans **(Lemetti et al.,2020)**

Significance of the study:

One of the main causes of disability in older adults is osteoarthritis (OA). Over the past few decades, hip and knee OA has become more common; in people 65 to 85 years old, the prevalence is at about 25%. The everyday activities of patients and their overall health are significantly impacted by OA. Because of the high number of individuals with this illness and the high expense of treatment, OA puts a major financial strain on healthcare systems **(Papalia et al., 2020)**.

About 85% of people over the age of 50 to 75 have some osteoarthritis symptoms, and 40% of those who have the condition have severe problems with everyday tasks to the point that it interferes with their ability to perform social or professional duties **(Dvis et al., 2019)** In the United States, 4.55% of people under 50 had this operation, and by 2030, there will likely be 3.5 million primary knee arthroplasty cases annually. One of the most common musculoskeletal disorders, knee OA affects roughly 22.9% of people over the age of 40 (Cui et al., 2020).

A preoperative training regimen can improve quadriceps strength, which can aid in pain relief and postoperative functional recovery (Zheng et al., 2022) Thus, the goal of physical rehabilitation—which includes exercises like quadriceps setting, leg raising, and passive and active range-of-motion—is to quickly maximize the patient's function. This is linked to a higher likelihood of an earlier discharge, which is linked to a lower overall cost of care. These workouts strengthen the afflicted extremity's muscles and help avoid thrombosis and muscular atrophy (Arial et al., 2018) Thus, the purpose of this study was to investigate how patients having knee arthroplasty would fare in terms of their knee function after implementing an exercise rehabilitation program.

Operational definitions

Rehabilitation Exercises program: is a multimodal strengthening program that aids patients in becoming stronger prior to surgery and expedites their recovery following it. The program includes exercise, knowledge and education, and an assessment of the patients' health needs. It was sponsored by (Eilstein et al.,2023)

Aim of this study

To investigate effect of physical rehabilitation exercises program on knee function for patients with end-stage osteoarthritis undergoing knee arthroplasty.

Research Hypothesis: With these objectives in mind, the following study hypothesis was created:

H1: After completing the rehabilitation exercise regimen, knee function would improve.

Null Hypothesis: Patients with end-stage osteoarthritis who underwent the rehabilitation exercise program would not see an improvement in knee function.

Subjects and Method

Research design

There was a study and control component to the quasi-experimental research design.

Study Settings

The study was carried out at the affiliated clinic and the Trauma & Orthopedic department of the Main Assiut University Hospital

Subjects

The study subjects comprised 60 patients attending the previously mentioned settings and had arthroplasty.

Sample

Using a straightforward randomization technique, the study sample was split into two groups (research and control), each with thirty patients: patients admitted to the orthopedic department within the first month were assigned to the study group, and patients admitted within the next month were assigned to the control group. While the control group received standard hospital care, the study group participated in a regimen of rehabilitation activities.

Sample size

The flow rate of end-stage osteoarthritis patients undergoing arthroplasty was 155 cases in 6 months, which was calculated using the epi-info program with a 95% confidence level. Based on the patients' admission date to the orthopedic department, 60 patients were selected at random for the sample.

Inclusion criteria

The following criteria were used to recruit cases from the affiliated clinic and the Trauma & Orthopedic department at the Main Assiut University Hospital in order to meet the inclusion criteria:

Both genders' ages ranged from 20 and upwards.

The patients were receiving arthroplasty and had radiographic indications of grade III, IV knee OA.

The study participants exhibited willingness to participate, alertness, and efficient communication.

Those who met the study's eligibility standards and expressed interest in participating filled out all of the questionnaires and were interviewed after signing a consent form.

Exclusion criteria

The following patients were not allowed to participate in the study: those with rheumatoid arthritis, peripheral neuropathy, history of knee surgery or damage, intra-articular corticosteroid injections within the month preceding, or any indications of acute inflammation or effusion.

Individuals with altered states of consciousness or mental conditions were not permitted to participate in the study.

Tools for Collecting Data

Data was collected using three different tools.

Tool I: Structured Patient Interview Sheet:

After examining relevant literature, the researchers created this basic Arabic-language tool to assess the demographic characteristics of the study participants. It contained the following:

- Demographic data, such as age, gender, profession, and level of education.

Tool II: Knowledge Assessment Sheet

This section included questions designed by researchers to gauge patients' understanding of knee arthroplasty care and treatment based on evaluations of the literature. This section was used to gauge the patient's understanding of potential causes, symptoms, and signs of osteoarthritis; total knee replacement; types of knee exercises; practicing these exercises; frequency; duration; reasons for not practicing these exercises; warning signs; complications reported to the physician; and, if available, the source of information.

The patient's knowledge was scored using the following system: each right response received one grade, while no answer or an incorrect answer received zero. The total score for the patient's knowledge was calculated by adding the scores for each set of questions. The overall level of knowledge was divided into three categories: fair for scores between 50% and 75%, poor for scores less than or equal to 50%, and good for scores greater than or equal to 75%.

Validity and dependability: With r = 0,81 the knowledge assessment questionnaire showed good Cronbach's alpha reliability.

Tool III: Knee Osteoarthritis Western Ontario and McMaster Arthritis Index (WOMAC)

In 1982, Western Ontario and McMaster Universities established the WOMAC Index (WOMAC Osteoarthritis Index, 2013) The scale is frequently used to assess osteoarthritis in the knee. The self-administered survey consists of three subscales: Five different areas of pain: standing straight up, walking, using stairs, sleeping, and sitting. Two instances of stiffness: right after waking up and later in the day. Physical Function (17 items): using the stairs, getting up and down from a seat, standing, bending over, walking, shopping, putting on and taking off socks, getting up and down from bed, taking a bath, sitting, using the toilet, heavy and light household chores.

On a scale of 0–4, the test questions are rated as follows: None (0), Mild (1), Moderate (2), Severe (3), and Extreme (4). Each subscale on the questionnaire is summed, or a global score is calculated. Only the physical function subscale was used in this investigation. The physical function subscale scores are totaled, and the possible score range is 0-68. A total WOMAC score is often obtained by adding the scores from the physical function subscales. Higher WOMAC ratings suggest lower degrees of symptoms or impairment and poorer functional limits (Gorial et al.,2018)

Method of data collection

I. Administrative stage

The researcher acquired official authorization to perform the study from the dean of the nursing faculty, and the directors of the Trauma & Orthopedic department and the affiliated clinic at Assiut University Hospital

also received formal consent in the form of a letter. The letter authorized the study's conduct and made its purpose and design clear. Each patient gave their voluntary consent to participate, and the nature and goals of the study were explained.

II. **Development of the study tools** The nursing rehabilitation protocol and tools (I and II) were designed in Arabic based on established needs, baseline measurements, and pertinent literature. For patients with learning disabilities, it was enhanced with straightforward language and precise illustrations to assist them remember the information.

Validity testing: To assess the validity of the content, five professionals from the Faculty of Nursing's medical, surgical, and Gerontological nursing sectors were shown data gathering techniques. The experts' assessments of the elements' order, content appropriateness, and sentence clarity were taken into consideration when making the revisions.

– **The reliability of the tools** was put to the test using Cronbach's alpha. All three tools have reliability coefficients of.871,.989, and 0.94, indicating their reliability.

III. Pilot study

Prior to the start of data collection, six patients, or 10% of the total, who were included in the study took part in the pilot trial. The pilot study's objectives are to assess the tool's clarity and estimate completion time. In accordance with the results of the pilot study, the necessary modifications were made to the sheets

IV. Ethical Consideration

The "Research Ethics Committee" of the Assiut University Faculty of Nursing approved the study. As per the Declaration of Helsinki Ethical Guidelines for Medical Research by the World Medical Association. Every patient gave their informed consent to take part in the research. There was no patient risk associated with the research procedures. The ability to withdraw at any moment belongs to the participants. The subjects' identities and confidentiality were guaranteed. Data collecting took study subject privacy into consideration. The study complied with recommendations for clinical research ethics. It was completely up to the participants to withdraw from the study at any time for any reason or to deny participation.

V. Data collection stage

Eight months passed between the start of June 2023 and the beginning of January 2024 during the data gathering period. Every two days of the week, patients were observed. The data was gathered using the three steps that were mentioned below

A. Preparatory phase: The approved individuals have given their formal written consent for this study to be carried out. The researchers introduced themselves to the patients, went over the purpose of the study, and got their informed consent.

B. Planning phase: This stage involved planning the program's duration and timetable as well as scheduling the instructional sessions. The classroom and instructional techniques were among the other facilities that were inspected and organized.

- **Teaching time**: In order to find the best time for the participants, the medical staff and researchers worked together to assess their needs.
- **Instructional strategies and resources**: Basic teaching techniques were prepared, including as lecture, demonstration, remonstration, group discussion ect.
- **Teaching Materials or Media as**: PowerPoint presentations, mobile movies, and booklet handouts, and The media consisted of pictures, pamphlets, posters, and films.

C. Implementation phase

- After explaining the goal of the study to each patient, the researchers met with each patient one-on-one to establish therapeutic communication and gain their consent for voluntary participation in the study.
- On the first interview day preoperatively, before the initiation of the physical exercise rehabilitation protocol, all patients (control group and study group) underwent assessments using tools I and II to collect baseline data, medical information, arthroplasty-related knowledge, and tool III to evaluate lower knee function.

The exercises rehabilitation program

- The researcher created an exercise rehabilitation program to provide patients with knowledge and exercises to improve knee function after surgery after analyzing relevant literature.
- The study group that underwent the physical exercise rehabilitation regimen was divided into two educational and one practical session, and the researchers collected data from this group. Each session lasted between twenty-five and thirty minutes. After filling out all the necessary forms, every session was completed before surgery and used throughout the postoperative follow-up appointments.
- Data collecting sessions were conducted at Assiut University Hospital's trauma unit. In order to improve adherence and serve as a reminder throughout the protocol, researchers additionally maintained in touch with the patients under study via a smartphone.
- **During the first (educational) session**, the researcher gave the patient a brief explanation of the anatomy of the knee, the description and origin of osteoarthritis, as well as its signs, symptoms, stages, complications, and management.
- **During the second (educational) session,** which was educational in nature, the patient was given a basic explanation by the researcher about the significance of arthroplasty, post-surgery instructions, follow-up instructions, and rehabilitation exercises. For the purpose of supporting the patients and enhancing their sense of responsibility, one family member attended the session. In the event of a mistake, patients might voice their questions while listening and showing attention.

-The third (practical) session: covered instruction in fundamental rehabilitation activities. According to what the researchers showed the patient, the nursing rehabilitation protocol is meant to help patients over the course of the following few months with a few basic exercises that will help them gradually reduce pain and swelling, improve range of motion, and restore muscle strength, protect healing tissue, and enable them to perform daily activities on their own. It was advised that the patient's caregiver assist them in implementing these exercises at home following surgery. The nursing rehabilitation exercises are ***classified into four phases:***

Phase 1: Phase (Day 0- Hospital Discharge)

- Start restoring range of motion (ROM) by extending the knee less than or equal to 0 degrees and flexing it at least 90 degrees. Heel slides, active assisted knee flexion/extension while seated, passive knee flexion/extension, and ankle pumps.

Strength: Quad sets, glut sets, hamstring sets, and straight leg raises (SLR) with a focus on hip abduction/adduction, hip flexion while seated, and hip abduction/adduction with no lag.

Knee extension: Never submerge an operated knee with anything.

Complete each exercise for ten repetitions three to five times a day. After working out, use ice for ten to twenty minutes.

Phase 2: (Hospital Discharge-6 Weeks)

Maintain ROM progress, aiming for 0–110 degrees. Range of Motion and Quadriceps Keep doing all the phase 1 ROM exercises: To encourage complete extension, try the following: prone knee flexion, heel slide with towel, heel prop (towel under ankle), and/or prone knee hang. Start stationary cycling by going from a back-and-forth motion to a full Joint Extensions and Extension Techniques

As directed, begin mobilizations of the tibio-femoral and patellofemoral joints. Stretch hamstrings, quadriceps, and gastroc/soleus.

Strengthening: Use neuromuscular electrical stimulation (NMES) to strengthen the quadriceps if they are weak. Also, perform glut and hamstring sets.

- Do all the ROM, strengthening, and conditioning exercises three times a day for ten to twenty repetitions. Hold each stretch for 30 seconds, then do two to three repetitions of it. If can, ride a bike for five to ten minutes every day.

Phase 3: (6-12 Weeks)

Range of Motion and Flexibility: Keep up the riding and ROM exercises from phases 1 and 2, adding mild to moderate resistance as tolerated.

- Joint Mobilizations: As directed, carry out phase 2 activities.

Strengthening: Proceed with phase 2 exercises, varying the resistance as tolerable, and incorporate resistance equipment such as the leg press, hamstring curl, and 4-way as needed.

Hip machine: Single-leg stance, static balancing on a foam, Bosu, wobble board, etc.; add light agility drills (e.g., walking, karaoke, side stepping, tandem walking, and so on).

Endurance: A regimen of biking. Once normal range of motion is reached, perform ROM and stretching exercises once a day. Stretches should be held for 30 seconds, then repeated two or three times.

- Engage in three to five strengthening activities each week. Perform 15-20 reps in 2-3 sets.
- Try to get in at least 10 minutes of ROM cycling each day.
- For endurance, progress to walking or biking for 20 to 30 minutes three times a week.

Phase 4: (12 Weeks and Beyond)

- Range of Motion and Flexibility: Keep up daily stretching and range of motion exercises. Also, keep up strengthening routine by gradually increasing the resistance and lowering the repetition count.
- Keep up with all the phase three workouts, escalating the effort as tolerated. Maintain your endurance and keep up your walking, bike, and elliptical machine routines.
- Engage in daily ROM and flexibility exercises.
- Perform 2-3 sets of 10-15 strengthening and proprioception exercises three to five times a week.
- Repeats and a 30- to 45-minute endurance program three times a week.

D Evaluation phase:

The evaluation phase is the final stage of the nursing rehabilitation procedure. In the orthopedic outpatient clinic at Main Assiut University Hospital, patients were assessed four times (post-surgery, two weeks later, one month later, and three months later) to reevaluate their level of limb function, their knowledge of total knee replacement, and their capacity to perform particular activities for both the control and study groups using tools II and III.

Additionally, a telephone follow-up was done with the study group to assess their condition and adherence abilities.

Statistical analysis

For categorical data, "number" and "percent" were utilized, whilst "mean" and "standard deviation" were used for continuous variables. The chi-square test is used to compare categorical variables, and the T test ANOVA are used to evaluate continuous variables. The two-tailed p 0.05 was used to establish statistical significance. We employed Pearson correlation to show how the variables related to one another. For all analyses, the IBM SPSS 26.0 software was utilized.

Result

Table (1): This table confirms that women make up the majority of patients in the study group (96.7%) and control group (80%), respectively. The age range of the study group was between 50 and 70 years old, while the control group had an age group that was 90% older. In terms of education, the majority of patients in both groups—73.3% and66.6%, respectively—have some degree of education. Regarding employment, the majority of patients in the study and control groups (66.7% and 60%) did not have a job. In terms of when knee osteoarthritis first developed, most patients in the research and control groups (96.7, %, 90 %) had the condition for more than ten years.

Table 2: Shows that after three months of program execution, the fair knowledge level had mproved from 63.3% post-surgery to 76.6% after one month. With p values of 0.001**, there was a very statistically significant difference in knowledge level post-surgery, after two weeks, and after one and a half months between the study and control groups.

Table 3: shows how the investigated patient's level of knee function increased over the course of the program stages. For instance, the patient's capacity to travel upstairs improved from 3.9+1.09 after surgery to 4.9+0.31 after one month. demonstrates that, with respect to knee function among patients following knee arthroplasty, there was a highly statistically significant difference between the study and control groups after two weeks or after one and a third of a month, with p values of (0.001**). Climb and descend stairs, stand from a chair, and kneel on the front of the knee.

Table 4: demonstrates that the study and control groups had a highly statistically significant difference. Following knee arthroplasty, patients' capacity to do certain tasks (jump and land on the affected leg and stop and start fast) was measured at 2 weeks and 1 month, with p values of (0.006**).

Table 5: demonstrates that the patients' age and the total score of knowledge about total knee replacement had a statistically significant difference and negative connection (r= -.390 P= 0.033). Furthermore, two weeks following the operation, there was a statistically significant positive association (r=0388) between the patients' occupation and their overall knowledge score about total knee replacement and their age.

Table 6: demonstrates that over the entire follow-up period, there was a statistically significant difference and a positive correlation between the patients' occupation and their level of limb function (r=.413 P= 0.023*).

Furthermore, throughout the whole follow-up period, there was a statistically significant difference and a positive connection between the patients' education level and their level of limb function (r=.421 P= 0.020*).

Table 7: demonstrates that after two weeks, there was a positive correlation and statistically significant differences between the patients' occupation and their knee ability to execute particular activities (r=.371 P= 0.044*). Furthermore, there was a statistically significant difference and positive association with the control group's patients' post-surgery education (r=-.425P= 0.019*).

Table (1): Baseline demographics of the study's group compared to the control groups among patients undergoing arthroplasty (No = 60)

Variables	Study group n=30		Control group n=30		Significance
Age	n	%	N	%	
25- > 40 years	0	0.0	1	3.3	0.206
40- 55 Years	0	0.0	2	3.7	
55-> 70	30	100	27	90	
Gender					
Male	1	3.3	6	20	0.051*
Female	29	96.7	24	80	
Occupation					
Work	7	23.3	12	40.0	
Not work	23	76.7	18	60	0.004 **
Education level					
Non educated	8	26.7	10	33.4	0.253
Educated	22	73.3	20	66.6	
Onset of knee osteoarthritis					
5 to less than 10 years.	1	3.3	3	7	0.204
More than 10 years	29	96.7	27	90	

* Statistically significant difference (p <05) ** highly statistically significant difference (p < 0.01).

Table (2) Comparison between the studied patients' knowledge level and Mean± SD about total knee replacement in pre, after and follow up phases (no = 60):

Knowledge Level	Immediate-surgery		After2 weeks		After 1 month		After 3 months		P 1	P 2	P 3	P 4	Pa ll
	Study	Control	Study	Control	Study	Control	Study	Control					
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)					
Good	9 (30.0)	0 (0.0)	1 (3.3)	0 (0.0)	5 (16.7)	0(0.0)	3 (10.0)	0 (0.0)	0.001**	0.001**	0.001**	0.001**	0.001**
Fair	19 (63.3)	0 (0.0)	12 (40.0	1(3.3)	23 (76.6)	1 (3.3)	27 (90.0	2 (6.7)					
Poor	2 (6.7)	30 (100.0	17 (56.7	29 (96.7)	2 (6.7)	29 (96.7)	0 (0.0)	28 (93.3					
Mean±SD	6.4±1.30	4.2±1.3	8.47±1.16	4.07±1.6	8.17±.87	3.77±1.59	8.9±1.41	3.77±1.17					

Cochrane test (**) highly statistical significant difference

(P1) between post-surgery and after2 weeks

(P2) between post-surgery and after1 month

(P3) between post-surgery and after3months

(P4) between after 2week and after 3 month

(pall) between post-surgery, after2 weeks, after1 month and after 3 months

Table (3): Level of knee function among patient undergoing knee arthroplasty during the program phases (immediate-surgery, post 2 weeks and follow up after 1 & 3 months (No = 60).

Limb function	Groups	Immediate-surgery	After 2 weeks	After 1month	After 3 months	P. value
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Walk	Study	3.93±1.44	4.67±0.67	4.97±0.18	4.97±0.18	**0.321**
	Control	3.6±1.3	4.8±0.41	5.0±0. 0	5.0±0. 0	
Go up stairs	Study	3.9±1.09	3.1±1.15	4.9±0.31	4.8±0.92	**0.001****
	Control	1.5±1.46	2.87±0.68	4.9±0.31	4.47±0.57	
Go downstairs	Study	3.27±1.66	3.17±1.12	4.9±0.31	4.8±0.92	**0.001****
	Control	1.5±1.456	4.4±1.22	4.9±0.25	4.67±0.48	
Stand	Study	3.0±1.58	4.8±0.61	4.97±0.18	4.97±0.18	**0.150**
	Control	3.57±1.4	4.9±0.25	5.0±0. 0	5.0±0. 0	
Kneel on the front of the knee	Study	3.5±1.22	3.37±1.401	4.9±0.25	4.97±0.18	**0.001****
	Control	2.2±1.71	3.77±0.63	4.9±0.25	4.87±0.35	
Squat	Study	3.13±1.57	3.23±1.07	4.9±0.25	4.97±0.18	**0.054**
	Control	2.37±1.45	3.6±0.67	4.9±0.25	4.9±0.31	
Site with the knee bent	Study	3.3±1.56	3.67±1.15	4.9±0.25	4.97±0.18	**0.059**
	Control	2.5±1.53	3.9±0.80	5.0±0. 0	5.0±0. 0	
Rise from a chair	Study	2.87±1.59	4.30±1.08	4.97±0.18	4.97±0.18	**0.005****
	Control	3.47±1.11	4.9±0.31	5.0±0. 0	5.0±0. 0	

Anova test (**) highly statistically significant difference

Table (4) Knee ability to perform specific activities among patient undergoing knee arthroplasty during the program phases (immediate-surgery, post 2 weeks and follow up after 1 & 3 months) (No = 60):

Limb specific activities	Groups	Immediate-post surgery	After 2 weeks	After 1month	After 3months	P. value
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Run straight Ahead	Study	3.77±1.33	4.37±0.72	4.70±0.46	4.97±0.18	**0.948**
	Control	3.77±0.89	3.97±0.72	4.87±0.35	5.0±0.0	
Jump and land on the involved leg	Study	0.23±0.97	0.80±1.27	1.73±1.62	3.13±1.67	**0.006****
	Control	0.20±0.61	0.03±0.18	0.0±0.0	2.17±1.34	
Stop and start quickly	Study	2.97±1.58	4.07±0.64	4.63±0.56	4.93±0.36	**0.006****
	Control	3.03±0.89	4.0±0.58	4.87±0.35	5.0±0.0	
Cut and pivot on your involved leg	Study	3.20±0.99	4.0±0.64	4.60±0.56	4.93±0.36	**0.064**
	Control	3.20±0.99	4.03±0.56	4.87±0.35	5.0±0.0	

Anova test (**) highly statistically significant difference

Table (5) Correlation between patient's total knowledge scores for patient undergoing arthroplasty and demographic characteristics through the program phases.

		Total knowledge scores about total knee replacement							
		Study group				Control group			
		Immediate – post surgery	After 2 wks.	After 1mth	After 3 MThs	Post-surgery	After 2 wks.	After 1mth	After 3 MThs
Age	Pearson Correlation	A	A	A	A	-.012-	**-.390-***	-.146-	-0.064-
	Sig. (2-tailed)	----	-------	------	------	0.949	**0.033**	0.440	0.738
Gender	Pearson Correlation	-.087-	0.076	0.036	0.125	-0.052-	0.129	-0.021-	-0.029-
	Sig. (2-tailed)	0.648	0.692	0.850	0.511	0.784	0.496	0.911	0.879
Occupation	Pearson Correlation	0.211	0-.187-	0.231	-0.137-	0.177	**0.388***	-.017-	0.229
	Sig. (2-tailed)	0.264	0.323	.220	.470	0.350	**0.034**	.928	0.222

Education	Pearson Correlation	0.096	-0.016-	0.096	-0.069-	0.046	0.205	-0.065-	0.146
	Sig. (2-tailed)	0.615	0.933	0.615	0.716	0.811	0.278	.731	0.441

(*.) Correlation is significant at the 0.05 level (2-tailed).

(A). cannot be computed because at least one of the variables is constant.

Table (6) Correlation between level limb function among patient undergoing knee arthroplasty and demographic characteristics in pre, after and follow up:

Demographic characteristics		**Level Limb function among patient undergoing knee arthroplasty**							
		Study group				**Control group**			
		Immediate post-surgery	**After 2wks**	**After 1mth**	**After 3 mths**	**Post-surgery**	**After 2 wks**	**After 1mth**	**After 3 mths**
Age	Pearson Correlation	A	A	A	A	.277	-.088-	-.033-	.136
	Sig. (2-tailed)	----	-------	------	------	.139	.645	.862	.473
Gender	Pearson Correlation	0.148	-0.248-	-0.138-	-.087-	.075	.154	-.230-	.036
	Sig. (2-tailed)	.436	.186	.466	.648	.693	.416	.222	.849
Occupation	Pearson Correlation	-.183-	**.413***	.059	**.396***	.178	.015	-.051-	**.386***
	Sig. (2-tailed)	.334	0**.023**	0.756	**.030**	.347	.939	.788	**.035**
Education	Pearson Correlation	-.151-	0**.421***	-.044-	.265	-.004-	.180	0-.119-	-.009-
	Sig. (2-tailed)	.425	0**.020**	.817	.156	.984	0.342	0.532	0.962

(*.) Correlation is significant at the 0.05 level (2-tailed).

(A). cannot be computed because at least one of the variables is constant.

Table (7) Correlation between knee ability to perform specific activities among patient undergoing knee arthroplasty and demographic characteristics in different program application.

demographic characteristic		knee ability to perform specific activities among patient undergoing knee arthroplasty							
		Study group				Control group			
		Immediate Post-surgery	After 2wks	After 1mth	After 3mths	Immediate Post-surgery	After 2 wks.	After 1mth	After 3 MThs
Age	Pearson Correlation	A	A	A	A	.102	-.236-	**.383***	0.336
	Sig. (2-tailed)	----	-------	------	------	.591	.209	**.037**	0.070
Gender	Pearson Correlation	.168	.206	-.131-	-.003-	-.291-	-.158-	.102	0.063
	Sig. (2-tailed)	.375	.274	.489	.986	.119	.404	0.591	0.740
Occupation	Pearson Correlation	-.166-	**.371***	.126	.270	.164	-.175-	0.131	0.028
	Sig. (2-tailed)	.382	**.044**	.506	.150	.387	.354	0.489	0.881
Education	Pearson Correlation	-.172-	.383*	.143	-.058-	**-.425-***	-.106-	0.271	0.152
	Sig. (2-tailed)	.364	.036	.450	.761	**.019**	.575	0.147	0.422

(*.) Correlation is significant at the 0.05 level (2-tailed).

(A). cannot be computed because at least one of the variables is constant.

Discussion

For individuals who do not react to non-surgical therapy, total knee arthroplasty (TKA) is a safe and affordable option for reducing pain and restoring physical function. TKA entails removing the knee joint affected by OA and replacing it with a prosthetic device. Extended rehabilitation is often required after the procedure **Aytekin et al. (2019) [13].** According to data research, patients should learn knee nursing skills, prevent chronic knee injuries, strengthen knee management, exercise, and protect their joints appropriately **(Zheng et al., 2022).**

In terms of age, the bulk of the control group and the entire research group were between 50 and 70 years old. This is comparable to the findings of **Jamali et al. (2020).** who discovered that between 60 and 90% of adults 65 years of age and older have osteoarthritis; roughly 10% of males and 18% of women over 60 have the condition in their knees. The musculoskeletal system's aging changes make people more susceptible to osteoarthritis.

The current investigation concurs with **Ibrahim & Taha (2021**) findings. When the authors of the study examined the impact of an educational program on nurses' knowledge, practices, and patients' outcomes following total knee arthroplasty, they discovered that the majority of the study group and over half of the control group were between the ages of 51 and 60. This finding links aging to alterations in joint tissues. Furthermore, this outcome is consistent with a study by **Kwoh et al. (2015)** titled "Determinants of patient preferences for total knee replacement," which found that the average age of the patients was 58.68±8.13. Moreover, this result is consistent with that of **Fawzy et al. (2020)** in their study "Bio psychosocial needs of patients undergoing total knee replacement," they found that, with a mean age of 59.7±6.86 and a range of 41–72 years, slightly more than half of the patients were over 60.

According to the gender, most of the patients in this study were female; this finding is consistent with **Ebru et al. (2019)** that found arthritis to be the fourth (29.5%) most common condition in older females. This may be brought on by the osteoporotic changes that occur in women after menopause. Additionally, **Chen et al. (2019**) who examined the impact of a home exercise program on senior patients suffering from osteoarthritis in their knees, noted that most of the participants were female. Additionally, **Rittharomya et al. (2020)** discovered that women made up the majority of both groups.

In terms of occupation, the current study finds that over half of the patients were unemployed. This finding is consistent with that of **Fawzy et al. (2020)**, who discovered that 25% of the patients were retired. This outcome pertains to the legal retirement age in Egypt, which is sixty years old, not older.

In terms of education level, the current study's findings showed that the majority of both groups had a high school diploma, which is supported by **Chen et al. (2019)** findings that the majority of the sample under study had a high school diploma.

The results of the current study show a statistically significant difference (p-value >0.051* and 0.004 ** respectively) in the demographic features of gender and occupation between the two groups. It contradicts the findings of **Rittharomya et al. (2020),** who claimed that at baseline, there were no appreciable variations in the characteristics of the participants or the outcome variables.

Regarding the duration of knee osteoarthritis, the study's findings indicate that the majority of patients had the condition for longer than ten years; these findings are consistent with those of **Taha & Ibrahim (2021).** They discovered that knee problems dating back more than ten years were reported by two-fifths of the study and control groups. This result may be explained by patients' desire to stop experiencing pain. They decide against doing extensive surgery. As a result, they decide to keep taking precautionary steps to postpone or prevent TKR. According to **Singh & Lewallenin (2014)** study, "Time trends in the characteristics of patients undergoing primary total knee arthroplasty," about half of the patients had knee disease for more than ten years. These findings corroborated their findings.

Many elderly persons with KOA adopt improper drugs or exercise regimens due to a lack of health-related understanding, which ultimately causes their pain to worsen. For this reason, it's critical to give senior KOA patients appropriate health education and exercise advice. For the following reason, patients with KOA may have experienced a reduction in knee pain with HBEI (home-based exercise intervention) (**Chen et al., 2019).**

Regarding knowledge, our study showed that once the program was implemented, the patients in the study group had a much higher overall knowledge level. Additionally, our research reveals a highly statistically significant difference in total knowledge scores and post-operative instructions between the study and control groups, with a P-value of (P.0001**). This suggests that the physical exercise rehabilitation program has a positive impact on patients' knowledge for orthostatic patients undergoing knee arthroplasty. The effects of a patient-specific integrated education program on pain, perioperative anxiety, and functional recovery after total knee replacement were examined by **Cheng-Jung Ho et al. (2022)**, which supported this. They discovered that postoperative care navigation, in-hospital group education classes, patient-specific preoperative education, and rehabilitation are useful in lowering perioperative anxiety, promoting functional recovery after total knee arthroplasty, and minimizing postoperative discomfort.

Additionally, **Chen et al. (2019) [18]** noted that patients should be able to take appropriate action to ease their knee discomfort, which would ultimately improve their symptoms, thanks to the knowledge about correct knee care offered by the health-education program. By the study's twelfth week, they discovered substantial group differences in terms of functional and symptom outcomes, with the intervention group showing noticeably better improvement than the control group across the board.

limb function: Our research reveals that during the program phases (post-surgery, follow-up after 1 & 3 months, and post-surgery) there were statistically significant differences between the study and control regarding limb function of patients undergoing knee arthroplasty, particularly for (go upstairs, go downstairs, kneel on the front of the knee, & rise from a chair) with P-value (0.001,0.001, 0.001,0.005), respectively. which might be included in a preoperative rehabilitation training program can effectively improve patients' capacity to get out of bed, increase their ability to recover from surgery using independent activity, lessen their postoperative discomfort, and boost their clinical performance. This shows that orthostatic patients having knee arthroplasty benefit from a physical exercise rehabilitation program in terms of their ability to use their limbs. This finding is consistent with **Taha & Ibrahim's (2021)** explanation of a statistically significant difference between the study and control groups, with better outcomes for study group patients than for control group patients in terms of lower extremity function scores at two weeks and one month following surgery. This conclusion was consistent with the findings of **Reslan et al. (2018)**, who found that at post (2 weeks) and follow-up (4 weeks), the intervention group in their study had higher knee scores than the control group with highly statistically significant differences between both groups.

Regarding the knee's capacity to carry out particular tasks in patients receiving knee arthroplasty during the post-surgery, post-2-week, and follow-up after 1 & 3 months' program stages. Our findings demonstrate that, with a p-value of (0.006)**, there are highly statistically significant differences between the study and control groups in (Jump and land on the affected limb & Stop and start rapidly). From the researcher point view, this might be because the rehabilitation program's precise and quantitative content can improve bedside communication, actively assist patients in beginning early active training, and motivate patients to finish the rehabilitation exercise content every day. This will help patients transition from passive treatment to active participation in treatment, which will effectively improve self-management skills and rehabilitation training compliance.

This finding is consistent with **Zheng et al. (2022)** who stated that following two weeks of preoperative training, the intervention group's quadriceps muscular strength (on the surgical side) considerably increased as compared to baseline; additionally, the intervention group had significantly higher values at baseline and at one and three months postoperatively.

Additionally**, Chen et al. (2019)** found that at week 12, the intervention group considerably outperformed the control group in terms of muscle strength, balance, and mobility. The WOMAC index was utilized in this study to assess how well home exercise helped individuals with KOA symptoms. According to the findings, compared to patients who simply got health education, patients who received the exercise intervention also

experienced much reduced pain and stiffness in their joints.

Furthermore, the results of our study are consistent with those of **Rittharomya et al. (2020)**, who discovered that the experimental group's mean ratings for movement ability, health-related quality, and quadriceps muscular strength—both left and right—were significantly greater than those of the control group. Additionally, it was shown by **Hashizaki et al. (2023)** that following two weeks of preoperative training, the intervention group's quadriceps muscle strength (on the surgical side) considerably increased in comparison to baseline.

According to numerous studies, patients who have had total knee arthroplasty struggle to return to their previous level of function. According to **Bade et al. (2010),** study group members significantly outperformed the control group in terms of daily living activities and sports activity scale scores. Before they were discharged, two weeks, one month, and three months following surgery, the patients in this study were assessed. This aligns with the findings of **Zheng et al. (2022).** Who discovered that the knee function was 87.40 ± 2.43 one month following surgery. Before the procedure and one day, three days, and one month later, the experimental group's and the observation group's knee function had greatly improved. Additionally, **Van Leeuwen et al. (2019)** revealed that the WOMAC score ($p < 0.05$), chair stand, stair climb, and 6MWT all showed significant main effects of time.

Preoperative rehabilitation is an exercise-focused regimen prior to surgery that enhances patients' function, maximizes their physiological reserves, and prepares them to tolerate surgical stress in order to expedite the return of patients' postoperative functional status to preoperative and daily life **Molenaar et al. (2019).** Rehabilitation exercise programs are remarkably beneficial for improving mobility, strength, propriocepsis, balance, range of motion, and performance in sports, work, and ADLs. **Davis et al. (2019)**. The TKA participants reported that preoperative function was improved by rehabilitation as opposed to standard treatment (SMD -0.48 (95% CI -0.97 to 0.02); $p = 0.06$). Six trials involving 250 participants in THA revealed that rehabilitation had a nonsignificant effect (SMD -0.18 (95% CI -0.43 to 0.07); $p = 0.16$). There was no discernible improvement in function following surgery. Rehabilitation may help function following total knee arthroplasty (TKI); nevertheless, three trials with 110 people found no significant difference in the benefit (SMD -0.69 (95% CI -01.89 to 0.49); $p = 0.25$) **De klerk, et al. (2023).**

The current study's findings were also corroborated by **Hashizaki et al. (2023),** who created a non-randomized controlled trial to assess how well a three-week preoperative rehabilitation program improved patients' physical function before total knee arthroplasty surgery. Three months following surgery, we discovered that preoperative exercise training led to a considerably longer 6-min walking distance in comparison to the control group. When compared to

the control group, the injured leg's knee extension strength rose significantly in the intervention group. Three months after surgery, both groups' pain levels were decreased, and exercise therapy administered one month before to surgery had no bearing on the alleviation of postoperative pain.

From a perspective point of view, pre-operative patient education has been identified as an essential component of the clinical pathways for knee replacement. The experiences of patients following knee arthroplasty were improved by the use of straightforward patient education pamphlets and instructional videos. The benefits of post-discharge physical therapy activities for improving muscle strength, function, range of motion, and mobility following total knee replacement

According to the study's findings, which were in line with earlier research, the PERP was significantly more effective than the control group on all end variables (education, limp function, and particular knee function) **Jonsson et al., (2019).**

Conclusions

Based on the findings of the most recent investigation, the researchers came to the conclusion that following the implementation of a physical exercise rehabilitation program, there was a statistically significant difference in the knowledge level between the study group's arthroplasty patients and the control group. Additionally, during the program's phases, there were statistically significant differences in the study group's knee function level and ability to perform specific activities.

The exercise regimen is realistic, seems to benefit patients with advanced osteoarthritis in the knee, and helps patients regain basic functional abilities early in the healing process**.**

Recommendations

Based on the study results, it is recommended to:

- Giving a handout copies of physical exercises rehabilitation program for all patients diagnosed with end stage osteoarthritis undergoing arthroplasty to prevent complications and achieve better outcome.
- Replication of the current study on a larger probability sample is recommended to attain generalizability and wider utilization of the nursing teaching protocol.
- Applying physical exercise program as mandatory clinical pathway for patient undergoing arthroplasty.

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