How to Cite:

Elhaweet, E. A. I., Almakarem, A. S. A., Khalil, A. S. A., & Ahmed, H. A. H. (2021). The effect of prehabilitation program regarding compression therapy on post-surgical swelling and pain among patients with total knee arthroplasty. *International Journal of Health Sciences*, *6*(S8), 2936–2956. https://doi.org/10.53730/ijhs.v6nS8.12630

The effect of prehabilitation program regarding compression therapy on post-surgical swelling and pain among patients with total knee arthroplasty

Eman Ahmed Ibrahim Elhaweet
Lecturer of Medical-Surgical Nursing Department, Faculty of Nursing, Ain Shams University, Egypt

Amal S. Abu Almakarem
Department of Basic Medical Sciences, Faculty of Applied Medical Sciences, Al Baha University, Saudi Arabia

Asmaa Said Ali Khalil
Assistant Professor of Medical-Surgical Nursing Department, Faculty of Nursing, Ain Shams University, Egypt

Hoda Ahmed Hussein Ahmed
Assistant Professor of Medical Surgical Nursing, Modern University for Technology and Information, Egypt

Background: Total knee replacement is a medical procedure that comprises amputating the damaged knee and implanting a prosthetic. Postoperative knee swelling and discomfort are common after complete knee replacement surgery. In order to reduce postoperative knee discomfort and swelling in patients who have had total knee arthroplasty, compression treatment is frequently used as part of the rehabilitation process. **Aim of the study**: To evaluate the effect of prehabilitation program regarding compression therapy on post-surgical swelling and pain among patients with total knee arthroplasty. **Research design**: a quasi-experimental research design was used to achieve the aim of the study. **Setting**: This study was carried out in Orthopedic Surgery wards and Orthopedic Outpatients' Clinics at Ain Shams University Hospitals, Cairo governorate, Egypt. **Subjects**: a purposive sample of 100 adult patients who divided into two groups (50 each one), the first was the control group and the second was the study group (compression therapy group). **Data collection tools**: Four tools were utilized; **Tool (I):** Patient Interviewing Questionnaire **Tool (II):** Swelling measuring scale, **Tool (III):** Visual Analogue Scale (VAS) for pain **Tool IV:** Range of motion observational checklist. **Results**: The current study revealed that there was a significant improvement in patient`s knowledge, and there was a statistically significant difference regarding improvement of post-surgical swelling, pain, and range of motion in the compression therapy group when compared with the control group. **Conclusion**: A prehabilitation program regarding compression therapy has a positive effect on patients` knowledge, reducing post-surgical swelling and pain among adult patients with total knee arthroplasty and enhancing the practice of range of motion **Recommendation**: Based on the results of the current study we recommended that, periodic training program conducted to increased patients` knowledge regarding compression therapy.

***Keywords*---**compression therapy, pain, rehabilitation program, swelling, total knee arthroplasty.

Introduction

Inflammation of the synovial joint causes pain, edema, limited joint mobility, and stiffness in patients with osteoarthritis of the knee. Among those over 65, osteoarthritis is a prevalent chronic illness. Several practical physical therapy interventions have been proposed by prior research. These include home exercises, physical agent treatment, braces and orthoses, aerobic walking, strengthening and balancing training, manual therapy, and weight reduction programs. People with end-stage knee osteoarthritis continue to consider having a total knee arthroplasty (TKA) to improve their quality of life and physical function, even though these physical treatment techniques have shown to be successful **(Miozzari et al., 2021).**

Hemarthrosis, edema, and lymphoedema might affect the patient after surgery and need longer rehabilitation times, while significant problems are uncommon. According to **Brock et al. (2017),** there are a number of strategies that may be used to lessen post-operative edema, including immobilization, cold treatment, compression therapy, and elevating the afflicted leg. Of the major frequent post-operative complications that most patients describe following total knee arthroplasty (TKA), swelling is prevalent (90.7%) **(Szots et al., 2015).**

Swelling can cause pain, stiffness, and difficulty moving the knee joint, making rehabilitation more challenging and time-consuming. Intraarticular bleeding and periarticular tissue inflammation are the causes of swelling. Obesity is defined as a body mass index (BMI) of 30 kg/m2, and the percentage of obese TKA patients is rising. 39.8% of TKA patients in Denmark were obese in 2016 **(Linda et al., 2021).** Obese individuals with a BMI of 30 kg/m2 are particularly at risk for post-surgical complications after total knee arthroplasty (TKA). The higher complication risk among obese individuals has socioeconomic implications since it increases the likelihood of readmissions and unforeseen outpatient visits **(Zusmanovich**, **et al., 2018).**

Hayes and colleagues (2020) found that ninety days after surgery, 25.2% of ER visits were related to edema in the operated leg, and 10% of these visits resulted in readmission **(Rossman et al., 2016).** In 2016, 8.2% of patients in Denmark were readmitted within 30 days following their first knee replacement surgery. Numerous studies have demonstrated that obesity raises the risk of readmission following total knee arthroplasty (TKI), despite the fact that the readmission rate for obese Danish TKA patients remains unclear.

Post-surgical edema following TKA could be more successfully addressed by using Treatments for lessening and avoiding edema include cold compression, cryotherapy, elastic bandaging, compression bandages, and compression treatment. In addition, the Centre for Planned Orthopaedics at Naestved Hospital suggests mobility, elevation of the leg over the heart, knee motions, foot pumps, and rest. While it is feasible to lessen knee swelling following total knee arthroplasty (TKA), further research is required to determine viable treatments. A compression stocking is a useful intervention to reduce edema because it applies regulated pressure to the leg, encouraging blood to move up toward the heart (**Brock et al., 2017).**

It is still unclear if compression treatment works for TKA patients. TKA is a surgical procedure where a prosthesis is implanted in place of the injured knee. It has been suggested as an efficient treatment for lowering pain and recovering physical function in patients with end-stage knee osteoarthritis after advancements in surgical and artificial prosthesis design over the past few decades **(Kim et al., 2020)**. By 2030, 3.48 million main TKA procedures—a rise of 673%—are expected to be performed in the US **(Kurtz et al., 2017)**. Over 75,000 main TKA procedures are performed annually in Korea (Statistics Korea). stocking is a practical intervention to reduce swelling.

Despite research showing significant outcomes in terms of pain, functional recovery, and quality of life following a successful total knee arthroplasty (TKA), patients still experience

persistent limitations in physical function, muscular strength, and balance until the first year after surgery **(Jiang et al., 2017).** Previous studies have demonstrated that a variety of physical therapy techniques can assist patients having total knee arthroplasty (TKA) in achieving favorable physical and functional results **(Berghmans et al., 2018).** Most physical therapy methods for TKA rehabilitation focus on the early postoperative period, even though prior physical function and muscle strength may affect postoperative outcomes **(Devasenapathy et al., 2019).**

Knee replacement surgery can improve a patient's quality of life and lessen suffering for people with severe knee arthritis. One of the most common orthopedic operations is total knee arthroplasty (TKA), often known as complete knee replacement. The highest success rate is seen with this orthopedic treatment. According to medical literature, the operation has a great track record, with favorable long-term outcomes and minimal rates of complications. However, postoperative knee swelling is a common consequence due to periarticular tissue inflammation and intraarticular bleeding. Pain-induced atherogenic reflex inhibition and quadriceps weakness result in suboptimal functional performance, which can decrease patient-reported outcomes, prolong hospital stays, and postpone rehabilitation. Additionally, substantial knee swelling is associated with higher chances of wound dehiscence and infection; pay particular attention to the immediate aftermath **(Li et al., 2020).**

This occurrence might have three possible causes. First, elevating a leg increases the amount of blood from the lower limb vasculature that enters the intrathoracic veins, increasing the preload on the heart. Moreover, there is a correlation between straight leg raising and an increase in systemic vascular resistance. Additionally, when the leg is raised during deflation, the gravitational effect will significantly reduce the blood transfer to the ischemic limb **(Kort et al., 2020).**

Following total knee arthroplasty (TKA), knee swelling reduces knee-extension strength and functional performance, which makes postoperative mobilization and training difficult. Following total knee arthroplasty (TKA), inflammation of the periarticular tissues and intraarticular hemorrhage are the main causes of knee swelling. It was shown that minimizing intraarticular postoperative bleeding, a high-compression bandage from the toes to the middle of the thigh can maintain compression for at least 48 hours. This tight compression bandage does not restrict the patient's range of motion, even if the dressing's non-elastic properties may make knee flexion uncomfortable **(Vasta et al., 2020).**

Compression bandage treatment is well-established for treating lymphedema and venous ulcers. By enhancing the efficacy of the calf muscle pump and permitting blood to move from the superficial to the deep venous systems, this external compression encourages venous return and reduces the hydrostatic pressure within the leg. Because they provide a low, pleasant resting pressure and, when walked on, activate the deep venous system and calf muscle pump more efficiently than their elastic counterparts, inelastic bandages are recommended in arthroplasty procedures **(Bjork & Ehmann, 2019).**

Prehabilitation, also known as preoperative rehabilitation, has been successfully applied to patients with cancer, cardiopulmonary disorders, and musculoskeletal disorders. It comprises behavioral or medical support interventions such as physical therapy, exercise, and lifestyle modifications that are completed prior to surgery. Preoperative rehabilitation programs have been demonstrated to improve range of motion (ROM), muscle strength, and health-related quality of life for patients undergoing total knee arthroplasty (TKA). However, the efficacy of preoperative interventions varies depending on intervention protocols, including program content, frequency, intensity, and duration. As such, the effectiveness of preoperative interventions remains controversial. Additionally, it has been demonstrated that patients who

are candidates for TKA benefit from a rehabilitation program in terms of early-phase results following TKA **(Sharma et al., 2019).**

In order to preserve and improve the quality of life and post-operative care for patients having total knee arthroplasty, staff nurses are essential. These therapies might include positioning limbs, techniques for decreasing edema, help using wheelchairs and canes, instructing patients on the use of elastic bandages, and postoperative range-of-motion exercises for patients **(Miozzari et al., 2021).**

Significance of the study

Osteoarthritis is the most common disease of musculoskeletal disorders in which 595 million people living with arthritis worldwide. 80% of adults older than 55 have osteoarthritis, 23% of females being affected and 18% of males. 47% of females are affected with knee joint and 40% of males than hand and hip joint (25% only). In Egypt, 340.162 newly cases annually have osteoarthritis **(Shamekh et al.,. 2022).** Total knee arthroplasty increases postoperative problems, as determined by knee function and the development of edema and discomfort **(Lei et al., 2020).** Following surgery, all researches looked at changing positions alone or applying compression without following established protocols for care; this resulted in a sluggish recovery and improvement of knee range of motion **(Cabral et al., 2019).** Thus, the purpose of the study was to find out how a compression therapy-based rehabilitation program affected the patients' post-operative pain and edema after total knee replacement.

The aim of the study

This study aimed to evaluate the effect of prehabilitation program regarding compression therapy on post-surgical swelling and pain among patients with total knee arthroplasty through the following:

1. Assess patients` level of knowledge regarding total knee arthroplasty surgery and compression therapy
2. Assessing swelling grade for patients with total knee arthroplasty surgery
3. Assessing pain severity for patients with total knee arthroplasty surgery
4. Assessing range of motion practice for patients with total knee arthroplasty surgery
5. Designing and implementing the prehabilitation program based on patients` needs
6. Evaluate the effect of prehabilitation program regarding compression therapy on post-surgical swelling, pain and range of motion after total knee arthroplasty surgery

Study hypotheses

The present study hypothesized that:

H1: There will be a positive improvement of the patients` knowledge regarding total knee arthroplasty surgery and compression therapy for study group than control group after implementation of the program

H2: There will be a positive improvement of the post-surgical swelling for study group than control group after implementation of the program

H3: There will be a positive improvement in severity of post-surgical pain for study group than control group after implementation of the program

H4: There will be a positive improvement in patients` range of motion practice for study group than control group after implementation of the program.

Research design:

The quasi-experimental research design was utilized to fulfill the aim of the study.

Subjects and Methods Setting
This study was carried out in orthopedic surgery wards at Eldemerdash surgical hospital and orthopedic outpatient clinics at Ain Shams University Medicine Hospital which affiliated Ain Shams University Hospitals, Cairo- Egypt. This setting was selected due to the high prevalence of patients. The orthopedic ward in the ground floor consisted of two wards orthopedic ward (2) for females patients and orthopedic ward (3) for males patients and the Knee outpatient clinic in the ground floor also, and consisted of three out patients clinics each of them containing Four Patient examination room.

Subjects
A purposeful sample of one hundred adult patients was used, and they were split into two equal and randomly assigned groups of fifty each: the research group (compression treatment group) and the control group.

Sample size calculation
The level of significance for power analysis, 0.95(=1-0.95=0.5), at alpha, was used to calculate the sample size. 0.05 (one-sided) was chosen as the significance level, and 0.001 was chosen as the level of extreme significance.

Inclusion criteria:
- Patients from both genders
- Patients who consent to participate in the study
- Patients undergoing their first operation on one or both legs
- On the same operation day

Exclusion criteria included
- Patients are suffering from critical illness
- The patients unable to be cooperating and use the compression therapy were excluded from the study sample.

Tools of the study
Four tools were used to collect the data for the study as the following:

Tool I: Patient's Interview Questionnaire
This tool was developed by the researchers after reviewing the recent and related literature and research studies **(Weißenberger**,**et al., 2020; Jenny, and Baldairon (2021) & Guo et al. (2021);** to assess patients` knowledge regarding osteoarthritis, total knee arthroplasty surgery and compression therapy. It included four parts:

Part (1): It was concerned with demographic characteristics of the patients udder study:
It included age, gender, marital status, educational level, occupation, residence.

Part (2): It was concerned with patients' medical data: It included types of co-morbidity, family history osteoarthritis, obesity, previous history of joint injury, and the affected limb

Part (3): It was included patients` knowledge regarding osteoarthritis and total knee arthroplasty surgery as (definition, indications, contraindications, risks and complications, pre and post-surgery teaching)

Part (4): It was included patients` knowledge related to compression therapy as (definition, types, benefits, indications, contraindications, and precautions)

Tool (II):- Swelling Measuring Scale
This scale was adopted from **Brodovicz et al. (2009),** it was used to assess the grade of post-surgical swelling for patient with total knee arthroplasty surgery. The grading of edema (swelling) was determined by pit depth (measured visually) and recovery time from grade 0-4.

The scoring system:
This scale was used to rate the severity and the scores were as follows: **Grade 0:** No clinical edema. **Grade 1:** Slight pitting (≤2 mm depth) with no visible distortion that rebounds immediately (disappears immediately), **Grade 2:** (2-4mmdepth) lasts 10-15 second, **Grade 3:** (4-6mm depth) lasts more than 1 minute, **Grade 4:** (6-8mm depth) lasts 2-5 minutes

Tool (III):- Visual Analogue Scale (VAS) for pain
The Visual Analogue Scale (VAS) was adopted from **Delgado et al. (2018)** (standardized scale) for determining pain severity among studied patients. It was a horizontal line with an eleven-point numeric range. It was ranged from zero to ten, with zero being an example of patient with no pain and ten being the worst pain possible.

The scoring system
The values on the pain scale correspond to
The following pain levels: 1–3 = mild pain, 4–6 = moderate pain, and 7–10 = severe pain.

Tool (IV):- Range of Motion Observational checklist

It was adopted from **Williams (2022)** to assess the patients' practice to perform the range of motion exercises for upper and lower limb after total knee replacement. It was consisted of three parts as follows;

1. Pre-procedure steps
2. Procedure steps
3. Post- procedure steps

Scoring system
The range of motion exercises observational checklist consisted of 20 steps, one mark wae scored for done correctly step and Zero mark was given for not done step/ incorrect step. The satisfactory level of practice was considered if the scored ≥ 80% and those who scored < 80% was considered unsatisfactory level of practice.

Validity of the tools
The content validity of the tools, as well as their clarity, comprehensiveness, appropriateness, and relevance, were assessed by seven experts in the domains of medical surgical nursing and surgery. to ensure appropriateness of material and sentence clarity. The panel's decision did not change anything.

Reliability of the tools
The reliability score of the Visual Analogue Scale (VAS), which is used to measure pain, was r = 0.94. Cronbach's alpha for the swelling measurement scale is 0.87 overall, which indicates high reliability. A structured interview questionnaire's reliability coefficient was (r = 0.93).

Ethical Consideration
After the study's objectives were discussed, each participant completed an oral consent form. The researchers made a point of stressing that participation in the trial was entirely voluntary and that any patient can withdraw from it at any moment for any reason. Secrecy and anonymity were also ensured.

A pilot study
In addition to the primary research, 10% of the subjects—ten patients, five from each group—were exposed to it. The pilot research set out to ascertain the clarity, application, and

use of the tools as well as the time needed to finish each one. No adjustments were made in light of the pilot study's findings.

Data Collection Procedures

Twice a week, from 9 am to 12 pm, the researchers went to the locations they had previously chosen. There were five months involved in the data gathering process, from the beginning of May to the end of September 2021. The patients were given the questions and potential answers to help them finish the tools, and the researchers also performed in-person interviews with them. The study's implementation approach consisted of three phases: assessment and planning, implementation, and evaluation.

Field work:

It was done in three phases:

A. Assessment and planning phase:

During the assessment phase, the researchers prepared the data collection tools. All patients under study (study and control group patients) were assessed using study tools. The researchers assessed all newly admitted patients who undergo TKA surgery to ensure they met the study's inclusion criteria. The researchers held the first meeting with each patient in the study setting (orthopedic wards) to introduce them and briefly explained the nature and the aim of the study. They were informed that they had the right to withdraw at any time. The researchers took telephone numbers at the first contact to determine the next appointment to complete the data collection process. What's Apps group chats were held between the researchers and patients' participants to respond to any question and plan the next meetings. The researchers provided an overview and explanation about the study tools, then, researchers interviewed each participated patient individually to assess demographic data, medical health status, knowledge about the disease and TKA, tool II,III & IV. These tools were fulfilled within a time ranged from 20 minutes to 30 minutes. The data obtained during this phase to evaluate the effectiveness of the program. Based on the identified needs of the patients under study and reviewing related literature, the researchers developed prehabilitation program with attached printed Arabic booklet to satisfy the inadequate patients` knowledge.

Implementation phase:

Both study and control group subjects received the hospital routine care given to the patients who undergo TKA either before or after therapy or even the follow up care in the outpatient clinic. Prehabilitation program implemented for study group according to baseline assessment literature review. The teaching sessions were conducted in the orthopedic out- patient clinic and lecture classrooms in orthopedic Unit. The family members were involved in all teach sessions. Each session took about 40-50 minutes. These sessions were conducted for small groups ranging from 1-6 patients. Two sessions were conducted daily according to availability of patients.

The prehabilitation program was delivered in eight scheduled sessions (theoretical and practical). Theoretical part included anatomy of the knee, definition of osteoarthritis, types, risk factors, clinical manifestation, diagnostic measures, and management as well as definition of compression therapy, its technique, purposes, indications,

contraindications, and benefits, TKA surgery (definition, indications, contraindications, complications, pre and post teaching), The practical part focused on compression therapy technique, procedure, precautions. Small group discussion was methods of teaching used for theoretical part, but demonstration and redemonstration for practical part. In addition to use of PowerPoint presentation and relevant videos. The researchers communicate with study group participants after their discharge through WhatsApp chat and answer any questions related to program.

Swelling Measuring Scale was measured pre, post two weeks and post four weeks because Knee swelling was reduced after 14 days and a graduated medical elastic thigh compression stocking have a positive effect on reduction of swelling within two weeks after total knee arthroplasty **(Christensen et al., 2021).**

Visual Analogue Scale (VAS) for pain and Range of Motion Observational checklist were measured pre, immediate post, post two weeks and post four weeks because compression therapy provided extra stability to patients' joint while compressing it so patients can engage in functional activities immediately after surgery. Also the compression therapy improve pain score to the area, allowing for more freedom of movement to the joint **(Christensen et al., 2021).**

Compression therapy instructions

Patients in the research group, with the help of a physical therapist, were given compression bandages to cover the hydrocolloid surgical wound dressing in place of wool and crepe bandages. With a 50% bandage overlap from the toes to the groin, a light inner layer was put to the wounded leg. The outer compressive layer bandage was then securely applied on top, overlapping the bandages by an additional 50%. The bandage was thoroughly stretched to guarantee that there was enough compression applied before it was wrapped around the leg. The tourniquet's application following its removal was required because to its length up the thigh. The nurses received instruction on applying bandages correctly through a training film, a lesson, and feedback on applying bandages in real-world situations. This helped the nurses apply bandages consistently. After the procedure, the bandage was taken off, but the hydrocolloid wound dressing remained in place. Perform pre-assessment, two-week, and four-week evaluations of range of motion, edema, and pain.

The Evaluation phase:

In the evaluation phase we focus on assessing the effect of prehabilitation program regarding compression therapy on patient's knowledge, post-surgical swelling, pain, range of motion including; level of patient knowledge, severity of pain, grade of swelling, range of motion practice. By comparing the results between study and control groups at pre and post implementation of prehabilitation program regarding compression therapy using the same data collection tools after two weeks and after four weeks**.**

Statistical Design

Data was added up and checked. Software called SPSS version 19 was utilized for statistical analysis. The expression of categorical data was done using frequency and percent. When expressing numerical data, the mean and standard deviation (SD)

were utilized. Three different sets of numerical data were studied and compared using the T-test. To compare groupings of numerical data, the Chi-square test was created. The P-value was classified as significant if it was less than 0.05, highly significant if it was less than 0.001, and non-significant if it was higher than 0.05.

Results

Table (1): revealed that demographic characteristics of the patients under study, the findings showed that, the mean age of the studied patients in two groups was 50.12±3.33 for study group and 45.56±5.33 for control group and 64% and 62% were females in study and control respectively, 66% and 70% of them were married, 66% and 68% in study and control group respectively were had sedentary work, and 58% and 60% were live in urban area for study and control group respectively.

Table (2): the results in this table showed that, 30% and 24% of the studied patients were had orthopedic problems in the study and control group respectively. 64% and 50% of them had no family history of osteoarthritis, 48% and 44% of the patients in the study and control group respectively were obese 2. Also, 54% and 58% of them were had previous history of joint injury.62% and 58% of the patients in study and control groups the affected limb for them was right knee.

Table (3): revealed that there were significant improvement in patient`s knowledge for study group than control group after fulfillment of the program in which there were a statistical significant differences noticed between study and control group ($p<0.001$).

Figure (1): Illustrates that there were significant improvement for grade of swelling for study group than control group2 weeks after fulfillment of program in which there were a statistical significant differences found between study and control group ($p<0.001$).

Figure (2): shows that there was a statistically significant difference in knee swelling between the two groups four weeks after the procedure. The compression group had a significant postoperative improvement over the control group (P 0.003*).

Figure (3): Between the groups under analysis, there was a statistically significant difference in the mean pain levels four weeks after the procedure. Four weeks following surgery, the compression treatment group showed lower mean analog pain levels than the control group.

Figure (4): Illustrates that, there was a significant improvement in the practice of range of motion exercises for studied patients in the study group than control group in which there was a statistical significant differences noticed between two groups after implementation of the program(P 0.022*).

Table (4): Reveals that, there was relation between patient`s demographic characteristics (regarding age and residence) and patient`s severity of pain. Also, there was relation between patient`s demographic characteristics (regarding age) and grade of swelling. and there was relation between patient`s demographic characteristics (regarding age) and range of motion practice.

Table (5): Shows that, there were significant positive correlation between total patient`s knowledge , pain score, swelling grade and range of motion practice post implementation of the program.

Table (1): Demographic Characteristics of the Studied Patients (n=100).

Demographic characteristics	Control group (n=50)		Study group (n = 50)		P. value
	No.	%	No.	%	
Age (years):					
20-<30	3	6%	2	4%	0.446
30<40	5	10%	6	12%	
40<50	10	20%	12	24%	
≥50	32	64%	30	60%	
Mean ±SD	45.56±5.33		50.12±3.33		
Gender					
Female	31	62%	32	64%	0.564
Male	19	38%	18	36%	
Marital status					
Married	35	70%	33	66%	0.335
Not married	15	30%	17	34%	
Occupation					
Sedentary work	34	68.0	33	66%	0.336
physical work	16	32.0	17	34%	
Residence					
Urban area	30	60%	29	58%	0.543
Rural area	20	40%	21	42%	

Table (2): Frequency and Percentage Distribution of the Patients under Study Regarding Medical Clinical Data (n= 100)

Medical clinical data	Groups				Chi-square	
	Study group n=50		Control group n=50			
	No.	%	No.	%	X^2	P-value
Types of Co- morbid diseases						
▪ Hypertension	11	22%	11	22%	0.000	1.000
▪ Diabetes	11	22%	8	16%	0.579	0.446
▪ Cardiac disease	9	18%	10	20%	0.064	0.799
▪ Liver diseases	9	18%	12	24%	0.537	0.464
▪ Orthopedic problems	15	30%	12	24%	0.452	0.501
Family history of osteoarthritis						
▪ No	32	64%	25	50%	1.469	0.225
▪ Yes	18	36%	25	50%		
Obesity						
▪ Normal weight	11	22%	12	24%	0.163	0.922
▪ Obese 1	15	30%	16	32%		
▪ Obese 2	24	48%	22	44%		
Previous history of joint injury					1.002	0.317
▪ Yes	27	54%	29	58%		
▪ No	23	46%	21	42%		
Affected limb						
▪ Right knee	31	62%	29	58%	0.042	0.838
▪ Left knee	19	38%	21	42%		

Table 3: Total Satisfactory Level of Patients` Knowledge for Study and Control Groups Pre and Post Four weeks of prehabilitation program implementation (n=100).

Items	Pre implementation of program				Post implementation of program (4 weeks)				Pre-implementation		Post-implementation (4 weeks)	
	study group (n=50)		control group (n=50)		study group (n=50)		control group (n=50)		Test (X2/)	p-value	Test (X2/)	p-value
	No	%	No	%	No	%	No	%				
Knowledge regarding osteoarthritis												
Satisfactory	10	20%	8	16%	27	54%	12	24%	3.836	0.781	11.049	0.015*
Unsatisfactory	40	80%	42	84%	23	46%	38	76%				
Knowledge regarding total Arthroplasty surgery												
Satisfactory	15	30%	12	24%	37	74%	13	26%	1.719	0.129	15.366	<0.001**
Unsatisfactory	35	70%	38	76%	13	26%	37	74%				
Knowledge regarding compression therapy												
Satisfactory	16	32%	32	64%	36	72%	30	60%	4.858	0.459	7.063	0.033*
Unsatisfactory	34	68%	18	36%	14	28%	20	40%				
Total												
Satisfactory	14	28%	17	34%	33	66%	18	36%	5.514	0.522	10.654	0.021*
Unsatisfactory	36	72%	33	66%	17	34%	32	64%				

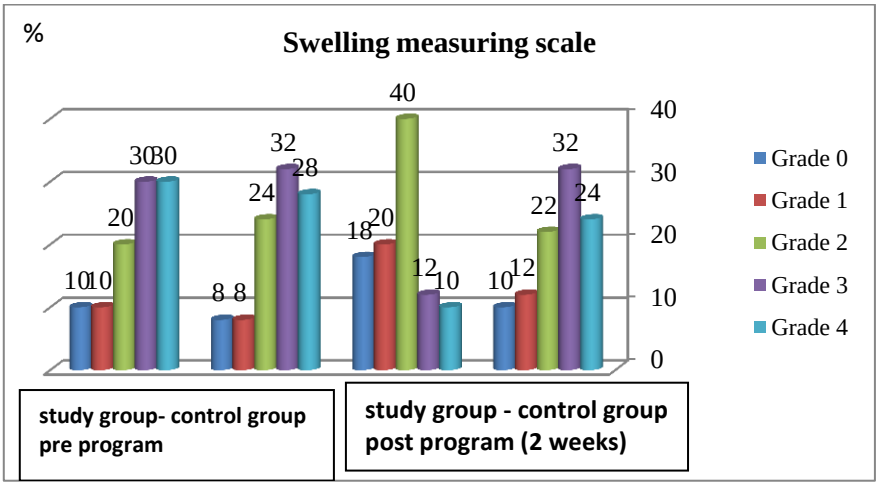

Figure (1): Comparison between Both Studied Groups Regarding Swelling measuring scale.

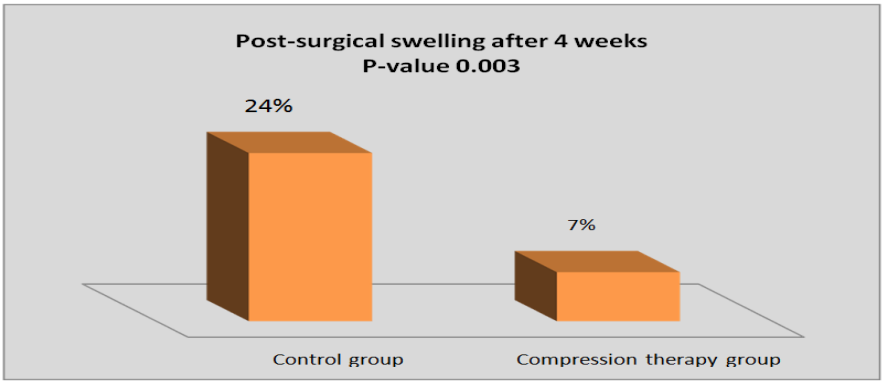

Figure 2. Comparison between both studied groups regarding post–surgical knee swelling after four weeks (no=50 each group)

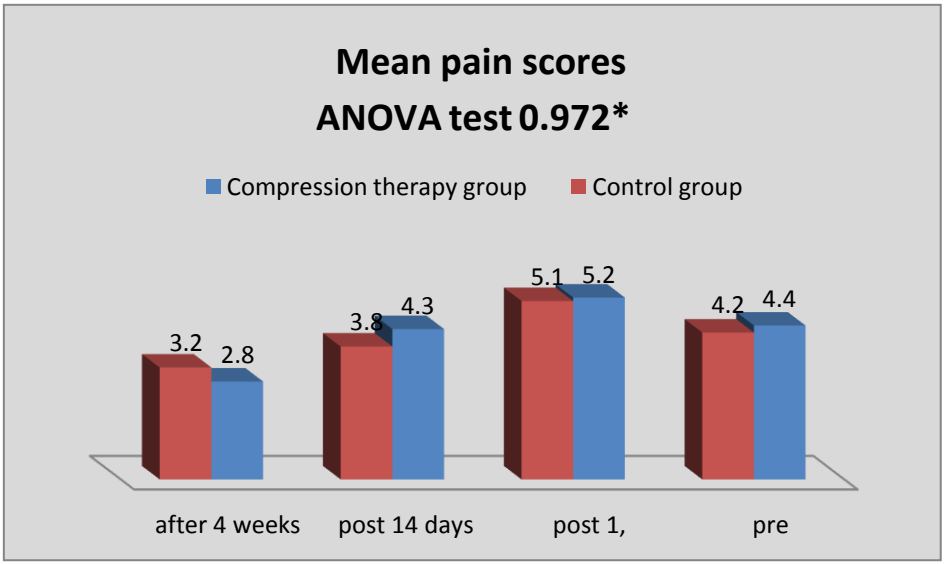

Figure 3. Differences between the both studied groups regarding mean analog pain scores pre, immediate post, post 14 days, and after 4 weeks (no=50 each group)

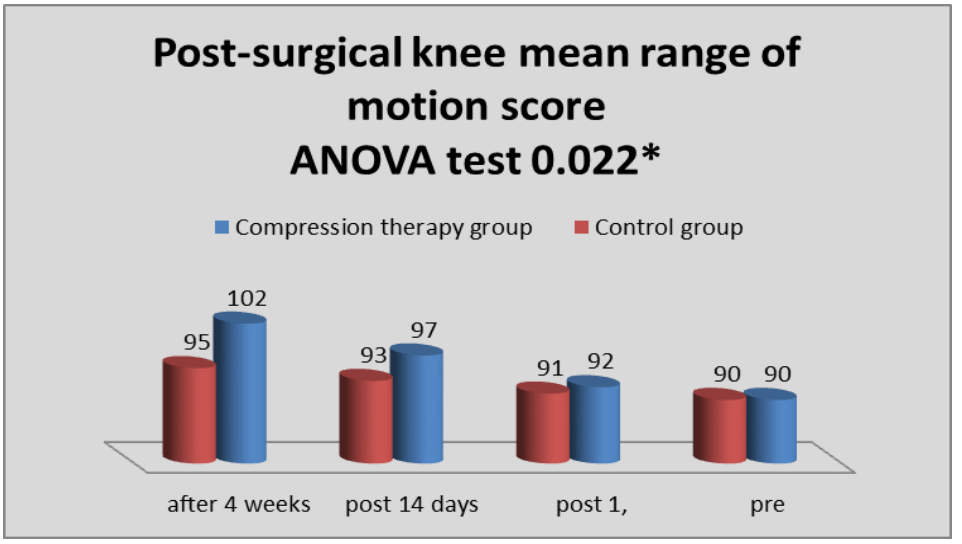

Figure 4. Differences between both studied groups regarding post–surgical knee range of motion pre, immediate post, post-14 days, and after 4 weeks (no=50 each group)

Table (4): Relation between demographic Characteristics of the patients and pain, swelling, and range of motions for Study and Control Groups (n=100).

		Severity of pain			
		Pre implementation of program		Post implementation of program	
		Study group	Control group	Study group	Control group
Age (years)	x^2	2.615	7.321	7.729	5.326
	p-value	0.222	0.702	0.021*	0.513
Gender	x^2	2.928	5.275	3.038	6.860
	p-value	0.756	0.558	0.332	0.651
Marital status	x^2	4.866	5.813	5.691	8.851
	p-value	0.460	0.561	0.538	0.335
Occupation	x^2	2.904	2.944	6.286	5.407
	p-value	0.251	0.254	0.608	0.517
Residence	x^2	2.195	5.251	9.102	1.465
	p-value	0.171	0.498	0.012*	0.096
		Swelling scale			
		Pre implementation of program		Post implementation of program (2weeks)	
		Study group	Control group	Study group	Control group
Age (years)	x^2	3.470	5.869	12.305	6.253
	p-value	0.700	0.537	<0.001**	0.606
Gender	x^2	4.891	6.989	1.410	7.680
	p-value	0.466	0.661	0.090	0.760
Marital status	x^2	3.317	7.641	4.462	6.124
	p-value	0.300	0.751	0.414	0.511
Occupation	x^2	2.322	3.873	1.887	2.670
	p-value	0.190	0.353	0.155	0.230
Residence	x^2	4.926	2.553	5.688	5.759
	p-value	0.612	0.782	0.546	0.553
		Range of motion exercises			
		Pre implementation of program		Post implementation of program (2weeks)	
		Study group	Control group	Study group	Control group
Age (years)	x^2	3.252	5.276	10.215	7.874
	p-value	0.287	0.504	0.004*	0.784
Gender	x^2	2.874	1.731	4.195	4.611
	p-value	0.248	0.131	0.387	0.425
Marital status	x^2	5.777	2.303	5.268	4.200
	p-value	0.560	0.187	0.500	0.675
Occupation	x^2	8.044	9.038	7.516	1.524
	p-value	0.388	0.332	0.447	0.107
Residence	x^2	7.093	5.485	2.949	4.470
	p-value	0.672	0.519	0.254	0.415

p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant

Table (5): Correlation between of Patients` total Level of knowledge and Pain, Swelling and Range of Motion Exercises for Study and Control Groups (n=100)

		Total of Patient knowledge			
		Pre implementation of program		Post implementation of program (2weeks)	
		Study group	Control group	Study group	Control group
Pain score	**r-value**	0.035	0.186	- 0.473	0.207
	p-value	0.786	0.460	0.019*	0.281
Swelling scale	**r-value**	0.056	0.190	- 0.652	0.283
	p-value	0.632	0.382	0.002*	0.237
Range of motion exercises	**r-value**	0.095	0.198	0.510	0.245
	p-value	0.532	0.293	0.003*	0.235

p-value >0.05 NS; *p-value <0.05 S; **p-value <0.001 HS

Discussion

Total knee arthroplasty (TKA) or total knee replacement (TKR) is a common orthopedic surgery that involves replacing the articular surfaces of the knee joint with smooth metal and highly cross-linked polyethylene plastic. The primary indication for TKA is relief of significant, disabling pain, decrease the swelling and enhance the physical functioning of the patients. Compression therapy is a very effective treatment modality used for patient undergoing total knee replacement, leg compression used for legs by wearing special medical compression stockings / bandages that come in different lengths and styles, to suit a variety of venous diseases and individual needs **(Burgess et al., 2021).**

The results of the present study revealed that, there were no statistically significant differences between study group and control group regarding demographic characteristics of the studied patients, the mean ages in years for control and study groups were (45.56 ± 5.33 and 50.12 ±3.33) respectively, this findings is agreed with **Arthritis Foundation (2024)** which mentioned that, osteoarthritis commonly occurred in the late of 40 years and middle the age of 50 years. While this results is not in the same line with **Hansen et al. (2019)** who mentioned in study entitled "Unicondylar knee arthroplasty has fewer complications but higher revision rates than total knee arthroplasty in a study of large United States databases" that, TKA was among the significantly younger age than older patients. In my opinion the factor of age may affect incidence of osteoarthritis and can lead to TKA specially if there were other comorbidity diseases, unhealthy life styles and risks for joint injury. Also, two thirds of the studied patients in the study and control groups were females and this findings are consisted with **National Institute of Health (2020)** which mentioned that the patients underwent TKA were 162,383 (61.7%) of them were females and 100,612 (38.3%) were males. While this findings are in consisted with **Miozzari et al. (2021)** who stated that, men are more likely than women to have had previous knee surgery prior to TKA.

Regarding occupation, the findings of this study revealed that, two thirds of the studied patients in the control group were sedentary work but less than in the study

group, and this is agreed with **(Jungwha et al., 2016)** who mentioned in study entitled" sedentary behavior and physical function: Objective Evidence from the Osteoarthritis Initiative" that, the most sedentary lifestyle group was associated with bad physical function compared to the other group, and this assured that, a sedentary lifestyle may be the major associated factor for the increase the number of primary knee osteoarthritis patient.

Concerning residence, the current study proved that, more than one half of the studied patients were live in urban area in the control group compared with study group nearly half of them and this results are in the same line with **(Yadavet al., 2022)** who mentioned in his study "prevalence of primary Knee Osteoarthritis in the Urban and Rural Population in India" that, urban areas is much higher than noticed in rural regions. While this finding is not match with **(Adrian et al., 2023)** who found in his study that patients living in urban areas had lower total joint arthroplasty employment compared to patients denizen in rural areas.

Regarding to medical health history of the patients under study, the current study revealed that, nearly one third of the studied patients in the study group were had orthopedic problems but one fourth only in the control group. In my standpoint knee osteoarthritis disease caused by different orthopedic problems in the knee and the patient neglect them to be advanced knee osteoarthritis which needs TKA.

Regarding family history, two thirds of the studied patients in the study group have no family history of osteoarthritis comparing to control group one half of them only. This results is agree with **(Shaikh**, **2024**) who proved in his study " family history and consanguine marriages a genetic risk predictor for knee osteoarthritis "that, A positive family history of OA was found to be associated with knee OA (68.9%) of the study sample. In addition to that, almost one half of the studied patients in the study group and control group were obese II. and this results are as same with (**Agarwal et al., 2022)** who mentioned in his study " The outcomes of total knee arthroplasty in morbidly obese patients: a systematic review of the literature" that**,** TKA in morbidly obese patients can be technically challenging due to numerous anatomical factors and patient co-morbidities. From the standpoint of the researcher the patient with knee osteoarthritis should maintain healthy diet to avoid the exposure obesity and avoid dangerous complications. Also, more than one half of the studied patients in two groups were having no previous history of joint injury, this results is not agreed with **(Thomas, 2017)** who mentioned that, recurrent post traumatic arthritis can affect 5 million people every year and can induce TKA.

The findings of the current study showed also, that nearly two thirds of the studied patients in the study group the affected limb for them was right knee but more than one half of them in the control group this result is in matching with **Burgess et al. (2021)** who found that the most affected knee of osteoarthritis was the right leg..

**As regards, satisfactory level of patient`s knowledge,** the current study showed that there was significant improvement in patient`s knowledge regarding osteoarthritis, TKA, and compression therapy for study group than control group in which statistically significant differences observed between two groups after implementation of the program. And this reflects the good effect of the

prehabilitation program regarding compression therapy. This result is consistent with **(Mahmoud et al. 2019)** who stated through his study "Effect of Nursing Instructions on Patient's Knowledge and Venous Leg Ulcer Healing", that the majority of the studied subjects had a satisfactory level of knowledge following nursing instructions, with a highly statistically significant difference between study and control group in terms of patient knowledge.

Furthermore, **In relation to grade of swelling** the current study showed that, there was a significant improvement for post-surgical swelling grade for study group patients versus control group in which statistically significant differences found between two groups after implementation of the program, this indicates to that compression therapy is an effective treatment for decreasing swelling grade for patients undergoing TKA. This finding is in the same line with **Khalil et al. (2022)** that proved in his study "Synergistic Effect of Compression Therapy and Leg Position on Patients Post Total Knee Arthroplasty Swelling, Pain and Range of Motion", that significant difference existed between all studied groups regarding swelling and range of motion degrees. But, this results is not agreed with **Linda et al. (2020)** who mentioned in his study "The effect of compression therapy on post-surgical swelling and pain after total knee arthroplasty" that, No significant difference was found between the groups regarding knee, calf and ankle swelling or pain.

Regarding severity of pain, the current study revealed that, there was a significant improvement of post-surgical pain for study group than control group in which statistically significant differences observed between two groups after implementation of the program. From researchers points of view, this finding indicates that compression therapy helps increase blood circulation in the lower legs, ankles and feet and reliving of pain. This results is consistent with **Bahiry and Masry (2022)** in study entitled "Impact of Educational Nursing Intervention on Compression Therapy Adherence and Recurrence of Venous Leg Ulcers: A Quasi-Experimental Study"who showed that, educational nursing intervention has significant effect to reduce pain and able to avoid recurrent venous leg ulcers. while the same result is not agreed with (**Khalil et al., 2022)** who mentioned that significant difference existed between all studied groups regarding swelling and range of motion degrees but no statistical significance regarding pain mean scores post total knee arthroplasty**..**

Regarding the effect of the program on degree of range of motion, the current study showed that, there was no significant differences observed between two groups pre-implementation of the program while after the program implementation, there was significant improvement for range of motion degree for study group than control group. This results is agreed with **Masanobu et al. (2023)** who mentioned in his study " the acute effect of roller massager on knee joint range of motion and muscle pain in older adults with total knee arthroplasty" that roller massage intervention is an effective tool for treating stiffness and pain after TKA. Also this result is agreed with **Khalil et al. (2022)** who stated that significant difference existed between all studied groups regarding swelling and range of motion degrees. from my standpoint the degree of range of motion improved because of the good

effect of compression therapy treatment which lead to reliving pain and swelling and subsequently lead to range of motion improving.

Regarding to, the relation between severity of pain and demographic characteristics of the studied patients, the current study proved that, there was positive relation between severity of pain and patients `demographic characteristics (regarding the age and residence) for study group than control group. In which statistically significant difference observed between two groups after implementation of the program. This result is agreed with **Kyung and Chang (2015)** who proved that, there was a significant improvement in pain, edema, and knee flexion and extension ROM in all subjects after intervention ($p<0.05$).

As regards the relation between swelling grade and demographic characteristics of the studied patients. The finding of the current study revealed that, there was positive relation between swelling grade for studied patients in the study group and their age in which statistically significant difference observed between two groups after implementation of the program. In my opinion this result reflects the positive effect of the program and clarity of the content and simple language which help the patients to follow instructions specified to swelling and edema. The previous results are not agreed with **Linda et al. (2020)** who mentioned in his study that, There was no statistically significant difference in limb swelling between different age groups ($P >0.05$). And the same results were in the same line with study done by " **Kyung and Chang (2015)** who proved that, there was a significant improvement in pain, edema, and knee flexion and extension ROM in all subjects after intervention ($p<0.05$).

Concerning, the relation between range of motion degree and demographic characteristics of the studied patients, the study findings showed that, there was positive relation between range of motion exercises for studied patients in the study group and their age in which statistically significant difference found between two groups after implementation of the guidelines. This results is in the same line with **Tomohiro et al. (2020)** in study entitled " Importance of knee flexion range of motion during the acute phase after total knee arthroplasty" who proved that, Knee flexion ROM after TKA has been shown to have significant correlations with age, body mass index (BMI), implant design, surgical technique, pain, and preoperative ROM.

As regards the correlation between total patient`s knowledge and their level of pain, swelling and range of motion** the current study showed that, there were positive correlation between total patients` knowledge and total pain score, swelling scale and range of motion degree for study group than control group after implementation of the program. This assured from standpoint of the researcher, the use of prehabilitation program regarding compression therapy increased patients' understanding and practice to compression treatment substantially. As a consequence, the patients are able to releive pain, decrease swelling and perform range of motion exercises. this results is consistent with **Bahiry and Masry (2022) who mentioned in his study that, there was significant improvement in patients knowledge for studied patient in the study group. Also this findings are agree with **Han and Kong (2024)** in study entitled" A Pilot Study on the Efficacy of an App-

Based Rehabilitation Counselling Program after Total Knee Arthroplasty" who revealed that, early rehabilitation immediately after TKA is critical for reducing knee pain, strengthening the quadriceps femoris for gait, reducing knee swelling, and restoring the normal range of motion (ROM) of the knee.

Conclusion

Based on the findings of the current study, it was concluded that the prehabilitation program regarding compression therapy has a positive effect on improvement patient`s knowledge regarding osteoarthritis, TKA and compression therapy, in which statistically significant differences observed between two groups. Also, this program has a positive effect on reducing post- surgical swelling and pain and improving of knee range of motion degree and these findings support and prove all the study hypotheses.

Recommendations

According to the study's findings, the researchers recommended that

- Continuous Training programs for nurses in orthopedic units and out- patient clinics regarding their role as a health educator for such group of patients.
- Periodic educational programs should be conducted to increase patient`s knowledge regarding TKA and compression therapy and its effect on quality of life
- More researches with a larger sample size in different geographical areas are needed to confirm and generalize the results.
- Developing educational programs for patients regarding preventive measures of orthopedic problems which lead to TKA
- All patients with advanced knee osteoarthritis and undergoing TKA in health care settings should have access to a concise and comprehensive Arabic brochure/booklet with compression therapy precautions and program.

References

Adrian, H, Change. R, Royes.E.K, Naverro, R., Paxton.E (2023): Utilization of Total Joint Arthroplasty by Rural-Urban Designation in Patients with Osteoarthritis in a Universal Coverage System, available at, https://pubmed.ncbi.nlm.nih.gov/37595769/.

Aggarwal A.V, Senthil N. Sambandam, and Dane K. Wukich[c] (2022): The Impact of Obesity on Total Knee aArthroplasty Outcomes: A retrospective matched cohort study, available at, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9449637/

Akash (2021) Total Knee Arthroplasty, Available at, https://www.jptrs.org/journal/view.html?doi=10.14474/ptrs.2015.4.2.79.

Arthritis Foundation (2024): Osteoarthritis, available at, https://www.arthritis.org/diseases/osteoarthritis

Behairy A, S, and Masry E, S (2022): Impact of Educational Nursing Intervention on Compression Therapy Adherence and Recurrence of Venous Leg Ulcers: A Quasi-Experimental Study. available at, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9218629.

Bjork, R., & Ehmann, S. (2019): STRIDE professional guide to compression garment selection for the lower extremity. Journal of wound care, 28(Sup6a), 1-44.

Brock, T., Sprowson, A., Muller, S., & Reed, M. (2017): STICKS study - short- sTretch inelastic compression bandage in knee swelling following total knee arthroplasty - a feasibility study. Trials; 18(1):6.

Burgess, L., Taylor, P., Wainwright, T., & Swain, I. (2021): Strength and Endurance Deficits in Adults with Moderate-to-Severe Hip Osteoarthritis, Compared to Healthy, Older Adults. Disability and Rehabilitation, 1-8

Cabral, H., Fonseca, V., Sousa, T., & Costa Leal, M. (2019): Synergistic effects of climate change and marine pollution: An overlooked interaction in coastal and estuarine areas. International journal of environmental research and public health, 16(15), 2737.

Christensen L., Christina E., Arnesen' Möller S., Hyldig N. (2021): The effect of compression therapy on post-surgical swelling and pain after total knee arthroplasty, International Journal of Orthopaedic and Trauma Nursing, Elsevier, Volume 41, https://doi.org/10.1016/j.ijotn.2020.100815, Available at https://www.sciencedirect.com/science/article/abs/pii/S1878124120301210

Delgado D.A., Lambert B.S., Boutris N, McCulloch P.C., Robbins A.B., Moreno M.R., Harris J.D. (2018): Validation of digital visual analog scale pain scoring with a traditional paper-based visual analog scale in adults. Journal of the American Academy of Orthopaedic Surgeons. Global research & reviews. Vol 2(3). At https://www.physio-pedia.com/Visual_Analogue_Scale#cite_note-:1-1

Devasenapathy, N.; Maddison, R.; Malhotra, R.; Zodepy, S.; Sharma, S.; & Belavy, D.L. (2019): Preoperative quadriceps muscle strength and functional ability predict performance-based outcomes 6 months after total knee arthroplasty: A systematic review. Phys. Ther, 99, 46–61.

Goh, S.L.; Perssom, M.S.M.; Stocks, J.; Hou, Y.; Welton, N.J.; Lin, J.; Hall, M.C.; Doherty, M.; Zhang, W. (2019): Relative efficacy of different exercises for pain, function, performance and quality of life in knee and hip osteoarthritis:

Hansen, E., Ong, K., Lau, E., Kurtz, S., & Lonner, J. (2019): Unicondylar knee arthroplasty has fewer complications but higher revision rates than total knee arthroplasty in a study of large United States databases. The Journal of arthroplasty, 34(8), 1617-1625.

Han S., Kong S. (2024): A Pilot Study on the Efficacy of an App-Based Rehabilitation Counselling Program after Total Knee Arthroplasty,Vol *12*(13), 1329; https://doi.org/10.3390/healthcare12131329

Hayes, K., Giannakeas, V., & Wong, A. (2020): Bisphosphonate use is protective of radiographic knee osteoarthritis progression among those with low disease severity and being non-overweight: datafrom the Osteoarthritis, 30(4), 77-89.

Hsu, J., Mir, H., Wally, M., & Seymour, R. (2019): Clinical practice guidelines for pain management in acute musculoskeletal injury. *Journal of orthopaedic trauma*, 33(5), e158.

Jenny, J., Baldairon, F., & (2021): Functional knee phenotypes of OA patients undergoing total knee arthroplasty are significantly more varus or valgus than in a non-OA control group. Knee Surgery, Sports Traumatology, *Arthroscopy*, 1-8.

Jiang, S.; Xiang, J.; Gao, X.; Guo, K.; & Liu, B. (2017): The comparison of telerehabilitation and face-to-face rehabilitation after total knee arthroplasty: A systematic review and meta-analysis. *J. Telemed. Telecare*, 24, 257–262.

Jungwha l, Rowland W. Chang, Linda Ehrlich-Jones, C. Kent Kwoh, Michael Nevitt, Pamela A. Semanik, Leena Sharma, Min-Woong Sohn, Jing Song, and Dorothy D. Dunlop (2016): Sedentary behavior and physical function: Objective Evidence from the Osteoarthritis Initiative, available at, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4336845/.

Khalil.S.S, Gaad.G.E, Diab.M.,T (2022): synergistic Effect of Compression Therapy and Leg Position on Patients Post Total Knee Arthroplasty Swelling, Pain and Range of Motion, available at, https://asnj.journals.ekb.eg/article_220945.

Kyung and Chang (2015), Changes in pain, swelling, and range of motion according to physical therapy intervention after total knee arthroplasty in elderly patients, Available at, https://www.jptrs.org/journal/view.html?doi=10.14474/ptrs.2015.4.2.79.

Kim, Y.H.; Park, J.W.; & Jang, Y.S. (2020): 20-Year minimum outcomes and survival rate of high-flexion versus standard total knee arthroplasty. *J. Arthroplast*, 36, 560–565.

Kurtz, S.; Ong, K.; Lau, E.; Mowat, F.; & Halpern, M. (2017): Projections of primary and revision hip and knee arthroplasty in the United States from 2015 to 2030. *JBJS*, 89, 780–785.

Lei, T.; Qian, H.; Hua, L.; de Abreu e Silva, G.M.; Hu, Y.; & Lei, P. (2020): Is high flexion total knee arthroplasty a rewarding procedure? An updated meta- analysis of prospective randomized controlled trials. Arch. Orthop. Trauma Surg, 141, 783–793.

Linda, M., Christensen, E., Arnesen,Sören, M., & Nana, H. (2021):The effect of compression therapy on post-surgical swelling and pain after total knee arthroplasty, *International Journal of Orthopaedic and Trauma Nursing, Elsevier*, April, Volume 41, April 2021, 100815

Li, Z., Li, B., Wang, G., Wang, K., Chen, J., Liang, Y. & Yang, Y. (2021): Impact of enhanced recovery nursing combined with limb training on knee joint function and neurological function after total knee arthroplasty in patients with knee osteoarthritis. American Journal of TranslationalResearch, 13(6), 6864.

Miozzari, H., Barea, C., Hannouche, D., & Lübbeke, A. (2021): History of previous surgery is associated with higher risk of revision after primary total knee arthroplasty: a cohort study from the Geneva Arthroplasty Registry. *Acta Orthopaedica*, 1-7.

Linda M R Christensen [1], Christina E Arnesen [2], Sören Möller Nana Hyldig [3] (2020): The effect of compression therapy on post-surgical swelling and pain after total knee arthroplasty available at, https://pubmed.ncbi.nlm.nih.gov/33339752/(2020)

Masanobu y,, Masatoshi.,N, Ayaka Iwata, R., and Noboru Yamada (2023) : The Acute Effect of Roller Massager on Knee Joint Range of Motion and Muscle Pain in Older Adults with Total Knee Arthroplasty, available at, https://www.ncbi.nlm.nih.gov/pmc/articles/ PMC10233222/

Mahmoud SI, El-Sayed ZM, Abo Deif HI.(2019) : Effect of Nursing Instructions on Patient's Knowledge and Venous Leg Ulcer Healing, available at, https://www.ncbi.nlm. nih.gov/pmc/articles/PMC9218629/.

Miozzari, H., Barea, C., Hannouche, D., & Lübbeke, A. (2021): History of previous surgery is associated with higher risk of revision after primary total knee arthroplasty: a cohort study from the Geneva Arthroplasty Registry. Acta Orthopaedica, 1-7.

National Institute of Health (2020): Gender and Total Joint Arthroplasty: Variable Outcomes by Procedure Type,Available at, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7387670/.

Rossman, A., Lecureux, E., Currat, D., & Jolles, B. (2016): Selective early hospital discharge does not increase readmission but unnecessary return to the emergency department is excessive across groups after primary total knee arthroplasty, *J Arthroplasty*. 9(11), e031657.

Shamekh, A, Alizadeh,M, [1] Nejadghaderi, S, A, Sullman, M, Kaufman, J,S, G,S, Collins, Kolahi, A, A, and Safiri, S(2022): The Burden of Osteoarthritis in the Middle East and North Africa Region From 1990 to 2019, available at, https://www.ncbi. nlm.nih.gov/pmc/articles/PMC9261477/

Sharma, R.; Ardebili, M.A.; & Abdulla, I.N. (2019): Does rehabilitation before total knee arthroplasty benefit postoperative recovery? A systematic review. *Indian*

J. Orthop, 53, 138–147.

Szots, *A.*, Zippelius, T., Kloss, N., & Jacob, B. (2015): Physical health problems experienced in the early postoperative recovery period following total knee replacement, International journal of orthopaedic and trauma nursing, *BMJ open*, 9(11), e031657.

Shaikh, R.S, Ur Rahman, A, A, Makhdoom, A, Jokhio, F, M, Adil, M, & Shaikh. A, M (2024). Family History and Consanguine Marriages a Genetic Risk Predictor for Knee Osteoarthritis: a Case-Control study. Journal of Population Therapeutics and Clinical Pharmacology, 31(1), 712–718. https://doi.org/10.53555/jptcp.v31i1.4069.

Thomas A. (2017): Post traumatic Osteoarthritis, available at https://my.clevelandclinic. org/health/diseases/14616-post-traumatic-arthritis

Tomohiro O.,, Osamu W.,, Tsuyoshi A,, MARUNO,H, and MIZUNO, K (2020): Importance of knee flexion Range of Motion During the Acute Phase After Total Knee Arthroplasty, available at, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7814201/.

Vasta, S., Papalia, R., Torre, G., Vorini, F., Papalia, G., Zampogna, B., Fossati, C., & Denaro, V. (2020): The influence of preoperative physical activity on postoperative outcomes of knee and hip arthroplasty surgery in the elderly: A systematic review. J. Clin. Med, 9, 969.

Weißenberger, M., Petersen, N., Bölch, S., Rak, D., Arnholdt, J., Rudert, M., & Holzapfel, B. (2020): Revision of unicompartmental knee arthroplasty using the in situ referencing technique. Operative Orthopädie und Traumatologie, 32(4), 273-283.

Williams., D. (2022): Nursing Procedures, 7th ed., Lippincott, London, pp. 1023- 1025.

Yadav, R., Verma, A.K, ; Chahar, B, Hemant., S, Patel, J, and Chandra P. (2022): Prevalence of Primary Knee Osteoarthritis in the Urban and Rural Population in India, available at, https://journals.lww.com/ijru/fulltext/2022/17030/prevalence_of_primary_knee_osteoarth ritis_in_the.4.aspx

Zusmanovich, S., Kloss, N., & Jacob, B. (2018): Postoperative complications of total joint arthroplasty in obese patients stratified by BMI, *J Arthroplasty*.