Effect of Application Cold Compresses on Range of Motion, Activity Daily Living and Pain Control Among Patients with Total Knee Replacement

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Abstract

Background: Total knee Replacement (TKR) are rapidly becoming one of the most common elective inpatient surgeries is really cartilage replacement with an artificial surface. The knee itself is not replaced. An artificial substitute for the cartilage is inserted onto the end of each of the bones. At present, cold therapy has been widely used in all kinds of surgery. After TKA, patients are prone to knee swelling and pain, even leading to the loss of knee function in severe cases. Postoperative cold therapy can reduce pain sensation and enhance the effectiveness of early rehabilitation training (Benner, et al., 2019). **Aim of this study:** is to evaluate effect of performance cold compresses on reducing post-operative pain among patients with total knee replacement. **Subjects and method: Design:** A quasi-experimental research design was used to achieve the aim of this study. **Setting:** The study was conducted in orthopedic department at Luxor International Hospital. **Sample:** A convenience sample of 60 adult patients post-knee replacement surgery. **Tools of data collection:** First tool Scio demographic and medical data Part (A): assess patients' socio- demographic data Part (B): assess patients' medical data Part(C): patient observational checklist: Part (D): knee range of motion (ROM) checklist; Numerical Rating Scale (NRS) second tool. **Result shows** a highly statistical significant reduction regarding level of pain between the two groups at 2nd, 3rd and 1 week postoperative. The total knee replacement surgery can change the lifestyle of a person living with osteoarthritis or another knee condition that causes continuous pain. The total knee replacement is a more invasive surgery where the bone is cut away and the entire joint is replaced with a prosthesis. Recovery is difficult, and usually takes six to eight weeks of intense physical therapy. The patient still needs physical therapy, but should be able to walk without assistive devices. **Recommendations:** The total knee replacement is effective at reducing pain in the knee. However, it is useful for different populations. There is more information about the total knee replacement because it is more common, and generally attracts a larger population.

Keywords: Cold compresses, Total Knee Replacement.

Introduction

The knee is typically described as a hinged joint. However, there are more complex and subtle motion and dynamic considerations. Physiologically, the knee also undergoes axial rotation and femoral "rollback" in deeper degrees of flexion. Additionally, terminal rotatory motion, known as the "screw home mechanism," occurs as the tibia externally rotates when the knee goes into terminal extension (Hyland & Varacallo, 2022).

Total knee arthroplasty (TKA) or total knee replacement (TKR), is a viable treatment for symptomatic osteoarthritis of the knee refractory to conservative measures. In those with end-stage degenerative changes compromising the articular cartilage affecting multiple compartments of the knee, the literature has yet to identify a potentially viable alternative option for the regeneration of cartilage. Thus, TKA has demonstrated reproducible, long-term, successful results in such patients concerning outcomes of decreased pain and improved overall quality of life (Liao & Xu, 2022).

According to certain research, 53% of patient of who underwent total knee replacing surgery experienced chronic pain; the severity of acute pain has a substantial impact on whether or not chronic pain develops. Patient comfort and satisfaction are also priorities in pain management; in order to attain these goals, patients must be cooperative with one another and sufficient nursing personnel must be organized **Devasenapathy, et al,2020) and Coviello, (2022).**

Pain is unavoidable after total knee replacement surgery, making the pain bearable has therefore been a priority in healthcare settings. Studies have shown that in order to experience a quick recovery after a knee surgery, controlling pain is a major concern (Corke 2018).

According to American Pain Management Society, pain management has been considered as a fifth vital sign, which has been increased an awareness among health professionals. However, it has always been a challenge, since the pain is very individualized (Lippincott 2019).

Nursing care is necessary and it helps patients to recover faster while managing the pain adequately, nursing evidence based care is important phenomena which offer patient safety and quick recovery from TKA (Parker 2015). Nurses play a major part in treating postoperative pain. The decision nurses make and the orientation of the care plan affects patients' pain scores, outcomes of the recovery and the length of hospital stay (Petter, 2017).

Cold therapy is the application of cryogenic substances on human skin to reduce local or systemic temperature, and then slow down nerve signal transmission, and decrease the activities of various biological enzymes to achieve the purpose of pain relief (Wang, et al., 2020).

At present, cold therapy has been widely used in all kinds of surgery. After TKA, patients are prone to knee swelling and pain, even leading to the loss of knee function in severe cases. Postoperative cold therapy can reduce pain sensation and enhance the effectiveness of early rehabilitation training (Benner, et al., 2019).

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(Kullenberg et al) Used cold compression for three days after TKA, the treatment patients demonstrated a better range of motion at discharge and three weeks follow-up. Furthermore, the mean time of hospital stay was less in the treatment group than in the control group (Van OOij, et al., 2020).Other studies have shown less pain , improved range of motion or less blood loss after cryotherapy (Gibbons, et al., 2017, Su, et al., 2016).

Despite the fact that many post-operative pain care methods are available, not all methods apply to every patient, so it is important that nurses know the effects of those various treatments in order to anticipate or find out early enough what is the most relevant care method which gives less side effects and complications to each individual patient. Nurses indeed strive to advocate for the best of the patients **(Petter, 2017)**.

The main responsibilities of the nurses in pain management are to know how to assess pain by appropriate planning and implementing the adequate treatments. **(Korean Knee Society. 2017).**The primary duties of nurses in pain management are to understand how to measure pain through proper planning and implementation of the right therapies. Additionally, the nurse must offer the right guidance and instructions for the subsequent care after discharge, including therapeutic strategies and techniques for pain relief utilizing both pharmaceutical and non-pharmacological approaches. **(Kazan et al. 2017).**

As part of cold therapy, cryogenic substances are administered to patients' skin to reduce discomfort. It lowers the action of various biological enzymes, lowers local or overall body temperature, and inhibits the transmission of nerve signals.**(Wang, et al., 2022).** Currently, all types of surgery use cold therapy extensively. Following TKA, patients are vulnerable to knee pain and edema, which in extreme situations can potentially result in the loss of knee function. Postoperative cold therapy can lessen pain perception and improve how well early rehabilitation training works. **(Basuny, et al., 2020).**

The primary duties of nurses in pain management are to understand how to measure pain through proper planning and implementation of the right therapies. Additionally, the nurse must offer the right guidance and instructions for the subsequent care after discharge, including therapeutic strategies and techniques for pain relief utilizing both pharmaceutical and non-pharmacological approaches. **(Kazan et al. 2017).**

Management of postoperative pain is largely the responsibility of nurses. The choice nurses make and the path of the care plan have an impact on patients' pain scores, recovery results, and hospital stay duration. Therefore, whether the therapies are pharmaceutical or non-pharmacological, the nurses should regularly monitor their efficacy and share

Significance of the study:
Recent estimates that was done by **(Naylor, Harmer, Franken, Crosbie, &Innes, 2020).** The year 2030 there will be 3.48 million TKAs performed annually although it is an extremely common and increasingly routine surgery, attention to detail is critical during the procedure to ensure that a well-balanced and functional, approximately out of 5 people that undergo a TKA will remain unsatisfied.

In Luxor hospital , at orthopedic department during my round with my student I found that Large number of patients after TKA operation returned to the hospital suffered from acute and severe pain also not able to perform the activities of daily living and knee range of motion, they cannot achieve the basic function of knee, for that my study was done in order to reduce post-operative pain and improve knee range of motion

Aim of the study:
The aim of this study was to evaluate the effect of performance cold compresses on reducing post-operative pain among patients with total knee replacement**.**

Research hypothesis:-
1. Application of cold compresses will reduce post-operative pain among patients with total knee replacement.
2. Application of cold compresses will assist patients to perform activity of daily living and knee range of motion nearly as pre-surgery.

Subjects and Methods
Setting:
The study was conducted in the orthopedic department at Luxor International Hospitals.

Study Design:
In this study, a quasi-experimental research design was applied.

Sample:
A convenience sample of 60 adult patients' post-knee replacement surgery. Who is fulfilling the inclusive criteria.

Inclusions Criteria:-
Patient is conscious and was freely agreeing to engage in the study and comply with study conditions.

Exclusions Criteria: -
Patients with dementia, those who have had a stroke that affected their lower extremities in the past, those who are extremely obese (body mass index of 30 cm or more), those who have rheumatoid arthritis or osteoporosis, and those who are under spinal and general anesthesia.

Tools of Data Collection
Two tools was developed and utilized by the researcher to gather data for this study; the researcher gathered the tools' content after conducting thorough literature review.

First tool:-
Patient structured interview sheet: that was designed by the researcher and comprised from three parts as follows:

Part I: **Socio- demographic data** of the patients preoperative as age, sex, marital status, education, residence, smoking history and occupation....etc.
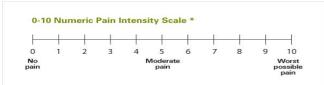
Part II: **Medical data as**: Date of admission, date of procedure, medical history, weight, BMI, deformity, any past leg surgeries, limitations on walking, usage of assistive devices, and prior health education programs for knee

replacement from orthopedic department nurses or other media... important performs, etc.

Part III: **Patient Observational Checklist:** The researcher created this tool to assess a patient's ability to carry out some daily tasks and knee range of motion (ROM) on the fourth post-op day. it was made up of four things: Knee flexion (bending knee by bringing heal toward back of thigh) and knee extension (return leg to the floor). The success of knee replacement surgery depends on it. Patients who have limited range of motion (ROM) before surgery are more likely to experience stiffness afterward. walking 10 steps in total. and 4- use the restroom.

Second Tool: Numeric of pain scale 2012. Using a numerical rating scale, assess the pain (NRS), NRS measures pain on a scale of 0 to 10. (0 mean no pain, 5 moderate pain and 10 mean worst possible). Nurses consider other indications and symptoms, such as anxiety, restlessness, and a rapid heart rate, in addition to pain ratings when assessing a patient's level of discomfort. (21)

Ethical considerations:

The objectives of the study was explained to the subjects and their approval to share in the study was been taken .Confidentiality of any obtained information was be ensured.

Tools validity and reliability:

A jury of five experts in the field of medical surgical nursing was evaluating the tools and scales for content validity. They revised the tools for clarity, relevance, applicability, comprehensiveness, understanding, and ease of implementation. Based on their recommendations, minor changes were made to the original versions. The instrument's internal consistency was examined.

Pilot Study:

10% (6 patients) of the sample was participating in a pilot study to evaluate the tools' **validity** and **reliability**. Then, in light of the findings of the pilot study, the tools was been changed.

Study procedure:-

In order to make data collecting easier, the researcher created tools that were translated into Arabic.

Results

Section (I): Socio-Demographic Characteristics:

First Tool: Socio- demographic and medical data: The researcher explained the goals and advantages of the study to each patient before obtaining their oral consent and beginning data collecting. Individual patient interviews will be conducted to gather socio-demographic information and a general assessment throughout the pre-operative phase. These interviews will last between 10 and 20 minutes each. First the study group, then the control group.

The researcher informed the patients during preoperative interviews that cold compresses after knee replacement surgery became your new best buddy and are a highly safe non-pharmacological technique to alleviate postoperative pain.

When a patient awakens from anesthesia, post-operative pain will start, necessitating the researcher's immediate application of topical, therapeutic cold compresses to relieve pain. Following a thorough literature study, the researcher calculated the length and frequency of cold compresses. In the first week following surgery, the researcher will apply cold compresses six times daily for 15-20 minutes. In the second week, it can be applied four times for 15–20 minutes. The patient is instructed to use the previous procedure for 15-20 minutes whenever they experience pain at home. When the researcher is not with the patients, the nursing staff will carry out this technique for the patients after the researcher has explained it to them. And how to gauge a patient's level of discomfort using a pain scale.

Second Tool: Numeric pain scale. Will be established for both groups of patients (study and control) at each post-operative day to assess the impact of cold compresses on reducing post-operative pain and enhancing various aspects of patient activity and tolerance (0 mean no pain, 5 moderate pain and 10 mean worst possible). The patient will be given a numeric pain scale by the researcher, who will then ask him to explain his discomfort by placing his finger on the appropriate area of the scale. After the first three days following surgery, both groups can conduct knee range of motion. Using the patient observational checklist, assess how much support is needed. Additionally, a patient's ability to do some daily activities, such as walking, is assessed using the Observational Checklist.

Limitations/difficulties of the study:

Wrong believes for some patients that cold compresses had negative effect or had no benefits for it in relieving pain or improving activity daily living and mobility level this lead to increase length of the study duration because of patient behavior
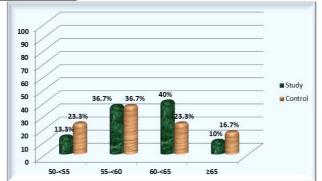

Figure (1): Percentage distribution of both study and control subjects regarding to their age (n=60)

Figure (1): Illustrates that the highest percentage (40%) of the study group's age ranged from 60 to 65 years, while the highest percentage (36.7%) of the control group ranged from 55 to 60 years. And the lowest percentage (10%) of the study group's age have more than 65 years, while the highest percentage (16.7%) of the control group's age has more than 65 years .
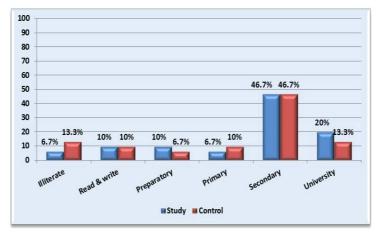

Figure (2): Percentage distribution of both study and control subjects regarding to their education level (n=60).

Figure (2): It illustrates that the largest percentages among study and control subjects had secondary education (46.7 % and 46.7%) respectively, and the lowest percentages among study were (6.7 % were illiterate & primary education) while the lowest percentages among control subjects 6.7% were preparatory education. .

Section (II): Medical Profile:
Table (1): Percentage distribution of both study and control subjects regarding to their medical characteristics (n=60).

P-value	Control (n=30)		Study (n=30)		Medical Profile
	%	**No.**	**%**	**No.**	
Medical Diagnosis					
0.963 [b]	40	12	36.7	11	Unilateral Knee Osteoarthritis
	50	15	53.3	16	Rheumatoid arthritis
	10	3	10	3	Psoriatic arthritis
Past medical history					
1.000 [b]	66.7	20	66.7	20	No Chronic Illness
	10	3	10	3	Diabetes
	13.3	4	13.3	4	Hypertension
	3.3	1	6.7	2	Hypothyroidism
	6.7	2	3.3	1	Diabetes & Hypertension`
BMI status					
0.730 [a]	30	9	26.7	8	(18.5-24.5): Healthy weight
	46.7	14	50	15	(25-30) Overweight
	13.3	4	10	3	(> 30 - 40) Obese
	10	3	13.3	4	(> 40) Very obese
	28.4 ± 5.9		**29.0 ± 6.1**		**Mean ± SD**
Gait status					
0.731 [b]	3.3	1	3.3	1	Stable
	86.7	26	76.7	23	Limping
	10	3	20	6	Dragging
Using Assistive Devices for Ambulation					
1.000 [b]	26.7	8	30	9	Crutches
	0	0	0	0	Canes
	0	0	0	0	Walkers
	73.3	22	70	21	Not Used

[*] P- value is significant at **(P ≤ 0.05)**
[a] *P*-value of student t test, [b] *P*-value of fisher's exact test.

Table 1 shows that the highest percentages of both study and control subjects were diagnosed as rheumatoid arthritis (53.3% & 50%) respectively, while the lowest percentages of both study and control subjects were having psoriatic arthritis (10% & 10%) respectively . Also, their past medical history among both study and control subjects (66.7% and 66.7%) respectively hadn't have any chronic illness, and the lowest percentages of both study and control subjects are diabetic and hypertensive (3.3% and 6.7%) respectively.

Also, it was found that the mean score BMI of the study and control subjects located in overweight category (29.0 ± 6.1, and

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28.4 ± 5.9) respectively. As regarding gait; it was found that the highest percentages of them had limping gait (76.7% & 86.7%) respectively. While the lowest percentages of them had stable gait (3.3 % & 3.3 %) respectively.

Related to using assistive devices for ambulation, it was found that the highest percentages of both study and control subjects didn't use any devices for ambulation (70% & 73.3%) respectively. While the lowest percentages of both study and control subjects was using crutches for ambulation (30 % & 26.7 %) respectively.

There was no statistical significance difference between the two groups regarding to medical characteristics at (P ≤ 0.05).

Table (2): Percentage distribution of both study and control subjects regarding to their performance for selected activity of daily living at 2ⁿᵈ, 3ʳᵈ & 1 week after application of cold compresses postoperatively (n=60).

Selected activity of daily living	Study (n=30)				Control (n=30)				P-value [a]
	Done		Not Done		Done		Not Done		
	No.	%	No.	%	No.	%	No.	%	
Eating ability									
2ⁿᵈ day postoperative	23	76.7	7	23.3	20	66.7	10	33.3	**0.001****
3ʳᵈ day postoperative	27	90	3	10	24	80	6	20	
After one week postoperative	30	100	0	0	30	100	0	0	
Ability of using a toilet									
2ⁿᵈ day postoperative	3	10	27	90	2	6.7	28	93.3	**0.001****
3ʳᵈ day postoperative	23	76.7	7	23.3	20	66.7	10	33.3	
After one week postoperative	26	86.7	4	13.3	21	70	9	30	
Ability of walking 10 steps									
2ⁿᵈ day postoperative	5	16.7	25	83.3	9	30	21	70	**0.001****
3ʳᵈ day postoperative	24	80	6	20	22	73.3	8	26.7	
After one week postoperative	27	90	3	10	24	80	6	20	

** P- value is highly significant **(P ≤ 0.01)**
[b] *P*- Repeated Measures Annova test.

Table (2): Shows a highly statistical significance difference between the two groups for all selected activity of daily living at 2ⁿᵈ, 3ʳᵈ and 1 week postoperatively.
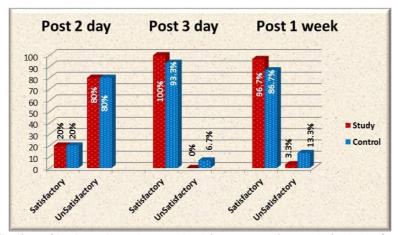.

Figure (3): Percentage distribution of both study and control subjects regarding to their level of performance of total score for all activity of daily living 2ⁿᵈ, 3ʳᵈ & 1 week of implementing cold compresses postoperatively. (n=60)

Figure (3): Reveals that the highest percentages of study and control subject possessed unsatisfactory level of practicing activity of daily living after 2 days postoperative (80% & 80%) respectively. While the highest percentages of study and control subject possessed satisfactory level of practicing activity of daily living after 1 week postoperative (96.7% & 86.7%) respectively. .

Table (3): Percentage distribution of both study and control subjects regarding to their ability to perform knee ROM at 2ⁿᵈ, 3ʳᵈ & 1 week after application of cold compresses postoperative (n=60).

ROM	Study (n=30)				Control (n=30)				P-value [a]
	Done		Not Done		Done		Not Done		
	No.	%	No.	%	No.	%	No.	%	
Flexion of the knee									
2ⁿᵈ day postoperative	12	40	18	60	11	36.7	19	63.3	**0.003****
3ʳᵈ day postoperative	22	73.3	8	26.7	20	66.7	10	33.3	
After one week postoperative	26	86.7	4	13.3	21	70	9	30	
Extension of the knee									

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ROM	Study (n=30)				Control (n=30)				P-value [a]
	Done		Not Done		Done		Not Done		
	No.	%	No.	%	No.	%	No.	%	
2nd day postoperative	17	56.7	13	43.3	11	36.7	19	63.3	
3rd day postoperative	21	70	9	30	19	63.3	11	36.7	0.001**
After one week postoperative	27	90	3	10	23	76.7	7	23.3	

** P- value is highly significant (P ≤ 0.01) .   [b] P- Repeated Measures Annova test.

Table (3): Showed a highly statistical significance difference between the two groups regarding flexion and extension of knee at 2nd, 3rd and 1 week postoperative.

Table (4): Mean score of both study and control subjects regarding to their post-operative pain after implementing cold compresses (n=60) .

Pain Scale	Study (n=30)	Control (n=30)	P-value [a]
	Mean ± SD	Mean ± SD	
2nd day postoperative	6.9 ± 1.06	7.86 ± 0.899	**0.001****
3rd day postoperative	3.2 ± 0.520	4.7 ± 1.01	**0.001****
1 week postoperative	2.06 ± 0.583	3.7 ± 1.11	**0.001****
P-value [b]	0.001**		

* P- value is significant (P ≤ 0.05)
** P- value is highly significant (P ≤ 0.01)   [a] P- t test
[b] P- Repeated Measures Annova test

   Table (4): Shows a highly statistical significance reduction regarding level of pain between the two groups at 2nd, 3rd and 1 week postoperative.

Table (5): Relations between Socio-demographic characteristics of both study and control subjects & level of pain after 1 week postoperative (n=60)

	Study				Control				
	Satisfied (n=29)		Not satisfied (n=1)		Satisfied (n=26)		Not satisfied (n=4)		
	No	%	No	%	No	%	No	%	
Age									
50-<55	4	13.7	0	0	6	23.1	1	25	
55-<60	11	37.9	0	0	9	34.6	2	50	
60-<65	11	37.9	1	100	6	23.1	1	25	0.174
≥65	3	10.3	0	0	5	19.2	0	0	
Sex									
Male	22	75.8	1	100	19	73.1	3	75	
Female	7	24.1	0	0	7	26.9	1	25	0.409
Marital status									
Single	4	13.7	0	0	5	19.2	0	0	
Married	22	75.8	0	0	18	69.2	2	50	
Widowed	2	6.8	1	100	1	3.8	2	50	0.194
Divorced	1	3.4	0	0	2	7.6	0	0	
Level of Education									
Illiterate	2	6.8	0	0	4	15.3	0	0	
Read & write	3	10.3	0	0	2	7.6	1	25	
Preparatory	3	10.3	0	0	2	7.6	0	0	
Primary	2	6.8	0	0	3	11.5	0	0	
Secondary	13	44.8	1	100	12	46.1	2	50	0.108
University	6	20.6	0	0	3	11.5	1	25	
Residence									
Rural	18	62.1	1	100	15	57.6	3	75	
Urban	11	37.9	0	0	11	42.3	1	25	0.278
Occupation									
Professional	10	34.4	0	0	12	46.1	1	25	
Manual	8	27.5	0	0	8	30.7	1	25	0.105
House wife	11	37.9	1	100	6	23.1	2	50	

* P- value is significant **(P ≤ 0.05)**   P- value – Chi square
   Table (5): Shows a non-significant association between socio-demographic characteristics and pain level among both study and control subjects after 1 week postoperative.

Table (6): Relations between medical profile of both study and control subjects & level of performance of selected activity of daily living after 1 week postoperative (n=60).

Medical profile	Selected activity of daily living After 1 week postoperative								P value
	Study				Control				
	Satisfied (n=29)		Not satisfied (n=1)		Satisfied (n=26)		Not satisfied (n=4)		
	No	%	No	%	No	%	No	%	
Medical Diagnosis									
Unilateral Knee Osteoarthritis	11	37.9	0	0	10	38.4	2	50	
Rheumatoid arthritis	15	51.7	1	100	14	53.8	1	25	
Psoriatic arthritis	3	10.3	0	0	2	7.6	1	25	0.267
Past medical history									
No Chronic Illness	20	68.9	0	0	17	65.3	3	75	
Diabetes	2	6.8	1	100	2	7.6	1	25	
Hypertension	4	13.7	0	0	4	15.3	0	0	
Hypothyroidism	1	3.4	0	0	2	7.6	0	0	0.161
Diabetes & Hypertension`	2	6.8	0	0	1	3.8	0	0	
BMI status									
(18.5-24.5): Healthy weight	8	27.5	0	0	8	30.7	1	25	
(25-30) Overweight	14	48.2	1	100	11	42.3	3	75	
(> 30 - 40) Obese	3	10.3	0	0	4	15.3	0	0	
(> 40) Very obese	4	13.7	0	0	3	11.5	0	0	0.173

Table (6): Shows a non-significant association between medical characteristics and selected activity of daily living among both study and control subjects after 1 week postoperative

Table (7): Correlation between pain level of both study and control subjects & performance of selected activity of daily living and knee ROM after 1 week postoperative (n=60)

Variables	Pain level			
	Study		Control	
	r	P	r	P
Activity of daily living	- 0.509	0.102	-0.444	0.145
ROM	-0.960	0.01*	-0.417	0.154

[*] P- value is significant (**P ≤ 0.05**)

Table (7): Shows a non-significant negative correlation between pain level and activity of daily living among both study and control subjects after 1 week postoperative, also, there is a negative correlation between pain level and knee ROM among both study and control subjects after 1 week postoperative with a significance difference for study group

Discussion

Total knee arthroplasty (TKA) is commonly performed in patients with end-stage osteoarthritis or rheumatic arthritis of the knee to relieve joint pain, increase mobility, and improve quality of life. However, TKA is followed by moderate to severe postoperative pain which inhibits early ambulation and range of motion, risking thromboembolism, and affects rehabilitation, patient satisfaction, and overall outcomes (Li, Ma, & Xiao , 2019).

Cold therapy can be applied to reduce pain and swelling in patients with total knee arthroplasty. The effect of cold therapy can lead to increase in joint movement due to temporary reduction in pain, and thus strengthen muscle strength (Park, 2021) .

The study was carried out aiming to: evaluate effect of performance cold compresses on reducing post-operative pain among patients with total knee replacement.

Regarding the socio-demographic characteristics the results of the current study revealed that around half of the study group were in age category between 60 to 65 years, while the one third of the control group were in age category between 55 to 60 years, this result relates the changes in joint tissues to the increasing age. Advanced age contributes to knee osteoarthritis, which considers the main indication of total knee arthroplasty surgery. This result agrees with(**Kwoh et al. 2015),** whose study entitled "Determinants of patient preferences for total knee replacement" also resulted in the mean age of patients was 58.68±8.13. Also, this finding is in the same line with **Fawzy et al. 2020),** in his study "Biopsychosocial needs of patients undergoing total knee replacement," they reported that slightly more than half of the studied patients were above 60 years at mean age 59.7±6.86 and range from 41-72 years.

In relation to education levels it was found that the around half of study and control group were secondarily educated, this finding is in consistent with **Vina et al. (2016)**, in a study entitled "Improvement following total knee replacement surgery: Exploring preoperative symptoms and change in preoperative symptoms," which found that most participants had secondary education, also, the result is in the same line with **Reslan et al. (2018),** who founded that half of both groups had high school.

The current study disagrees with **Franklin et al. (2017)** in a study entitled "Important patient characteristics differ prior to total knee arthroplasty and total hip arthroplasty," they reported that most patients had a college education.

Current study found that There was no statistical significance difference between both groups regarding their demographic characteristics with p-value >0.05, which indicates that the two groups were nearly homogenous.

The current study found that the gradual common medical diagnosis among both (study and control) groups were rheumatoid arthritis, Unilateral Knee Osteoarthritis or Psoriatic arthritis, this is agreed by **Çınar & Çam (2018)**, who studied "the effects of progressive relaxation method on the patients applied total knee arthroplasty" and who mentioned that degeneration of knee joint was due to rheumatoid arthritis, osteoarthritis, posttraumatic arthritis, and other nonspecific arthritis.

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Related to the patient's medical characteristics, the current study revealed that the common medical diagnosis among both (study and control) groups were rheumatoid arthritis, this finding might be because TKA is generally accepted as a definitive treatment for advanced knee arthritis after a patient fails non-operative treatments.

These results are in the same line with **Fawzy et al. (2020),** who reported that about three-quarters of patients under study were candidates to the TKR due to knee osteoarthritis. Also, this result agrees with **Souza et al.'s (2016)**, study entitled "Clinical demographics characteristics of total knee arthroplasty in a university hospital," which reported that osteoarthritis affected 87.65% of patients.

In relation to presence of chronic illness; the study illustrated that more than two thirds of both groups had no chronic illnesses while nearly quarter of the patients who had a chronic disease were diagnosed with hypertension, this finding might be due to more than half of the control and majority of the study group in the age category between 51 to 60 years old, and in this age category, in average people in Egypt related to many causes as hypertension.

This result was in congruence with **Taha & Ibrahim (2021),** who stated that more than one-third of the control group and half of the study group had hypertension. Also, **Ryu et al. (2021)** reported that osteoarthritis was significantly associated with hypertension diagnosis in this middle-aged after adjustment for age, smoking, alcohol, and obesity. This finding was congruent with **Souza et al. (2016),** who found that hypertension was the most prevalent comorbidity in participants.

This result in contrast with **Basuny, Zatton, & Abo-Hashem, (2020)** in study titled " Responsiveness of pain and associated health issues of patients with knee osteoarthritis to the revulsive compresses" found that more than half of participant patients had systemic disease, and more than two-fifths did not**.**

As regard body mass index (BMI) it was found that mean (29.0 ± 6.1, and 28.4 ± 5.9) of the study and control groups respectively. In the researcher point of view obesity and overweight can be attributed to the increased mechanical loading of the knee and hip, which can result in degeneration and damage to the cartilage of weight-bearing joints. This result was in line with **Elsaid, Othman & Mohamed (2018)**, who mentioned that about half of the patients' were overweight with BMI mean were (29.6±2.1 and 29.1±3.03).

As regarding gait; it was found that the majority of the study and control groups had limping gait during preoperative period, but most of them didn't use any devices for ambulation. While the lowest percentage of them had stable gait.

Results of the current study were supported by **Sloan, George & Hu (2014)** in the study done about "Productivity Improvements in Hip and Knee Surgery", who revealed that persons who underwent joint surgery tended to be more impaired in physical function than those who did not undergo surgery, regarding to the mean values on physical functioning.

Also, compatible with **Quervain et al. (2012)** in a study entitled "Prospective study of gait function before and 2 years after total knee arthroplasty", who stated that there were significant improvements in gait velocity and cadence and most of the ground reaction parameters after 2 years of total knee replacement than before.

Also, the current study result reveals that there was no statistical significance difference between both groups regarding medical history with a p value >0.05, which indicates that the two groups were nearly homogenous.

As regard activity of daily living:
The present study reveals that activity of daily living was improved after cold therapy which helps improvement in ROM and walking, the researcher regarded that to the benefits of cold application which might be attributed to a reduced inflammatory response.

Concerning range of motion (ROM), the present study showed that a highly statistical significant improvement regarding performance of knee ROM (flexion and extension) at 2nd, 3rd & 1 week after application of cold compresses postoperatively for the study group and show, satisfactory level of practicing knee ROM after implementing the cold compresses 2 days postoperatively. While the highest percentage of study and control subject possessed satisfactory level of practicing knee ROM after 1 week postoperatively.

This result is in line with **Liao & Xu (2022)** who investigated " The effect of cold therapy combined with ERAS in the postoperative care of patients undergoing total knee arthroplasty", who mentioned that the ROM scores of study group were significantly higher than those of control group at all-time points after surgery ($P < 0.05$).

Also agreement with **Van Ooij (2020)**, who studied that "Cryotherapy after Total Knee Arthroplasty provides faster recovery and better ranges of motion in short term follow up", who mentioned that the cryotherapy group showed a significant better knee flexion at the fourth postoperative day and after two and six weeks.

Regarding pain level, the results illustrate that A decrease in pain level was prominent with a mean value of 6. 6.9 ± 1.06 for the study group and 7.86 ± 0.89 for the groups on second day post-operative, with significant difference between the studied groups (P=0.001). A significant decrease in pain severity in study 3.2 ± 0.520 and control group 4.7 ± 1.01 was noticed at the third day post-operative, with a statistical significant difference between the two groups p = 0. 001.Also there were significant decrease in pain severity in study 2.06 ± 0.583 and control group 3.7 ± 1.11 was noticed at the 1st week post-operative, with a statistical ssignificant difference between the two groups p = 0. 001.

The present study revealed that the pain level was decreased after cold therapy which helps improvement in ROM and walking, the researcher regarded that to the benefits of cold application which might be attributed to a reduced inflammatory response, these is agreed by **Sadoghi, et al., (2018)**, who mentioned that study group showed a reduction in pain which cause the improvement in their ROM.

These results on the same line with **Thacoor & Sandiford (2019)**, who studied that "Cryotherapy following total knee arthroplasty: what is the evidence? ", who observed significantly better pain control and patient satisfaction in patients treated with cryotherapy compared to epidural anesthesia in studied patients following TKA.

Another agreement with **Elsaid, Othman & Mohamed (2018)**, noticed that a significant decrease in pain severity in study and control group at the second day after cryotherapy, with a statistical significant difference between the two groups.

Additionally, another study conducting in Bari by, **Coviello v et al, (2022)** who mentioned that significant reduction in pain score was observed at (24 h), however there was a reduction in pain score after every cooling session in the study group.

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The study demonstrated that there was a non-significant association between socio-demographic characteristics and pain level among both study and control subjects after 1 week postoperative. In the same line, **Lindberg et al. (2017)**, illustrated that sex and age were not associated with pain in their study, while age correlated with pain at rest and the female gender was a risk factor for early postoperative pain. On the contrary, **Devasenapathy et al. (2020)**, said that women had higher pain levels than men.

A systemic review by **Hernnd et al. (2015)**, disagree with current study demonstrated that in general postoperative pain association with sociodemographic characteristics as following; age has an inverse association, female sex was associated with more intensity, however, most of the studies found no association with level of education..

This result was agreed with Ahmed, Afshan & Khan (2022), who stated that, better pain relief would improve quality of life and ensure continuity of daily life routines of the patient.. Also in the same line with **Huang et al. (2021)**, a negative relationship between pain and knee adduction was reported.

To sum up of this discussion of the current study documented that, the studied patients showed better improvement of range of motion post implementing cold application as compared to the control group. In addition to that, most of the patients in study group represented a low level of pain compared to control group which support completely the study hypothesis.

Conclusion

Based on the findings of this study we can conclude that:

- The total knee replacement surgery can change the lifestyle of a person living with osteoarthritis or another knee condition that causes continuous pain. While there are many risks involved with this surgery and a long recovery process, the outcome is worth the work in most cases.
- The total knee replacement is a more invasive surgery where the bone is cut away and the entire joint is replaced with prosthesis. Recovery is difficult, and usually takes six to eight weeks of intense physical therapy. The patient still needs physical therapy, but should be able to walk without assistive devices.

Recommendations:

The total knee replacement is effective at reducing pain in the knee. However, it is useful for different populations. There is more information about the total knee replacement because it is more common, and generally attracts a larger population. If the patient has injury to more than one compartment of the knee, they are not eligible for a partial knee replacement. This would only correct part of their problem, because only part of the knee is replaced. However, if the patient only has injury to one compartment, they are eligible for the partial knee replacement.

The patients may need to decide which surgery is best for them. If their condition may progress and cause injury in additional compartments, they may want to consider a total knee replacement in case a revision may be needed in the future. If the patient's condition will not get worse. There are also fewer risks throughout the surgery and recovery process. This would be beneficial to the patient and their well-being.

Summary

Cold compresses after knee replacement surgery is one of non pharmacological methods which is very important to relive post operative pain after total knee replacement. It began new best friend for patients because it is very safe non pharmacological method to reduce post operative pain.

The physiologic effects of cold application include immediate vasoconstriction with reflexive vasodilation, decreased local metabolism and enzymatic activity, and decreased oxygen demand. Cold decreases muscle spindle fiber activity and slows nerve conduction velocity; therefore, it is often used to decrease spasticity and muscle guarding. It is commonly used to alleviate the pain of minor injuries, as well as decrease muscle soreness. The use of ice packs in treatment decreases the blood flow most rapidly at the beginning of the cooling period,[24] this occurs as a result of vasoconstriction, the initial reflex sympathetic activity.

The present Study aimed to:

This study is to evaluate effect of performance cold compresses on reducing post operative pain among patients with total knee replacement.

Methods:

To achieve the goal of this study, a quasi-experimental research methodology was used.

A purposively sample of 60 Adult patients post knee replacement surgery. Who is fulfilling the inclusive criteria, in orthopedic department at Luxor International Hospitals? And divided into two groups: study and control.

Tool of study:
Tools of data collection:

The current study data was collected through one tool and one scale as following:

First tool Scio demographic and medical data: - This tool was formulated by the researcher after extensive literature review as (clinical manual for nursing practices, Louise 2014 & lewis, et al., 2014. & JMFdS et al ,2016 (

Part (A): assess patients socio- demographic data as age, sex, marital status, education, residence....etc.

Part(B): assess patients medical data as: medical history , weight , deformity , any other surgery on legs , limiting walking , use assistance devices , previous health teaching program for knee replacement from orthopedic department nurses or other media… vital sings ...etc.

Part(C): patient observational checklist:

Patient's performance regards selected activity daily living (ADL). As eating, using a toilet, and walking. It was used in second and third day post operative after application of cold compress by the researcher to evaluative patient abilities to perform these activities also this part was evaluated again in the first follow up appointment for (after one week from surgery) all correct step scored (1) ,while incorrect or not done responses scored (0) with a satisfactory level of practice if more than 60% of the complete checklist and unsatisfactory level of knowledge if less than or equals 60%.

Part (D): knee rang of motion (ROM) checklist;

Patient's performance regard selected knee rang of motion (ROM) to assess patients degree to perform it at the fourth day after TKR surgery as literature was mentioned, this checklist included passive flexion and passive extension

knee ROM done by the researcher and assistant groups from department nurses two times daily. Also this part was evaluated again in the first follow up appointment for (after one week from surgery.

All correct step scored (1), while incorrect or not done responses scored (0) with a satisfactory level of practice if more than 60% of the complete checklist and unsatisfactory level of knowledge if less than or equals 60%.

Numerical Rating scale (NRS) adopting by **McCaffery. & Beebe (1989).**

This scale was applied to assess patient's pain level through rank from zero to ten, scoring system for this scale when patient assessment indicates (0) means no pain, 5 moderate pain and 10 means worst possible.

The finding of our study as the following:

As regards to socio-demographic character of the studied groups:

the highest percentage (40%) of the study group's age ranged from 60 to 65 years, while the highest percentage (36.7%) of the control group ranged from 55 to 60 years. And the lowest percentage (10%) of the study group's age have more than 65 years, while the lowest percentage (16.7%) of the control group's age has more than 65 years .

As regards to their level of performance of total score for all activity of daily living.

The highest percentages of study and control subject possessed unsatisfactory level of practicing activity of daily living after 2 days postoperative (80% & 80%) respectively. While the highest percentages of study and control subject possessed satisfactory level of practicing activity of daily living after 1 week postoperative (96.7% & 86.7%) respectively.

As regarding to their level of total score for all knee ROM

The highest percentages of study and control subject possessed unsatisfactory level of practicing knee ROM after implementing the cold compresses 2 days postoperatively (86.7% & 63.3%) respectively. While the highest percentages of study and control subject possessed satisfactory level of practicing knee ROM after 1week postoperatively (76.7% & 56.7%) respectively.

Both study and control subjects regarding to their post-operative pain after implementing cold compresses (n=60) .

Shows a highly statistical significance reduction regarding level of pain between the two groups at 2nd, 3rd and 1 week postoperative.

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