Effect of Cold Rub Gel, Warm Versus Contrast Therapy on Pain and Joint Function in Patients with Knee Osteoarthritis

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Abstract

Background: Osteoarthritis (OA) is by far the most common and debilitating form of arthritis which can be defined as a degenerative condition affecting the synovial joint. Osteoarthritis patients frequently complain of a dull aching sensation when moving. When utilized effectively, physical agents such as warm or cold therapy can help to combat the unpleasant process. **Aim**. This study aimed to evaluate the effect of cold rub gel, warm versus contrast therapy on pain and joint function in patients with knee osteoarthritis. **Design**: A quasi-experimental comparative research approach was used to achieve the study's goal. **Setting:** The research was carried out at the Orthopedic outpatient clinic, Helwan General Hospital, Egypt. **Sample**: 60 adult patients with unilateral knee osteoarthritis were chosen as a purposive sample. Tools: The data was collected using four different tools. **tool I:** A questionnaire for an interview**. Tool II:** Knee Injury and Osteoarthritis Outcome Scale (KOOS). **Tool III**: 0-10 Numeric pain rating scale. **Tool IV:** Observational checklist. Results: demonstrated that after using the cold rub gel, warm and contrast method of therapy, the overall knee symptoms score went from moderate to mild. But the contrast therapy had a significant effect in reducing knee symptoms and pain and improving joint knee function than the other methods**. Conclusions:** all of the three methods of therapy resulted in improvement in all knee symptoms and pain but the most appropriate method of treatment to relieve symptoms and pain was contrast therapy. **Recommendation:** the study recommended that Contrast therapy should be considered the most effective treatment option for relieving knee symptoms and pain in patients with knee osteoarthritis.

Keyword: cold rub gel, warm therapy, contrast therapy, knee osteoarthritis.

Introduction

Osteoarthritis (OA) is the most common disease affecting over 20 million people in the United States. Consultations for osteoarthritis account for 15% of all musculoskeletal consultations in those aged 45 years old and over. More than 10 million Americans have knee osteoarthritis. It is also the most common cause of disability in the United States (William C and Shiel JR, 2017) In Egypt, the prevalence rate for Osteoarthritis represents 5,596,869 of the total population (Statistics by Country for Osteoarthritis, 2019). Osteoarthritis affects the weight-bearing joints in the knees, hips, and hands. Osteoarthritis of the knee is a common and progressive condition. It is reported that 6% of adults suffer from Knee osteoarthritis is clinically significant, with the prevalence increasing with each decade of life (Michael et al., 2020).

It can be classified according to its causes or predisposing factors as either primary or secondary. The primary one (idiopathic) is the most typical type and has no identifiable causes rather than genetic predisposition. Several disorders are recognized as the causes of secondary OA. They can be grouped into four basic categories such as, metabolic as calcium crystal deposition and acromegaly; anatomic as leg length inequality and congenital hip dislocation; traumatic as fractures and sprains and inflammatory as ankylosing spondylitis and septicarthritis (Pellino et al., 2021).

Osteoarthritis patients frequently complain of dull ache pain when moving, which usually occurs as movement is began. As osteoarthritis progress, the pain becomes continuous, and the functionality of the joint is severely impaired (Michael et al., 2020). However, among community residents, it has been discovered that chronic pain is the most significant issue influencing daily life. Patients prefer to avoid physical exercise for fear of aggravating their discomfort. Moreover, knee OA sufferers often show joint stiffness, tenderness, crepitus, joint

enlargement, deformity, muscle weakness, limitation of joint motion, impaired proprioception, and disability. Patients may experience a serious impact on daily activities due to difficulty in walking, moving, climbing stairs, entering and exiting a vehicle, and/ or Instability or buckling of the joints together while sitting on a chair with weakness of the thigh muscles (Chen, 2020and Tsauo, et al., 2021).

It is not a curable disease, as the mechanism by which it arises and progress remains incompletely understood. Therefore, the goal of treatment is to reduce the disease's signs and symptoms and if possible to show its progression. Multiple treatment options are available for patients with OA of the knees including the use of superficial warm or cold, obesity management, exercises, oral pharmacological therapy, injection of corticosteroid, or ultimately knee joint replacement surgery (Cetin et al., 2021and Zhang et al., 2022).

Medication and surgery are not without risks and adverse effects that are not associated with some remedies such as warm on the surface or cold applications. Furthermore, not all treatment options meet the same results, supporting individualized patient management approaches; Others' benefits, such as corticosteroid injections, do not persist eternally and must be repeated. The use of superficial warm or cold regularly is a generally safe and low-cost treatment that can be used alone or in conjunction with other treatments. Contrast therapy is one strategy that involves the repetitive application of cold and then warm in an alternating fashion. It offers an alternative option in the management of many different musculoskeletal conditions including knee OA (Oosterveid F. And Rasker J, 2021 Soo Hoo et al., 2022).

Warmth can help with circulation and muscle relaxation, so decreasing pain, while cold can numb the pain, reduce swelling, constrict blood vessels, and block nerve impulses to the joint, (Brosseau et al., 2019). The usual sources of warm and/or cold therapy in- include either a warm or cold compress, ultrasound for heat modalities, either a warm or cold bath or shower, and heating pads for heat remedies (Berarducci A, 2019).

The nurse plays a crucial role in providing the right patient care by applying the conservative method used in the treatment of osteoarthritis such as thermo- therapy, cryotherapy, or contrast therapy. The nurse also should work with the patient during the application of therapy starting from preparation, and application over patients' affected joints with continuous observation for patients' tolerance of the procedure and skin or systemic reaction to the procedure. Moreover, the nurse should teach the patient self-application of these therapies (Dowall T, 2020).

Few studies are available to demonstrate if either cold, warm, or contrast therapies are of greater benefit and there are no clear answers or recommendations for patients to follow, hence the purpose of this study was to evaluate the effect of cold rub gel, warm, versus contrast treatment procedures on pain and joint function in patients with knee osteoarthritis.

Significance of the study

Osteoarthritis is the most common disease affecting 5,596,869 of the total population in Egypt (Statistics by the Country for Osteoarthritis, 2019). Osteoarthritis of the knee pain is a frequent and developing problem. According to reports, 6% of adults have clinically severe knee osteoarthritis, with the frequency growing with each passing decade (Michael et al., 2020). It has been observed that there are many patients ad- mitted to orthopedic outpatient, clinics, and rehabilitation departments with orthopedics department and physiotherapy. knee osteoarthritis in Helwan General Hospital complaining of joint pain, swelling, and unable to perform activities of daily living. Physiotherapeutic conservative measures are often an adjunct to medical treatment or a follow-up to surgical intervention warm or cold therapy, it is hoped that one of the therapies (warm, cold, or contrast) may aid in the relief of the patient's complaints and provide patients with simple, safe, time, effort, and cost-effective therapy options for their ailments and provide evidence-based practice that guides nurses when dealing with such problems.

Aim of the study

The purpose of the study was to evaluate theeffect of cold rub gel, warm، versus contrast

therapy on pain and joint function in patients with knee osteoarthritis.

Research Hypotheses

To meet the study's aim, the following research hypotheses were developed:

1. Cold rub gel, warm and contrast therapy resulted in improvement in all knee symptoms and pain.
2. Contrast therapy will be more effective in decreasing pain and knee joint function than warm or cold therapy.

Operational definitions:

Contrast therapy: is one strategy thatinvolves the repetitive application of cold then warm in an alternating fashion.

Patient's joint function and pain: referred to Knee osteoarthritis outcomes; an improvement of patient's practice of the three treatment procedures, had a positive effect on osteoarthritis problems and pain.

Subjects and Method

1. Subjects

Design: quasi-experimental comparative research design was used to attain the study's aim.

Setting: The research was done at orthopedic outpatient clinics in Helwan General Hospital.

Subjects: A group of 60 adult patients with unilateral knee osteoarthritis was purposively chosen who are:

Inclusion criteria:

Willing to take part in the study, both sexes with no history of the previous knee or hip arthroplasty or any other orthopedic surgical procedure on the affected knee, having no metal implants and/or pacemaker or cardiac disorders that affect local circulation and not re- receiving corticosteroid injection to the knee within the past 6 months as well, free from diminished sensation to heat orcold in the knee area.

Sample size: The subjects of our study were chosen from orthopedic outpatient clinics in Helwan General Hospital which are considered reference hospitals for knee osteoarthritis cases. Knee osteoarthritis cases at attending orthopedics outpatient clinics in Helwan General Hospital were 3900 cases annually. With power, 80% of the sample size was87 cases. So, we collect our data from 87 subjects that matched the selection criteria, only 60 subjects agreed to complete all three treatment protocols therapy and27 subjects refused to carry cold and contrast therapy.

Data collection was compiled using Four tools:

Tool I: Structured interviewing questionnaire:

Based on an examination of pertinent and contemporary literature, the researcher created it in Arabic. **(Knufinke et al., 2018)**. It included the following three parts:

Part one: Demographic Data. It included information about the patient's age, sex, marital status, level of education, and occupation.

Part two: Medical Data. It was comprised of questions about body mass index, reasons for visiting the hospital, family history of osteoarthritis, and vital signs.

Part three: Localized inflammation, redness, and heat. etc. are all side effects of the treatment.

Tool II: Knee Injury and Osteoarthritis Outcome Score (KOOS): It was developed by **(Roos and Lohmander, 2003)** to gauge patients' feelings regarding their knees and related issues. The English version was used and then translated by the researchers. The scoring system was modified by researchers it is divided into five parts as follows:

Part one (pain): It contained questions about knee pain sensations in the previous week, such as the frequency and severity of knee pain. during twisting, straitening, Knee Bending, on a level surface, walking, going up and down stairs, being in bed at night, sitting or lying, and standing upright.

Part two (other symptoms): It asks about other symptoms you've had in the recent

week, such as swelling in your knee or hearing noises when you move your knee, hanging up knee on moving and the ability to fully straighten and bend the knee. Also, there were questions about the amount and severity of experienced knee joint stiffness during the last week after waking in the morning, after sitting, lying, or resting later in the day.

Part three (function in daily living): Questions about the degree of experienced difficulty in the function of daily living in the last week during descending and ascending stairs, rising from sitting, standing, bending to pick up an object from the floor, walking on aflat surface, getting in and out of the car, going shopping, put- ting on and off socks, lying in and raising from bed, getting in and out of bath and toilet and having light and heavydomestic duties.

Part four (function in sport and recreation): Questions about the degree of experienced difficulty in sports and recreational activities during the last week in squatting, running, jumping, twisting, andkneeling the injured knee.

Part five (knee-related quality of life): Questions about the frequency of awareness of knee problems, whether lifestyles are modified to avoid potentially damaging activities, and the amount of difficulty with the knee during the last week.

Scoring system: The standardized answer options were given five Likert boxes and each question had a score from zero to four in which zero indicates no problems, while four indicates extreme problems. Each of the five scores was calculated as the sum of the items included. A total score of 144-186 indicates extreme knee symptoms, while 100 to 143 score indicates moderate symptoms but 56 to 99 indicates mild symptoms and less than 56 represents no knee symptoms.

Tool III: 0-10 numeric pain rating scale: It was developed by **(Mc Caffery and Beebe, 1993)** to assess pain intensity. The scale translated by the researchers consisted of a 10 cm line that was numerated from zero to ten in which: 0= no pain, 1-3= mild pain (little interfering with activities of daily living), 4-6= moderate pain (interfering significantly with activities of daily living), 7-10= severe pain (disabling, unable to perform activities of daily living).

Tool IV: Observational checklist: It was developed by the researchers to assess subjects' practice for applying the three treatment procedures. It consisted of seven statements to be checked by the researchers if it was carried out by the subjects or not such as assessing the skin of the knee, checking the temperature of the water, filling the pack for one- half to two-thirds, removing air from the pack, checking the pack for leaks, covering the pack with a towel then applying it and assessing the response of the skin to the applied pack.

Scoring system: each statement was given a score of one of the actions being made correctly and zero if it is not done or done incorrectly. The total score was summed with a higher score indicatinggood practice.

Operational design

The operational design includes the preparatory phase, content validity and reliability, pilot study, and fieldwork.

A) Preparatory phase:

It included reviewing related literature and theoretical knowledge of various aspects of the study using books, articles, and periodicals to develop tools for data collection.

B) Tool validity and reliability:

- **Tool Validity:**

Tool validity was conducted to determine whether the tool covered the aim of the study or not. It was tested through a panel of seven experts; three professors, three assistant professors, and one lecturer of medical surgical nursing from Ain Shams and Helwan University who review the tool to ensure its validity for comprehensiveness, accuracy, clarity, and relevance. **Tools development:** the first and fourth tools were constructed by the researchers after reviewing the relevant

literature, while the second tool was developed by **Roos and Lohmander** and the third tool was developed by **McCaffery and Beebe. Tool II and III** were translated into Arabic by the researchers then all tools were tested for content validity by 5 experts in the Nursing and Orthopedic fields. Modifications were done accordingly to ascertain relevance and completeness.

Tool Reliability:

The reliability of the developed tools was tested and assessed in a pilot study by measuring their internal Consistency using Cronbach's alpha method. All tools were tested using a test-retest method and a Pearson correlation coefficient formula was used. It was 8.7 for Tool 1, 8.9 for Tool II, 9.1 for Tool III, and 7.8 for Tool IV.

C) Pilot study:

Before the actual study, a pilot study was conducted on 10% of the study sample (6 patients) to test the feasibility and applicability of the tools and then necessary modifications were carried out accordingly. Data obtained from the pilot study were not included in the current study.

D) Field work:

The study was conducted through three consecutive phases: interviewing & assessment phase, implementation phase, and evaluation phase which takes three months for data collection from the start of May 2023 till the end of July 2023.

The interviewing and assessment phase:

The researchers introduced themselves to every participant, and explain the purpose of the study, the components of the tools, and the steps of the contrast therapy. The time required to complete the questionnaire ranged from 20-35 minutes for every patient and assured them that confidentiality would be maintained throughout the study then verbal consent was obtained from each participant.

The implementation phase:

The researcher-initiated data collection by assessing demographic and medical data by interviewing each participant individually using a tool I.

a. The opinion of patients about knee and associated problems for each participant was assessed using knee injury and osteoarthritis outcome score (KOOS) (tool II). Each participant was assessed for pain and its intensity using a 0-10 numeric pain rating scale (tool III).
b. All participants were observed for their practice about all of the three treatment procedures using tool IV (observational checklist).
c. Each participant was asked to complete the three treatment procedures including cold rub gel, warm, and contrast (alternating cold and warm for one week; 7 days duration). The applications were applied through bottles over layers of the towel around the affected knee as follows:

1. Assess the condition of the skin where the bag is applied for; color, sensation, temperature, and alteration in skin integrity as a wound, edema, and bleeding.
2. Check the temperature of the water for warm or contrast therapy with a bath thermometer (40-43c^{o}) or test it by the inner wrist.
3. Fill the bag with water for warm therapy or with cold rub gel for cold therapy. The filling should be one-half to two-thirds full.
4. Remove the air from the bag by placing the bag on a flat surface to permit the water to come into the opening then close it to remove the air.
5. Check the bag for leaks.
6. Cover the bag with a towel then apply it over the affected knee. Assess the skins' response to the applied bag at frequent intervals. Remove it if swelling, pain, redness, or any side effect occurs.
7. Each treatment procedure consisted of twice a day (morning and evening) application of the treatment options for 5 consecutive days followed by 2 days of no treatment. Each of the twice-daily treatments was applied for 20 minutes except for the contrast treatment which consisted of 4 minutes of warmth followed by one minute with no treatment followed by two minutes of cold rub gel. This cycle was repeated three times in a total session of 21 minutes.
8. After one week from the given instruction and before practicing the three treatment procedures, the researchers assessed each

participant for improving their practice for applying these therapies by using the observational checklist (tool IV), and then the researchers correct the wrong practices and answer their questions.

9. Each participant was assessed for KOOS to assess the changes of knee problem changes from week to week induced by treatment procedures and a 0-10 numeric pain rating scale to assess responses of patients' pain to treatment procedures another three times (on the 7th day of each treatment procedure).

The evaluation phase:

After the compilation of all three treatment procedures, each participant was asked about any adverse events for any of the three-treatment procedures.

Administrative and Ethical Considerations:

The research was approved a written consent was obtained from the patients who participated in the work after explaining the nature and purpose of the study.

The necessary approvals were obtained from the director and nursing director of Helwan General Hospital.

The necessary ethical approvals were obtained from the ethical committee of the Faculty of Nursing, Helwan University, session No.34

Patients were assured data confidentiality, and the researchers initially introduced themselves to the study subjects and were informed that their participation is voluntary and they can withdraw at any time from the work.

Statistical analysis:

1. Data were collected, tabulated, and statistically analyzed with SPSS statistical package version II. Two types of statistics were done: **Descriptive** such as number, percentage, mean and standard deviation.

2. Analytical:

a. T-test for comparison between two groups with quantitative data**.**

b. Paired T-test to study the effectivenessof methods of treatment before andafter for one group.

c. Friedman test for comparison of qualitative data between two or more groups.P-value was considered significant if less than 5%

Limitation:

The Study sample did not prefer the cold rub gel therapy and a lot of them refused to apply it which foster the researchers to decrease the number of and data studied sample collection take a long time in the time of applications

Results

Table (1) revealed that the mean age of the study subjects was 54.21± 9.37 years**.** There three-fourth studied sample (75%) were females. As regard occupation, less than two-thirds of them (60%) were housewives. Regarding the medical data, the mean body mass index (BMI) was 36.64±4.7. Only 10% of the studied sample had a positive family history of osteoarthritis.

Table (2) revealed that there were substantial differences in improvements in subjects'practice for all items of applying the three treatment procedures. This table support hypothesis number 1.

Table (3) illustrated that the mean pre-total Osteoarthritis and Knee Injuries Outcomes Score Scale (KOOS) and the mean total KOOS after cold therapy of the studied sample indicated that patients had moderate knee symptoms. While after warm and contrast therapy; the total score indicated mild knee symptoms. Also, there was evidence that there were statistically significant differences between the total KOOS score pre-intervention and after the three methods of intervention.

Table (4) found that statistically significant differences existed between total pain scores pre-intervention and after the three methods of intervention.

Table (5) and figure (1) showed that contrast therapy had a significant effect in reducing the total KOOS and pain scale than cold rub gel or warm therapy. This table and figure support hypothesis 2.

Table (6) presented that more than one-third of the studied sample (35%) had redness after applying the warm therapy protocol. While no one of them (0.0%) complained of side effects from cold or contrast therapy.

Table (7) There were no significant

differences between males and females, according to the study regarding the total KOOS score. While there were some notable distinctions between them regarding total pain score with warm and contrast therapy

Table (1): Distribution of biodemographic characteristics for studied sample.

Demographic data	No=60	%
Age:		
Mean ±SD	54.21±9.37	
Sex:		
Male Female	15	25.0
	45	75.0
Education:		
Illiterate	27	45
Basic education Higher	9	15
education	24	40
Occupation:		
Manual Administrative	17	28.3
Housewife	7	11.7
	36	60.0
Marital status:		
Married	50	83.3
Widowed	10	16.7
BMI:		
Mean± SD	36.64 ±4.7	
Reasons for visiting hospital		
Swelling and hotnessDifficult	42	70.0
movement	18	30.0
Family history of osteoarthritis		
Yes	6	10.0
No	54	90.0

NB: All vital signs of all subjects were in the normal range.

Table (2): Distribution of the analyzed sample according to their practice before and after instructions for a week

The observed items	Before the treatment procedures N=60		After the treatment Procedures N=60		Mc-Nemarand P-value
	No	%	No	%	
Assessing the skin					
Correct	0.0	0.0	30	50	> 0.001*
Incorrect	60	100	30	50	
Checking the temperature of the water					> 0.0001*
Correct	0.0	0.0	42	70	
Incorrect	60	100	18	30	
Filling the pack for one half to two thirds					
Correct	12	20	46	76.7	> 0.0001*
Incorrect	48	80	14	23.3	
Removing the air					
Correct	5	8.3	21	35	> 0.05*
Incorrect	55	91.7	39	65	
Checking the pack for leaks					
Correct	11	18.3	45	75	>0.0001*
Incorrect	49	81.7	15	25	
Covering the pack with a towel					
Correct Incorrect	3	5	19	31.7	> 0.01*
	57	95	41	68.3	
Assessing the skin' response					
Correct	17	28.3	59	98.3	> 0.001*
Incorrect	43	71.7	1	1.7	

Significant *

Table (3): Pre-assessment total KOOS* score of the studied sample compared to post-cold rub gel, warm, and contrast assessments.

Total KOOS score	Mean ± SD	T-test	P-value
Pre-total score			
Follow up 1(cold therapy) total score	131.22±21.18 107.17±26.16	10.37**	<0.0001
Pre-total score			
Follow up 2(warm therapy) total score	131.22±21.18 75.25±23.31	23.79**	<0.0001
Pre-total score			
Follow up 3(contrast therapy) total score	131.22±21.18 71.52±24.61	26.64**	<0.0001

KOOS*: Knee injury and osteoarthritis outcome score.
**Indicate significance differences.
The total means KOOS: score the mild knee symptoms.

Table (4): Pre-assessment total pain score of the studied sample compared to post cold, warm and contrast assessments.

Total pain score	Mean ± SD	T-test	P-value
Pre-total score			
Follow up 1(cold therapy) total score	8.57±1.54 7.57±1.94	7.22*	<0.0001
Pre-total score			
Follow up 2(warm therapy) total score	8.55±1.52 5.31±1.94	20.73*	<0.0001
Pre-total score			
Follow up 3(contrast therapy) total score	8.54±1.52 3.44±1.52	31.66*	<0.0001

*Indicate significance differences.

Figure (1): The percentage distribution of the examined sample in terms of pain intensity after cold rub gel,warm, and contrast therapy application.

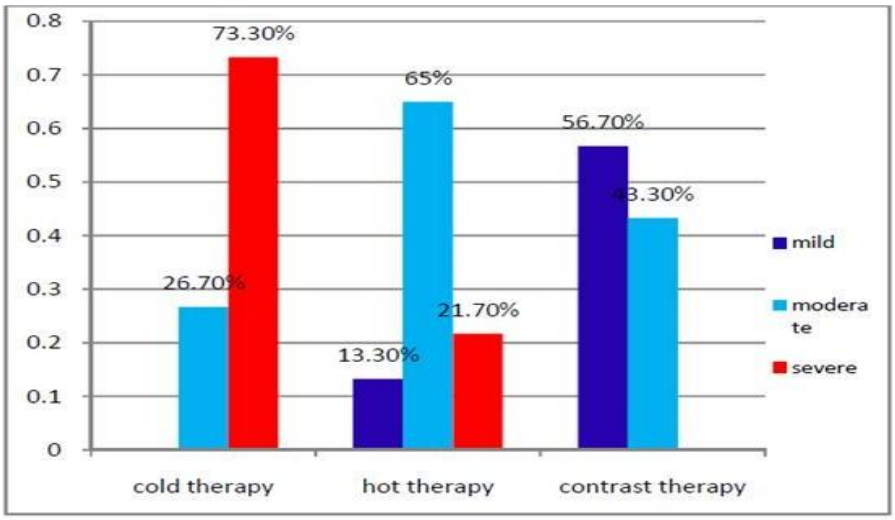

Table (5): Total KOOS * and pain scores the sample under investigation about the effectiveness of cold, warm, and contrast therapy.

variables	Cold rub gel therapy Mean ±SD	Warm therapy Mean ±SD	Contrast therapy Mean ±SD	Friedman test (X^2)	p-Value
Total KOOS score	109.15±28.19	76.26±23.31	72.52±23.58	91.96	<0.0001**
Total pain score	7.54±1.92	5.34±1.92	3.47±1.53	114.24	<0.0001**

*****KOOS: Knee injury and osteoarthritis outcome score.
Indicate significance differences.**

Table (6): Comparison between cold rub gel, warm, and contrast therapy as regarding their side effects on the studied sample.

Quality of life domains	Cold rub gel therapy (No=60)		Warm therapy (No=60)		Contrast therapy (No=60)		X^2	P-value
	No	%	No	%	No	%		
Redness	0.0	0.0	21	35,0	0.0	0.0		
Hotness	0.0	0.0	2	3.3	0.0	0.0	27.2	<0.0001*
No	60	100	37	61.7	60	100		

*Indicate significance differences**.**

Table (7): Comparison between males and females of the analyzed sample's regarding mean and standard deviation of total KOOS and pain score with cold, warm, and contrast therapy.

Variables	Male	Female	T-test	P-Value
Total KOOS score	**Mean ±SD**	**Mean ±SD**		
Pre-total KOOS score	124.07±22.93	134.12±18.68	1057	>0.05
Follow up 1 (cold) totalKOOS score	106.72 ±20.76	109.96±27.90	0.44	>0.05
Follow up 1 (warm) totalKOOS score	72.05±18.68	76.34±24.78	0.68	>0.05
Follow up 1 (contrast) totalKOOS score	64.42±16.54	71.24±26.63	1.21	>0.05
Total pain score	**Mean ±SD**	**Mean ±SD**		
Pre-total pain score	8.15±1.54	8.73±1.50	1.24	>0.05
Follow up 1 (cold) total painscore	7±2.15	7.72±1.89	1.21	>0.05
Follow up 1 (warm) totalpain score	4.44±1.57	5.55±2.0	2.22	<0.05*
Follow up 1 (contrast) totalpain score	2.67±1.24	3.69±1.58	2.29	<0.01*

*Indicate significance differences**.**

Discussion

Osteoarthritis is the third leading cause of disease burden and the fourth most important disability root cause in the world. It was recently estimated that since 1990, the prevalence of arthritis has increased by 750000 cases per year (Lawrence et al., 2019 Rabenda et al., 2020).

The present study showed that the average age of the sample under stud was 54.21±9.37 years**.** This finding is consistent with Tsauo et al., 2021 and Sarzi- puttini et al., 2022 who reported that Age is a factor in osteoarthritis occurrence, and the prevalence increase substantially after the age of 50 years in women and 55 years in men.

Regarding sex, Sarzi-puttini et al., 2022 mentioned that knee osteoarthritis is more common in women than men. This is consistent with the findings of the current research which stated that three-quarters of the group under study were females. Also, about two-thirds of the sample for this study were found to be housewives. This corresponds to the study of (Lievense et al., 2021) who stated that any work involving repetitive tasks and overloading the joints and corresponding muscles increases the risk of knee osteoarthritis.

It is summarized in a study (Coggen et al., 2020) that, a higher body mass index significantly correlated with joint replacement risk rising due to osteoarthritis. This is consistent with the study's findings, which showed that the sample's mean body mass index was 36.64 ± 4.7 kg/m. Also, Shaban H., 2014 mentioned that the

body mass index of the sample was 36.75±5.16 k/m.

Regarding the family history of osteoarthritis, the majority of the studied sample of the present study had no familial predisposition for osteoarthritis. This is in contrast to the results of Roberts and Lappe, 2019 who reported that the incidence of osteoarthritis is three times higher among sisters of osteoarthritis than in the general population. This might be explained by the current study's sample being small which is not amenable to study prevalence.

Concerning the subjects' practice of the three treatment procedures, it was noticed that improvements were statistically significant in all areas of the subjects' practice after educating them. This result is incongruous with Zaghaloul, 2016 who reported that practice is influenced by knowledge and there was a statistically significant higher mean performance score of the studied sample post-program than pre-program.

The cardinal and dominant symptoms of osteoarthritis are pain joint which may be deep, aching, and localized while with knee osteoarthritis, there are specific knee symptoms such as knee pain and other symptoms as joint stiffness and knee swelling, alteration in activities of daily living, function, and sports and quality of life. In the present study, the mean pre-total knee osteoarthritis outcome score indicated moderate knee symptoms and the pre-total pain score indicated severe pain (Cicuttini F and Grainger, 2018).

Numerous studies had recommended that a combination of pharmacological and nonpharmacological treatment is frequently employed in guidelines for the management of hip and knee OA (Zhang et al., 2022). A variety of modalities have been investigated in the treatment as heat or cold therapy (Hulme et al., 2017). Regarding cold rub gel therapy, it was found that the total KOOS and pain scores were decreased after applying the cold therapy but patients still had moderate KOOS and severe pain. This fits in with (Brosseau et al., 2019 and Zhang et al., 2022) who reported that applications of ice packs for three weeks are followed by some improvement in pain. In contrast to this study, Bleakley et al., 2016) mentioned that twenty minutes cold applications can reduce the transmission of painful impulses by up to 29.4% and last about 30 minutes after its removal. This may be explained by our patients were not prefer applying cold rub gel which may affect the results.

About warm therapy, it was found that warm therapy reduces the total KOSS score to mild knee symptoms. In this respect, Garge, 2018stated that the application of heat produces vasodilatation which increases oxygen to tissues that reduce knee symptoms such as the stiffness of joints. Also, the findings of the current research revealed that warm therapy decreases pain intensity to a moderate score. This agrees with Lofgren and Norrbrink, 2018 who stated the average level of pain in patients receiving warm therapy decreased before the treatment. This may be occurring due to a rise in the nerve pain threshold.

With respect to the effect of contrast therapy, it was shown that the total KOOS score was decreased to mild knee symptoms, and the total pain score decreased to moderate score. This may be illustrated by Bonhaman et al., 2021 who concluded that there is a side effect of contrast therapy for knee osteoarthritis symptoms such as reduction of inflammation, decreased edema, pain, and stiffness, but the physiological basis of the treatment is not adequately understood. Dengar et al., 2022 confirmed that contrast therapy provided the greatest improvement in total KOOS and pain score than cold or warm therapy. This finding supports the results and hypothesis of the present study.

Regarding the side effects of the different treatment modalities, it was concluded that redness occurred in more than one-third of the studied sample after applying warm therapy. This result coincides with (Nadler et al., 2019) who summarized that warm modalities provide significant pain relief with low side effects.

Dengar et al., 2022 stated that the reasons for the impact of cold, heat, or contrast require additional investigations but gender is likely to play some role. This agrees with the finding of the present research which demonstrated a significant difference between total pain scores for males and females after applying warm and contrast therapy.

Conclusion

The present study revealed that a distinct

individual effect was observed for the use of cold rub gel, warm, and contrast therapy for knee osteoarthritis pain and joint function, but greater knee problems and pain relief were found when subjects used contrast therapy. Application of cold rub gel, warm, and contrast is non-invasive and generally safe.

Recommendations

Based on the results of the current study, the following recommendations can be suggested:

1. Superficial warm, cold rub gel or contrast therapy should be included in the early effort to manage patients with osteoarthritis
2. Contrast therapy should be considered the most effective treatment option for relieving knee symptoms and pain.
3. Replication of the study with a larger sample must be considered in the development of future research to allow greater generalization of the results. Also, the patient's preference for the treatment option should be considered which may affect the results.

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