

## Effect of Compressive Cryotherapy on Pain intensity and Swelling among Patients Post Knee Arthroscopy

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### Abstract

**Background:** Following a knee arthroscopy, discomfort and swelling are common in the early post-operative phase. For patients, it is crucial to minimize discomfort and swelling in the knee, but these conditions can also make it more difficult for them to adhere to early physiotherapy and postpone rehabilitation. Reduction of pain and swelling following knee arthroscopy has been demonstrated using compressive cryotherapy. **Aim:** This study aimed to evaluate effect of compressive cryotherapy on pain intensity and swelling among patients post knee arthroscopy. **Setting:** the study was carried out at the inpatient departments of El-Hadara Orthopedic and Traumatology University Hospital, Alexandria, Egypt. **Materials and Method:** A quasi-experimental research design was utilized. Data were collected from 60 adult patients scheduled for knee arthroscopic were included and divided randomly into two equal groups (control and study). Biosociodemographic Structured Interview Schedule ,Numerical Rating Scale-11 (NRS-11) and Post Knee Arthroscopy Circumference Measurements (in centimeters) are tools were utilized for data collection . **Results:** After compressive cryotherapy, the study group's pain intensity decreased significantly ( $MCp < 0.001^*$ ) by (0.0%) as opposed to the control group's (46.7%). Additionally , the study group's mean swelling value decreased from  $44.23 \pm 2.40$  to  $42.93 \pm 1.64$  and the control group's from  $48.13 \pm 2.34$  to  $47.57 \pm 2.60$ , respectively . **Conclusion and recommendations :** Following the application of compressive cryotherapy, the study groups' pain intensity and knee swelling significantly decreased compared to the control group in the first and second post-operative days. :To obtain conclusions that are more broadly applicable, the current study should be replicated using a larger statistical sample size drawn from various areas and a longer follow-up time.

**Keywords:** Compressive Cryotherapy, Pain Intensity, Swelling, Knee Arthroscopy

### Introduction

Arthroscopic knee surgery has emerged as a prominent orthopedic intervention for addressing both degenerative and traumatic knee disorders, particularly in developed nations. Thacoor & Sandiford et al . (2019 ) , Sonesson et al.(2020) . This minimally invasive procedure has gained significant traction in recent years, with its application expanding notably among the working-age population, specifically those between 19 and 60 years old. The global prevalence of this surgical technique is underscored by the staggering statistic of approximately 2 million knee arthroscopies performed annually worldwide, reflecting its widespread adoption in orthopedic practice. Elsaid et al. (2018) , Abram et al. (2020). Despite its popularity, patients undergoing arthroscopic knee surgery often face a challenging recovery period. In the immediate postoperative phase, patients commonly experience a constellation of

symptoms that can impede their rehabilitation progress. These typically include pain, swelling, and inflammation, not only within the knee joint itself but also in the surrounding soft tissues. These postoperative complications pose significant hurdles to patient recovery, potentially prolonging rehabilitation and delaying the return to normal activities. Hamdan et al. (2022) .

Even though knee arthroscopic surgery is fewer invasive than open surgeries , patients may still have serious postoperative challenges . Many patients experience considerable knee swelling and pain early following surgery. Zhang et al . (2022). These symptoms arise from various factors inherent to the surgical process, including manipulating sensitive structures such as the fat pad, joint capsule, and anterior synovium . Additionally, activating nociceptors and free nerve terminals within the synovial tissue contributes to the pain experience. The body's natural inflammatory response to tissue damage at

the operative site further exacerbates local swelling. Lee et al. (2023).

The management of these postoperative symptoms is crucial, as uncontrolled pain and swelling can have far-reaching consequences. Patients may face extended hospital stays, and increased utilization of medical resources if these issues are not adequately addressed. Hamdan et al. (2022), Roberts. (2024). Thus, the primary postoperative goals of the nurses are to decrease knee pain and swelling, restore knee joint motion, strengthen the surrounding muscles, monitor for any problems, and establish postoperative follow-up regimens that incorporate both non-pharmacological and pharmaceuticals. Bazied et al. (2022), Mahmoud et al. (2022), Bölükbaşı & Şahin. (2021).

In postoperative care, cryotherapy, sometimes referred to as "cold therapy," has become increasingly popular as a non-pharmacological intervention, especially after knee arthroscopy. According to Yildiz et al. (2024) it is a technique for cooling the tissue to lower local metabolism. In addition, the primary goal of cryotherapy following a knee arthroscopy is to increase range of motion by lowering discomfort, oedema, and bleeding. Depending on the intended function, cold application techniques can now be either wet or dry. While dry cold application uses cold gel packs and ice packs, wet cold application uses compresses soaked in ice or cold water, ice massage, and local or general cold water baths. Kazan et al. (2017), de Oliveira Mianutti et al. (2021), Yildiz et al. (2024).

One kind of advanced cryotherapy is compressive cryotherapy. Cryotherapy and compression therapy can be applied in a variety of methods, including with ice packs, cold-compression braces, or computer-assisted cryotherapy equipment. de Vries et al. (2024). Compressive cryotherapy works physiologically by decreasing intra-articular temperature, reducing pain by slowing nerve conduction velocity, promoting immediate vasoconstriction, minimizing vascular spasm, and slowing blood flow, all of which contribute to the final reduction of tissue edema. Thacoor & Sandiford. (2019). Furthermore, Compression with cold therapy ensures full contact between the ice and the skin and promoting conduction, thus enhancing the

effect of cold application on tissue temperature and decreasing blood flow to the tissue. Engelhard et al. (2019), Quesnot et al. (2024), Chen et al. (2021), Park. (2021), de Vries et al. (2024).

Integrating compressive cryotherapy into post-operative care protocols for knee arthroscopy patients represents a promising approach to enhancing recovery outcomes. By leveraging the combined effects of cold therapy and compression, this technique offers a comprehensive strategy for managing patients' common challenges in the immediate postoperative period. de Oliveira et al. (2021), de Vries. et al. (2024). As research in this area continues to evolve, compressive cryotherapy may become an increasingly important component of evidence-based post-operative care in orthopedic settings.

Some studies have suggested that compressive cryotherapy may offer superior outcomes in the early stages of rehabilitation after various knee surgeries compared to traditional cryotherapy methods alone. These findings have sparked interest in the orthopedic community, as effective management of post-operative pain and swelling is crucial for optimizing patient recovery and facilitating early mobilization. Despite these promising indications, the application of compressive cryotherapy in the post-arthroscopic knee surgery setting has not been thoroughly investigated, leaving clinicians with uncertainty regarding its effectiveness in this particular patient population. Klaber et al. (2019), Thacoor & Sandiford. (2019), Zhong et al. (2021), Greenhalgh. (2023). Consequently, this study set out to evaluate the effect of compressive cryotherapy on pain intensity and swelling among patients post knee arthroscopy.

#### **This study aimed to:**

Evaluate effect of compressive cryotherapy on pain intensity and swelling among patients post knee arthroscopy.

#### **Research Hypothesis:**

**H1:** Patients who have undergone knee arthroscopy and receive compressive cryotherapy would experience a more significant reduction in postoperative pain intensity compared to those who do not receive this intervention.

**H2:** Patients who have undergone knee arthroscopy and receive compressive cryotherapy would experience a more significant reduction in postoperative knee swelling than those who do not receive this intervention.

## Materials and Method

### Materials

**Research design:** A quasi-experimental research design was utilized.

**Setting:** The study was carried out at the inpatient departments of El-Hadara Orthopaedic and Traumatology University Hospital, Alexandria, Egypt.

**Subjects:** Convenience sample of 60 adult patients scheduled for knee arthroscopy were included and divided randomly into two equal groups (control and study), thirty patients in each group. Control group received routine medical treatment only, and the study group received the compressive cryotherapy with routine medical treatment. All studied patients were selected according to the following criteria. Both male and female patients, between the ages of 20 and 60, without diabetes mellitus, peripheral vascular disease, circulatory dysfunction, and without any inflammatory or neoplastic conditions that could cause persistent pain.

**Sample size calculation :** The study targeted patients undergoing knee arthroscopy and utilized the G\*Power software (version 3.1.9.7) for sample size estimation. The parameters set for the analysis included a power (1 -  $\beta$  error probability) of 0.95, an effect size of 0.25, an alpha ( $\alpha$  error probability) of 0.05, and two groups for comparison, along with references to previous studies. Considering a projected dropout rate of approximately 20%, the software calculated the minimum required sample size as 30 participants for the study group and 30 for the control group, resulting in 60 participants needed to achieve the desired statistical power while accounting for potential attrition. Kang. (2021).

**Tools for data collection:** To achieve the study's aim, three tools were employed to gather data.

**Tool I: Biosociodemographic Structured Interview Schedule :** This questionnaire was

developed by the researchers based on review of the literature. Elsaid et al. (2018), de Oliveira et al. (2021), Bazied et al. (2022), Mahmoud et al. (2022), Marinova et al. (2023), de Vries et al. (2024) to obtain information's about socio-demographic and clinical data of the studied patients. It was divided into the following two parts:

**Part 1:** This part included questions on the age, gender, marital status, education level, occupation, income and area of residence.

**Part 2:** This section covered questions on the clinical information of the studied patients, including associated medical diseases, previous knee surgeries, family history of orthopedic disease, body mass index, and the reason for the current admission.

### Tool II: Numerical Rating Scale-11 (NRS-11):

This scale was adopted from Atisook et al. (2021) to assess the degree of pain intensity experienced by the studied patients. It is a single 11-point numerical scale with a range of 0 to 10. A score of zero indicated no pain, a score of (one to three) indicated mild pain, a score of (four to six) indicated moderate pain, a score of (seven to ten) indicated the highest possible amount of pain.

### Tool III: Post Knee Arthroscopy Circumference Measurements (in centimetres).

Measurements of knee circumference were obtained to evaluate postoperative knee swelling. The researchers used a measuring tape (A flexible tape measure with markings in 1-mm increments, measuring 1.5 cm in width and 1 m in length.), to measure the knee at the mid-patella point while it was in its maximum extension. The results of the measurements were recorded in a record chart, and then the total scores were calculated and converted into percentages. Marinova et al. (2023), Kazan & Görgülü. (2017).

### Method:

**The study was accomplished as follows:**

- 1- An approval from the Research Ethics committee, Faculty of Nursing, Alexandria University was obtained.
- 2- A written approval to conduct the study was obtained from the Faculty of Nursing to the administrative authorities to collect data and

- permission was obtained after explaining the purpose of the study.
- 3- Tool I & III was developed by the researchers after reviewing the relevant literatures . Elsaid et al. (2018) , de Oliveira et al. (2021), Bazied et al. (2022), Mahmoud et al. (2022) Marinova et al. (2023) , de Vries et al. (2024), Kazan & Görgülü. (2017).
  - 4- Tool II was adopted from Atisook et al. (2021).
  - 5- Content and construct validity of the study tool were established by a jury of five experts in the fields of Medical Surgical Nursing and Orthopedic surgery. The necessary modifications were introduced.
  - 6- The tools reliability were tested using Cronbach's Alpha Coefficient Test ( $r=0.891$ ,  $r= 0. 0.942$ ), which denote high reliability.
  - 7- A pilot study was conducted on six patients at the beginning of the study to test the feasibility and applicability of the tools; these patients were excluded from the actual study sample.

#### **Data collection and implementation of the study:**

- After securing the administrative approval, data collection was started and continued for a period of 10 months (from the end of June 2023 to end of April 2024. )

#### **Research Procedure:**

- The baseline data about sociodemographic and clinical data using tool I was assessed for both groups (control & study) on preoperative period . This interview took between 30 and 45 minutes for each patient in both studied groups.
- The body mass index of each patient was calculated by the researcher using the clinic's scale and calculating their weight in kilogrammes divided by their height in meters squared (kg/m<sup>2</sup>).
- **For the control group**, patients were left to the standard hospital care (medication, including antibiotics and analgesics) with follow-up conducted immediately and on the first and second post-operative days without any intervention.
- **For the study group**, the patients underwent compressive cryotherapy in the immediate and

first two days after surgery. This was accomplished by using a cold bag knee wrap device at the surgical site over the single layer of bandage for a duration of 15-20 minutes, three times a day, at intervals of two hours.

- Prior to applying compressive cryotherapy, the pain intensity was measured immediately post-operatively using the Numerical Rating Scale 11 (NRS-11). Additionally , on the first and second days after surgery, and within 15 minutes of the intervention immediately post-operatively .
- Measurements of the knee circumference were obtained to evaluate knee swelling. The measurements were collected at the mid-patella point during maximum knee extension prior to the application of compressive cryotherapy immediately following surgery and after receiving compressive cryotherapy on the first and second post-operative days, knee circumference measurements were taken simultaneously (in the morning) in order to prevent subsequent swelling from prolonged daily use of the extremity and continuous upright activity, and the results were then recorded.
- The impact of compressive cryotherapy on pain and swelling following arthroscopy was evaluated using the following methods:
  - Assess pain intensity by comparing the study group's postoperative pain intensity to that of the control group. Using tool II.
  - Measure knee circumference post-operatively, record the measurements, and compare the results in the two study groups to assess knee swelling . Using tool III.

#### **Ethical Considerations:**

- A written informed consent from subjects to participate in the study was obtained before data collection and after explanation of the aim of the study.
- Participants' voluntary participation and their right to withdraw from the study at any time was emphasized.
- Anonymity of patients was maintained.
- Privacy of patients was maintained.

- Confidentiality of the collected data was assured.

### **Statistical analysis of the data:**

- Data were fed to the computer and analyzed using IBM SPSS software package version 23.0. Comparisons between groups for categorical variables were assessed using Chi-square test (Monte Carlo). Student t-test was used to compare two categories for normally distributed quantitative variables, ANOVA with repeated measures between the three periods in each group. Friedman test for categorical variables, to compare between more than two periods. Significance of the obtained results was judged at the 5% level Turney. (2023) , Mishra et al .(2019).

### **Results**

**Table 1: Shows comparison between the study and control group patients according to Biosociodemographic data .** Regarding the mean age of the study group it ranges (44.30±10.48), compared to (43.90±9.63) for the control group patients. In both the study and control groups, the percentage of females was greater (53.3% and 66.7%, respectively) , with no statistical significant differences were detected between both groups ( $MCP=0.192$ ) . Regarding education and occupation, the table shows that there were no statistically significant differences between the two studied groups ( $MCP=0.29, 0.518$ ) respectively .The majority of both groups were married , live in urban area , no significant differences were detected between both groups regarding marital status and area of residence ( $MCP= 0.435$ ), ( $MCP=1.000$ ) respectively . Furthermore, a majority of the study group's patients (60.0%) and the control group's patients (56.7%) expressed that their income was insufficient. Also there was no statistically significant income difference between the two studied groups was observed  $MCP=(0.067)$  .

**Table (2): Presents a comparison based on clinical data between the two study groups of patients..** It is evident that over half of the study group (63.3%) and the control group (63.3%) did not have any associated medical disorders, and no statistically significant differences were found between the two groups with respect to associated medical diseases ( $MCP=1.000$ ). Furthermore In both the study (73.3%) and control (70.0%)

groups, the most commonly reported diagnosis was knee arthroscopy for therapeutic purposes. With regards to previous knee surgeries and family history of orthopaedic diseases, the majority of study participants and the control group (60.0% and 60%, respectively) did not have a family history. Additionally, more than two thirds of study participants (70.0%) and the control group (73.3%) reported having no previous knee surgeries performed. No statistically significant differences were found between the two groups with respect to family history and previous knee surgeries ( $MCP= 1.000$  and  $MCP= 0.774$ ), respectively. In terms of body mass index, approximately one-third of the study and control groups (26.7% and 33.0%, respectively) were overweight. While more than half of the study and control groups (53.3% and 56.7%, respectively) were obese. In addition, no statistically significant differences in body mass index ( $MCP=0.733$ ) were observed between the two groups.

**Table (3): Demonstrates a comparison of the two study groups' patients' pain intensity before and after compressive cryotherapy. .** It was noted that prior to receiving compressive cryotherapy, the same proportion of patients (100%) in both study groups reported having severe pain . The majority of patients in the control group (80.0%) reported severe knee pain following an arthroscopy, whereas more than half of patients in the study group (66.7%) reported moderate knee pain after applying compressive cryotherapy within 15 minutes. Additionally, a highly statistically significant difference was observed between the two study groups ( $MCP = <0.001*$ ). Furthermore , the table showed that on the first postoperative day following compressive cryotherapy, one-third (30.0%) and over two-thirds (70.0%) of the study group reported mild and moderate knee pain respectively, compared to approximately one-quarter (26.7%) and over half (70.0%) of the control group who reported moderate and severe knee pain following an arthroscopy. A highly significant statistical difference was found between the two study groups ( $MCP= <0.001*$ ). Ultimately, on the second post-operative day after compressive cryotherapy, the study group's pain intensity decreased significantly ( $MCP=<0.001*$ ) by (0.0%) as opposed to the control group's (46.7%).

**Table (4): Presents a comparison of the post knee arthroscopy circumference measurements (in centimeters) of the two study group participants before and after compressive cryotherapy**

Prior to applying compressive cryotherapy, no statistically significant differences were observed between the two studied groups ( $P=0.390$ ) with a mean value of ( $48.10\pm 3.12$ ) for

the study group compared to ( $48.73\pm 2.50$ ) for the control group. In the first and second postoperative days following the application of compressive cryotherapy, the study group's mean swelling value decreased from  $44.23\pm 2.40$  to  $42.93\pm 1.64$  and the control group's from  $48.13\pm 2.34$  to  $47.57\pm 2.60$ , respectively, with significant differences were observed in both studied groups regarding the knee circumference, where  $P= (<0.001^*, <0.001^*)$  respectively.

**Table (I): Comparison between the study and control group patients according to Biosociodemographic data .**

Sociod-demographic data	Study (n=30)		Control (n=30)		$\chi^2$	MC <sub>p</sub>
	No	%	No	%		
<b>Age</b>						
20-<30	2	6.7%	3	10.0%	3.848	0.495
30-<40	8	26.7%	8	26.7%		
40-<50	11	36.7%	10	33.3%		
50-<60	6	20.0%	9	30.0%		
≤60	3	10.0%	0	0.0%		
Mean ±SD	44.30±10.48		43.90±9.63		0.154	0.878
<b>Gender</b>						
Male	14	46.7%	10	33.3%	2.443	0.192
Female	16	53.3%	20	66.7%		
<b>Educational level</b>						
Illiterate	17	56.7%	12	40.0%	3.973	0.29
Primary	5	16.7%	4	13.3%		
Secondary	3	10.0%	9	30.0%		
Bachelor	5	16.7%	5	16.7%		
<b>Marital status</b>						
Single	4	13.3%	6	20.0%	2.9	0.435
Married	17	56.7%	17	56.7%		
Widow	6	20.0%	2	6.7%		
Divorced	3	10.0%	5	16.7%		
<b>Occupation</b>						
Unemployed	14	46.7%	10	33.3%	1.314	0.518
Manual work	10	33.3%	11	36.7%		
Sedentary work	6	20.0%	9	30.0%		
<b>Residence</b>						
Rural	9	30.0%	9	30.0%	0.000	1.000
Urban	21	70.0%	21	70.0%		
<b>Income (from the patient's point of view)</b>						
Not enough	18	60.0%	17	56.7%	3.354	(0.067)
Enough	12	40.0%	13	43.3%		

$\chi^2$ : Chi square test MC: Monte Carlo

Table (2): A comparison based on clinical data between the two study groups of patients.

Clinical data	Study (n=30)		Control (n=30)		$\chi^2$	MCp
	No	%	No	%		
<b>Associated medical diseases</b>						
Yes	11	36.7%	11	36.7%	0.000	1.000
No	19	63.3%	19	63.3%		
<b>The reason for the current admission</b>						
Knee arthroscopy for diagnostic purpose	8	26.7 %	9	30.0%	0.000	1.000
Knee arthroscopy for therapeutic purpose	22	73.3%	21	70.0%		
<b>Previous knee surgeries</b>						
Yes	9	30.0%	8	26.7%	0.082	0.774
No	21	70.0%	22	73.3%		
<b>Family history of orthopedic disease</b>						
Yes	12	40.0%	12	40.0%	0.000	1.000
No	18	60.0%	18	60.0%		
<b>Body mass index</b>						
Normal weight	6	20.0%	4	13.3%	0.622	0.733
Over weight	8	26.7%	9	30.0%		
Obese	16	53.3%	17	56.7. %		

$\chi^2$ : Chi square test MC: Monte Carlo

Table (3): A comparison of the two study groups' patients' pain intensity before and after compressive cryotherapy.

Pain intensity	Study (n=30)		Control (n=30)		$\chi^2$	MCp
	No	%	No	%		
<b>Immediately post operative (0 day) (Before to applying compressive cryotherapy)</b>						
○ Mild	0	0.0%	0	0.0%	-	-
○ Moderate	0	0.0%	0	0.0%		
○ Severe	30	100.0%	30	100.0%		
<b>Immediately post operative (0 day) (After the application of compressive cryotherapy within 15 min )</b>						
○ Mild	2	6.7%	1	3.3%	30.127*	<0.001*
○ Moderate	20	66.7%	5	16.7%		
○ Severe	8	26.6 %	24	80.0%		
<b>1<sup>st</sup> Post-operative day (After the application of compressive cryotherapy )</b>						
○ Mild	9	30.0%	1	3.3%	33.228*	<0.001*
○ Moderate	21	70.0%	8	26.7%		
○ Severe	0	0.0%	21	70.0%		
<b>2<sup>nd</sup> Post-operative day (After the application of compressive cryotherapy)</b>						
○ Mild	17	56.7%	8	26.7%	18.430*	<0.001*
○ Moderate	13	43.3%	8	26.7%		
○ Severe	0	0.0%	14	46.7%		
<b>Fr (p)</b>	<b>56.408*(&lt;0.001)*</b>		<b>22.262*(&lt;0.001)*</b>			
<b>p<sub>1</sub></b>	<0.001*		0.061			
<b>P<sub>2</sub></b>	<0.001*		0.001*			
<b>P<sub>3</sub></b>	0.302		0.138			

2: Chi square test MC: Monte Carlo

Fr: Friedman test, Sig. bet. periods was done using Post Hoc Test (adjusted Bonferroni)

P1: p value for comparing between pre and postoperative first day for each group

P2: p value for comparing between pre and postoperative second day for each group

P3: p value for comparing between postoperative first and second day for each group

\*: Statistically significant at  $p \leq 0.05$

**Table (4):** A comparison of the post knee arthroscopy circumference measurements (in centimeters) of the two study group participants before and after compressive cryotherapy

Post knee arthroscopy circumference measurements (in centimetres)	Study (n=30) Mean ±SD	Control (n=30) Mean ±SD	t	p
○ Immediately post operative (0 day) (Before to applying compressive cryotherapy)	48.10±3.12	48.73±2.50	0.867	0.390
○ 1 <sup>st</sup> Post-operative day (After the application of compressive cryotherapy )	44.23±2.40	48.13±2.34	6.363*	<0.001*
○ 2 <sup>nd</sup> Post-operative day (After the application of compressive cryotherapy)	42.93±1.64	47.57±2.60	8.268*	<0.001*
<b>F(p)</b>	<b>251.45*(&lt;0.001)*</b>	<b>16.045*(&lt;0.001)*</b>		
<b>P<sub>1</sub></b>	<b>&lt;0.001*</b>	<b>0.003*</b>		
<b>P<sub>2</sub></b>	<b>&lt;0.001*</b>	<b>0.001*</b>		
<b>P<sub>3</sub></b>	<b>&lt;0.001*</b>	<b>0.002*</b>		

t: Independent t-test

F: F test (ANOVA) with repeated measures Sig. bet. periods was done using Post Hoc Test (adjusted Bonferroni)

P1: p value for comparing between pre and postoperative first day for each group

P2: p value for comparing between pre and postoperative second day for each group

P3: p value for comparing between postoperative first and second day for each group

\*: Statistically significant at  $p \leq 0.05$

## Discussion

Knee arthroscopy, while minimally invasive, often results in short-term postoperative challenges for patients, including pain, swelling, and functional limitations. Effective management of these symptoms in the immediate postoperative period is crucial for optimizing long-term outcomes and facilitating early functional recover Cui et al. (2021). Compressive cryotherapy has emerged as a promising intervention that combines the benefits of cold therapy with compression to address these postoperative issues Park. (2021), Given the potential benefits of this intervention, there is a need for rigorous evaluation of its efficacy in the specific context of post-arthroscopic knee surgery. This study aims to address this knowledge gap by investigating the effects of compressive cryotherapy on two key postoperative outcomes: pain intensity and swelling in patients who have undergone knee arthroscopy.

**In terms of sociodemographic data**, the current study findings showed that the majority of patients in both groups belonged to the 40–50 age range. This outcome could be explained by the ageing process changing the tissues surrounding the joint and increasing its susceptibility to the onset and course of degenerative diseases. This finding is in conflict with that of Mahmoud et al. (2022) study, "Effect of Nursing

Rehabilitation Program on Knee Functional Outcomes for Patients undergoing Arthroscopic Meniscus Surgery," which found that the majority of the studied patients were between the ages of 20 and less than 30, with a mean age of (27.45±6.58& 28.45± 5.58) years.

The study findings showed that married women made up the majority of the patients in both groups. This result was consistent with reports by Hussein et al. (2020 & Moses et al. (2024) that over half of their study participants were women, and the majority of them were married. This phenomenon may be caused by the fact that middle-aged women have lower oestrogen levels, which may increase bone resorption and decrease bone formation, ultimately leading to osteoporosis and other knee issues. Women today are also more likely to experience knee problems as a result of increased activity at home and in the workplace.

With regard to clinical data, the study findings showed that more than half of the study group and the control group had no corresponding medical conditions. In this instance, Bazied et al. (2022) demonstrated that almost two thirds of the their participants did not have any chronic illnesses. Additionally, the results of this study indicated that over half of the study and control groups were obese in terms of body mass index. This finding might be connected to the idea that being obesity raises the risk of osteoarthritis



by adding extra strain, which quickly erodes the cartilage at the tips of bones. This finding is in contrast to that of Hussein et al. (2020), who confirmed that the majority of the patients were overweight in their study. In addition to the current study found that there was no statistically significant difference in the clinical data and socio-demographic features of the two groups, suggesting that they were almost identical.

**Regarding pain following knee arthroscopy surgery**, the findings showed that, prior to the application of compressive cryotherapy, no statistically significant difference was seen between the both studied groups. In addition, after applying compressive cryotherapy for 15 minutes and on the first and second post-operative days, the study group's pain intensity statistically decreased compared to the control group. The quick onset of pain relief could be attributed to the synergistic effect of cold therapy and compression, which may enhance the analgesic properties of cryotherapy by improving tissue cooling and reducing local inflammation more effectively than cryotherapy alone. This result agrees with Isaid et al. (2018) who found similar findings in a previous similar study. Furthermore, this result is congruent with Klaber et al. (2019), Their research entitled "Compressive cryotherapy is superior to cryotherapy alone in reducing pain after hip arthroscopy." demonstrated that patients who received compressive cryotherapy had less discomfort during the first recovery period and could go back home sooner. Also, a decrease in the need for analgesics was observed in association with compressive cryotherapy.

The sustained pain reduction observed in the compressive cryotherapy group over the first and second postoperative days is consistent with the meta-analysis by Song et al. (2016), which found that patients undergoing compressive cryotherapy tended to have less pain than those receiving cryotherapy alone in the early postoperative period following knee surgery. Similarly, (Muaddi et al., 2023 & Khan et al., 2024) found that compressive cryotherapy is a practical and reasonably priced treatment that decreases postoperative pain and opioid use without altering the duration of hospital stay or the frequency of surgical site infections. Additionally, two weeks after surgery, there was an improvement in function in comparison to usual treatment.

**Regarding knee circumference**, The results of the study indicated that there was no statistically significant difference observed between the two groups in terms of the knee swelling of the affected leg prior to compressive cryotherapy. While the study groups' mean knee circumference swelling value considerably decreased in comparison to the control groups in the first and second post-operative days after the application of compressive cryotherapy. This result might be related to the impacts of compressive cryotherapy, which incorporate diminished tissue metabolism, localized vasoconstriction that reduces the production of inflammatory mediators so diminishing edema. This result is endorsed by Yang et al. (2023) in their study titled "Comparison of a cryopneumatic compression device and ice packs for cryotherapy following anterior cruciate ligament reconstruction" mentioned that during the early postoperative phase after anterior cruciate ligament reconstruction, cryopneumatic compression application was associated to a significant decrease in joint effusion and visual analog scale (VAS) pain levels when compared to normal ice packs.

The continued decrease in knee circumference for the compressive cryotherapy group on the second postoperative day, contrasted with the minimal change in the control group, underscores the sustained benefits of compressive cryotherapy over time Yao et al. (2024). This prolonged effect is consistent with the meta-analysis by Song et al. (2016), which found that patients undergoing compressive cryotherapy tended to have less swelling than those receiving cryotherapy alone in the early postoperative period following knee surgery.

Additionally, this result is consistent with the findings of Elsaid et al. (2018), who reported that there was no statistically significant difference between the studied groups before intervention and the second day following cryotherapy application. However, the mean swelling value on the last day was significantly different in the study group and dropped more than in the control group. Additionally, according to Quesnot et al. (2024), the compression cryotherapy technique had the following advantages, a markedly quicker improvement in passive knee flexion range of motion, a higher decrease in oedema, and less pain and discomfort during activity.

## Conclusions

In conclusion, this study's findings demonstrate that compressive cryotherapy significantly reduces pain intensity and knee circumference in patients following knee arthroscopy compared to standard care. The results indicate that patients receiving compressive cryotherapy experienced a notable decrease in postoperative pain levels and swelling, particularly within the first two days after surgery. These outcomes underscore the effectiveness of compressive cryotherapy as a beneficial intervention for enhancing recovery and improving patient comfort in the postoperative setting, suggesting its potential for routine implementation in clinical practice for individuals undergoing knee arthroscopy.

## Recommendations

**The study's findings lead to the following recommendations being proposed:**

- Periodic in-service training programs are recommended for orthopedic nurses to enhance their knowledge and skills regarding the significance of compressive cryotherapy following knee arthroscopy in reducing postoperative pain severity and knee swelling.
- Posters and a comprehensive, simple, illustrated pamphlet with instructions for postoperative compressive cryotherapy should be available to patients. Healthcare settings ought to have access to these resources.
- To obtain conclusions that are more broadly applicable, the current study should be replicated using a larger statistical sample size drawn from various areas and a longer follow-up time.

## Limitations of the study

The maintenance of knee arthroscopies in the unit and the temporary unavailability of tools for knee arthroscopy are the two primary limitations of our study, which resulted in a lengthy data collection period and a dearth of cases.

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