Effect of Ice Chips on Severity of Chemotherapy Induced Oral Mucositis

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Abstract

Background: Chemotherapy is a common cancer treatment, yet it can cause adverse medication responses, such as mucositis of the mouth. This may have a profound effect on treatment outcomes and patients' quality of life by altering their physical, emotional, and psychological well-being. Oral cooling using ice chips is a common low-cost, easy-to-use technique that helps reduce oral mucositis (OM) from developing and is unlikely to have any negative side effects. **Aim:** To evaluate the effect of ice chips on severity of chemotherapy induced oral mucositis. **Design:** Time-series quasi-experimental design was utilized to achieve the aim of the current study. **Setting:** Clinical Oncology and Nuclear Medicine Department at El kasr Al Eini University Hospital in Cairo, Egypt. **Sample:** A purposive sample of 60 adult male and female patients who received Platinol chemotherapy for the first time and fulfilled the inclusion criteria. **Tools:** Four tools were utilized**: (**1) Personal Data Assessment Form, (2) WHO Oral Mucositis Grading Scale, (3) Patient Reported Oral Mucositis Symptoms (PROMS) Scale, and (4) Numeric Pain Intensity Scale. **Results:** Highly statistical significant differences were observed between study and control group after applying ice ships at the end of 1st, 2nd & 3rd weeks of intervention with a P value= 0.000. A marked decline was also observed in the OM symptoms mean scores in the study group when compared to the control group at the end of 1st, 2nd & 3rd weeks of intervention. **Conclusion:** Highly statistical significant differences were observed between study and control group regarding oral mucositis grades, symptoms severity mean scores and pain intensity mean scores throughout the measurement time. **Recommendation:** Ice ships can be recommended as safe, cheap, and easy applicable method for reducing the severity of OM among patients with cancer receiving Platinol chemotherapy.

Key Words: Ice chips, Severity of Oral Mucositis, Chemotherapy, Patients with Cancer.

Introduction

Cancer is one of the leading causes of death worldwide. It is defined as a group of diseases characterized by the growth of abnormal cells beyond their usual boundaries which can invade adjoining parts of the body and/or spread to other organs. Management of cancer includes surgery, chemotherapy, and radiation therapy. Chemotherapy is the most common treatment modality which suppresses the uncontrolled cell division by interfering with cellular function and reproduction **(National Cancer Institute, 2020).**

Chemotherapy may be used to reduce tumor size preoperatively, or to destroy any remaining tumor cells postoperatively. Cells with rapid growth rates such as new blood cells in the bone marrow, epithelium, hair follicles, reproductive organs and oral cavities are very susceptible to damage due to chemotherapy **(El-Tohamy & Abusaad, 2021).** The oral cavity is highly susceptible to direct and indirect toxic effects of chemotherapy. The rapid rate of proliferation of epithelial lining of oral cavity makes it susceptible to oral mucositis **(OM) (Erika, Mulhaeriah, Miskad, Zuraida & Achmad, 2021).**

Chemotherapy induced OM is probably the most prevalent, highly symptomatic and debilitating complication of chemotherapy that affects patients' function, quality of life, and ability to tolerate treatment (**Jehn et al., 2019**). It is defined as an inflammation of the epithelial lining of the oral cavity; initially presents as erythema of the oral mucosa, progressing to atrophy and ulceration. Worldwide, between 20% and 40% of patients with cancer receiving standard chemotherapy dosages develop OM **(Çakmak & Nural, 2019).**

Chemotherapy in the form of Platinol medication, which has a trade name of Cisplatin, is a type of chemotherapy medication prescribed for patients with diverse forms of cancer. This type of medication can be applied either on its own or in combination with other therapies and prescription drugs. Platinol has to be administered intravenously as an infusion and usually takes the form of a yellow, freeze-dried powder. It has the ability to destroy the basal cell layer of the oral mucosa, and ultimately causes a pause or atrophy of cell division that progress to ulceration. These ulcers are characterized by irregular shapes, peripheral erythema and pain that can hinder the person's ability to eat, swallow, and talk **(Makovec, 2019).**

Pain induced by oral mucositis can impair patients' quality of life, ability to speak, swallow, and to maintain oral hygiene. Generally, the excruciating mouth lesion affects about 20–40% of patients receiving Platinol chemotherapy and 76% of patients undergoing high-dose chemotherapy. Severe OM develops in more than 90% of patients receiving treatment for more than one cycle. On occasion, the severity of pain necessitates delaying or stopping cancer treatment **(Steinmann et al., 2021).**

Under normal conditions, oral mucosa and saliva are two normal protective barriers that hinder the invasion by microorganisms. Nevertheless, with the administration of Platinol chemotherapeutic medication, these barriers become disrupted. The occurrence of OM disrupts the function and integrity of the oral cavity, which alters patients' functional, psychological status and quality of life. Also, it can cause dry mouth which in turn leads to secondary infections. Other potential effects include changes in the sense of taste resulting in altered fluid and food intake, dehydration and malnutrition. Consequently, it may become a serious problem for patients receiving several cycles of the medication **(Çakmak & Nural, 2019).**

Early clinical signs of chemotherapy induced OM appear within approximately three to ten days following the administration of Platinol medication. It develops to ulcers which gradually increase in its number and size, and tend to form large ulcerated zones. The intensity of OM peaks within approximately two weeks and generally heals when managed properly by twenty-one days after administration. Generally, the majority of patients require chemotherapy treatment every two weeks **(Johansson et al., 2019).** During the subsequent chemotherapy cycle, patients who had OM during the prior cycle and were not treated right once could complain of severe mucositis **(Sianturi & Irawati, 2019).** Therefore, prevention of chemotherapy induced OM can help patients adhere to optimal dosages and reap the full benefits of therapy with minimal discomfort **(Silaban, Nasution & Siregar, 2020).**

Early intervention for OM is crucial. As a result, many complementary and alternative medicine such as chamomile, Aloe Vera, honey, sesame oil extractions, and cooling therapy utilizing ice chips have been tested for their effect on prevention and management of chemotherapy induced OM **(Agnihotri, Kaur & Arora, 2020; Rasheed et al., 2020; Taban, Mumtaz &Ali, 2020 & Yarom et al., 2020).** Oral cooling therapy is considered one of the recent modalities used to prevent and manage OM by inducing local cooling effect to oral tissues for prophylaxis and management purposes. It can induce local vasoconstriction of the blood vessels which reduces the oral mucosal blood flow and eliminates the volume of blood containing chemotherapeutic drugs from reaching the mouth. It also reduces the amount of drug distributed to cells with a consequent decrease in the direct toxicity effect, hence altering the severity of OM **(Correa et al., 2020).**

Oral cooling therapy which can be defined as the application of ice chips to the mouth is characterized by high safety, less side effects, easy application, and low cost. This could contribute to its wide application in clinical settings worthwhile. For best results, it requires the patients sucking on ice chips before, during, and after infusions of chemotherapy medications (**Johansson et al., 2019)**. As ice chips can induce local hypothermia to the oral cavity and result in a reduction in blood perfusion to the oral mucosal tissues (**Erika et al., 2021**). It can also reduce the rate of metabolism in the oral epithelium, which may decrease the risk of inflammation caused by the local cytotoxic activity of chemotherapy (**Okamoto et al., 2019**).

As part of active participation in the prevention and management of chemotherapy-induced OM, oncology nurses are accountable for ensuring patient safety and promoting their quality of life (Nawi, Chui, Ishak & Chan, 2018). In addition to providing oral care education, delivering pharmacological and non-pharmacological therapies, conducting oral assessment, and assisting patients in coping with symptoms discomfort; nurses play a crucial role in managing OM (**Park & Lee, 2019).** Effective assessment and monitoring of the oral cavity and symptoms, disease management with an emphasis on making sure that patients have access to the right intervention, and oral care education are just a few of the duties nurses have when managing **OM (Baysal & Sari, 2019).**Therefore, the aim of the current study was to evaluate the effect of ice chips on severity of chemotherapy induced oral mucositis.

Significance of the study

Chemotherapy-related side effects, such as mucositis increased dramatically after its administration. The prognosis and quality of life of patients with mucositis have continuously declined due to a lack of effective treatment and preventative strategies (**Steinmann et al., 2021**). It was not until sixty years later that the intricate mechanisms underlying the pathophysiology of mucositis were identified, and lesions linked to the cytotoxic effects of chemotherapy and/or radiation therapy (RT) were referred to as mucositis (**Bai, 2019**). It is caused by the epithelial mucosa's inflammatory response to the cytotoxic effects of chemotherapy.

Mucositis affects about 40% of patients receiving Platinol medication, and with the administration of higher doses, the severity of OM increases to almost 90%. For the management of patients suffering from high-grade mucositis, 19% of them would require hospitalization and a delay in chemotherapeutic treatment. This could lower the quality of life, worsen the prognosis, and raise the costs for patient care (Rodrigues et al., 2020). Although there are currently a number of therapies and preventive strategies available, it is unclear how successful they are. Therefore, different oral care protocols and strategies were designed to prevent or minimize OM severity among patients receiving chemotherapy **(Wardill et al., 2020).**

Patients' chances of survival have greatly increased because of the advancements in cancer treatment. Nevertheless, there are currently very few viable methods for treating or preventing oral mucositis caused by chemotherapy, which frequently results in either re-modulation or an early end to the treatment (**Jasiński et al., 2021**). Additionally, this raises hospitalization rates, which raises public health expenses and lowers patients' quality of life. By using oral cooling therapy, a simple, non-invasive procedure to manage symptoms linked to OM, it may be possible to manage patients' complains and establish a customized, focused intervention (**Correa et al., 2020 & Yarom et al., 2020**). Consequently, this could make it possible to investigate ice chips' ability to prevent complications in a high-risk subpopulation, and increase the clinical outcomes' significance (**Lu et al., 2020**).

Oral mucositis is still a poorly recognized adverse effect of chemotherapy today. It is imperative that oncology nurse work to enhance the quality of life for cancer patients and subsequently lower the treatment expenses. Also, it is hoped that the results from the current study can provide new insight about the positive effect of applying ice chips on the severity of oral mucositis, and add to the bulk of knowledge which contribute to effective nursing

management for patients receiving chemotherapy. Therefore, the aim of the current study was to evaluate the effect of ice chips on severity of chemotherapy induced oral mucositis.

Aim of the study

This study aimed to evaluate the effect of ice chips on severity of chemotherapy induced oral mucositis.

Research Hypotheses

To achieve the aim of the current study, the following hypotheses were postulated:

HI: There will be a difference regarding oral mucositis grades between the study and control groups throughout measurement time.

H2: The total mean scores of oral mucositis symptoms among the study group will be less than the control group throughout the measurement time.

H3: The total mean scores of numeric pain intensity among the study group will be less than the control group throughout the measurement time.

Operational definitions:

Chemotherapy Induced Oral Mucositis:

In the current study, it is the administration of Platinol chemotherapy which will start from day 1 and continues for three weeks (one session/week). Occurrence of oral mucositis induced by the administration of plationol chemotherapy is common among the study and control groups, its five grades (from 0-4), as well as symptoms will be measured at the end of 1st, 2nd & 3rd weeks of the study utilizing WHO Oral Mucositis Grading Scale, and Patient Reported Oral Mucositis Symptoms (PROMS) Scale.

Ice chips:

In the current study, ice chips are a form of oral cryotherapy which will be applied to the study group. It will be prepared in a special containers of ice cubes using distilled water for easily use by participants. Patients will be instructed to suck and move ice chips in their mouth for 3 minutes (intermittent duration) before the beginning of platinol chemotherapy session, and for additional 5 minutes (intermittent duration) after completion of intravenous chemotherapy. During the session, ice chips will be sucked by patients for 30 minutes continuously, then they will be given a long break for 20 minutes, this process will be repeated for another 30 minutes until chemotherapy session will be completed. As the ice chips melted, patients will be advised to spit out the cold liquid and take another one.

Methods

Design:

Time-series quasi-experimental design was utilized to achieve the aim of the current study. This design is one of the quasi-experimental designs in which the researchers periodically observe patients enrolled in the study. In particular, a time series allows researchers to see what factors influence variables from period to period. The time-series design with its numerous observations or measurements of the dependent variable helps strengthen the validity of the design. The experimental group in this design receives the intervention and the effect can be assessed before and after the intervention (Miller, Smith, & Pugatch, 2020).

In the current study, this design helped to determine the effect of ice chips (intervention/independent variable) on severity of chemotherapy induced oral mucositis (dependent variable) by conducting the assessment before the intervention as a baseline data and after the intervention to evaluate its effect.

Table 1: Schematic representation of research design:

Group	Pre-test	Manipulation	Post-test 1	Post-test 2	Post-test 3
Group 1(Study)	O1	X	O2	O3	O4
Group 2(Control)	O1	–	O2	O3	O4

Key:

O1: Pre- intervention assessment utilizing study tools as a baseline data.

X: Ice chips application (Intervention).

O2, O3& O4: Post-intervention assessment at the end of first, second, and third weeks of the study.

Setting:

The current study was conducted at Clinical Oncology and Nuclear Medicine Department which located in the first floor at El kasr Al Eini University Hospital in Cairo, Egypt.

Sample:

A purposive sample of 60 adult male and female patients who fulfilled the inclusion criteria were enrolled and divided into two equal groups (study group & control group). The study group received ice chips in addition to routine hospital care, while the control group received only routine hospital care. Assigning patients into these two groups was random; the even numbers were for the study group (I) and the odd numbers were for the control group (II).

Inclusion Criteria:

The following inclusion criteria were established: Adult patients who aged from 18-65 years old, with a confirmed diagnosis of having cancer, slated for intravenous infusion of Platinol chemotherapy during the initial chemotherapy cycle, scheduled for three-week cycle of the medication, agree to participate in the study, able to tolerate ice and able to communicate.

Exclusion Criteria:

The following exclusion criteria were established: Concurrent treatment with any other chemotherapeutic medications, suffering from diabetes mellitus, cardiovascular disorders, any immune-compromised disease, head and neck surgeries, oral or pharyngeal cancer and problems in the oral cavity. In addition, patients enrolled or signed consent for any other studies were also excluded from the study for not interfering with the desired outcomes.

Sample size calculation:

Sample size calculation: The following formula was used to determine the sample size with a 95% confidence level, 0.5 standard deviation (the predicted variation), and a 5% margin of error.

$$n = \left(\frac{Z\sigma_d}{E}\right)^2$$

- **Z** is the value of the standard normal distribution for the desired confidence level (e.g., Z = 1.96 for 95% confidence)
- **E** is the margin of error
- **σ** is the standard deviation of the outcome of interest.

The current study involved an estimated number of 60 adult male and female patients in total.

Tools:

The data of the current study was collected utilizing the following tools:

Tool I: Personal Data Assessment Form:

It was developed by the researchers, and involved data related to patients' personal characteristics as age, gender, level of education, occupation, marital status, medical diagnosis, etc…..

Tool II: World Health Organization (WHO) Oral Mucositis Grading Scale:

It is the simplest adopted grading system which measures the severity of oral mucositis (Athar, & Gentile, 2009). The scale is divided into five specific grades from zero to four (0-4).**The grading scale is classified as the following:** 1) Grade 0 (None)= None, 2) Grade 1(Mild)=Oral soreness and erythema, 3) Grade 2 (Moderate)= Oral erythema, ulcers, solid diet tolerated, 4) Grade 3 (Severe)= Oral ulcers, liquid diet only, and finally 5) Grade 4 (Life threatening)= Oral alimentation impossible.

Content validity was established by a panel of five experts in medical surgical nursing field, Faculty of Nursing, Cairo University. Reliability of the tool was established by Liu, Zhu & Guan (2012), and was highly significant as (Cronbach alpha= 0.865).

Tool III: Patient Reported Oral Mucositis Symptoms (PROMS) Scale

It is an adopted tool from Kushner et al. (2008), this scale allows evaluation of oral mucositis symptoms that threaten patients' quality of life. It includes ten items which are: 1) Mouth pain, 2) Difficulty speaking because of mouth sores, 3) Restriction of speech because of mouth sores, 4) Difficulty eating hard foods, 5) difficulty eating soft food, 6) restriction of eating, 7) Difficulty in drinking, 8) Restriction of drinking, 9) Difficulty swallowing, and 10) Change in taste.

The PROMS scale consists of 0-100 points on a horizontal line addressing oral functions affected by oral mucositis. The score that describe the degree of symptom difficulty has to be marked, where zero indicates no symptoms, and the total score is 1000 indicates severe symptoms. The reported symptoms are classified as the following: 1) None= (0), 2) Mild= (1 < 300), 3) Moderate= (300<700), and 4) Severe = (700-1000).

Content validity was tested by five experts in medical surgical nursing field, Faculty of Nursing, Cairo University. Reliability of PROMS Scale was established by Kushner et al., (2008), with an outstanding significant results as (Cronbach alpha = 0.98).

Tool IV: The Numeric Pain Intensity Scale:

It is an adopted 11–point scale, scored from 0 to 10, and used to assess the intensity of pain as reported by patients (McCaffery et al, 1989). Pain intensity scores are classified as: 1) Score (0) indicates no pain, 2) from (1-3) indicates mild pain, 3) scores (4-6) indicates moderate pain and finally 4) scores from (7-10) indicates severe pain. Validity test was done by five experts in the medical surgical nursing field, Faculty of Nursing, Cairo University. Reliability test of Numeric Pain Intensity Scale was established by Ferraz et al., (1990) as (Cronbach alpha = 0.947).

Procedure

Once the official permission was granted for conducting the current study, the procedure was preceded within four phases which included assessment, planning, implementation and evaluation.

Assessment phase: In this phase, and after extensive review of literature, feasibility of the study was checked, accessibility of the sample and facilities of the environment were also assessed. In addition content validity of the study tools were reviewed by a panel of five experts in Medical Surgical Nursing department from Faculty of Nursing Cairo University. Reliability of tools was checked and proved using Cronbach's alpha test**.**

Planning phase: Based on the outcome of the previous phase, the researchers started to randomly select study participants from Clinical Oncology and Nuclear Medicine Department at El kasr Al Eini University Hospital in Cairo, Egypt. Patients were assessed for the inclusion and exclusion criteria to make the final decision about their involvement in the current study. Selected participants were allocated randomly into two groups (Study and Control groups)**.**

Implementation phase: At the beginning, the researchers introduced themselves to the participants in order to initiate communication. Each participant who met the inclusion criteria was approached individually by the researchers to explain the purpose, nature,

and benefits of adherence to the current study. Written consent was obtained from the participants who were able to read and write as well as willing to participate in the study. While oral consent was taken from those who were illiterate and signed by their relatives. Moreover, privacy and confidentiality was assured for them.

Individualized interview session was conducted for each participant on the first day of receiving chemotherapy session to collect related personal data (Tool I). Then, the following three tools were also filled for all participants in the study and control groups and utilized as a baseline data including : WHO Oral Mucositis Grading Scale (Tool II), Patient Reported Oral Mucositis Symptoms (PROMS) Scale (Tool III) and Numeric Pain Intensity Scale (Tool IV).

In this phase, the control group received only their routine hospital care during the treatment period with chemotherapy in the form of: mouth wash by saline/ bicarbonate and antifungal medication as mycostatine when needed. In severe cases, oral antifungal medication and topical anesthesia were utilized for those with painful mouth sores.

The study group received routine hospital care in addition to ice chips. Ice chips was prepared in special containers of ice cubes using distilled water for easily use by participants in the study group. Platinol chemotherapy medication administered starting from day 1 and the cycle continues for three weeks (one session/week). Each session lasted about three hours, participants were instructed to suck and move ice chips in the mouth for 3 minutes (intermittent duration) before the beginning of chemotherapy session, and for additional 5 minutes (intermittent duration) after completion of intravenous chemotherapy. During the session, ice chips was sucked by participants for 30 minutes continuously, then give long break for 20 minutes, after that this process repeated for another 30 minutes until chemotherapy session completed. As the ice chips melted, participants were advised to spit out the cold liquid and take another one. They were instructed to keep mouth cavity cool as can as possible. Pain sensation in the mouth of fewer than 20 min is considered a factor in reusing ice. Participants learned this technique in five minutes, and all phases were completed within 180-210 minutes. Data was collected within six months started from May 2023 to November 2023.

Evaluation phase: Patients' oral mucositis grades, symptoms severity and pain intensity were evaluated in the study and control groups utilizing assessment tools II, III, &IV before and after intervention. These tools were utilized four times: 1st day assessment before administration of first intravenous chemotherapy medication (Platinol) as a baseline data to confirm that all participants were free from the presence of oral mucositis, and at the end of 1st ,2nd and 3rd weeks following chemotherapy administration sessions to evaluate the effect of intervention

Ethical Considerations

For ethical reasons, an official permission was taken from ethical committee of the faculty of Nursing, Cairo University (IRB: 2019041701). Informed consent was obtained from each participant after explaining the nature & purpose of the study. The researchers emphasized that participation in the study was entirely voluntary; anonymity and confidentiality was assured through coding the data. Participants had the right to withdraw from the study at any point without any penalty. Moreover, they were informed that the study data couldn't be reused for any other research purpose without their permission.

Statistical analysis

Obtained data was tabulated, computed and analyzed using statistical package for social sciences (SPSS) program version 23. Descriptive statistics including frequency and percentage distribution (No & %), mean and standard deviation (Mean $\pm SD$) were utilized. Inferential statistics as T-test was used to make a comparison regarding quantitative data between study and control groups. While, Chi square test was used to compare qualitative data between the study and control groups. Moreover, a probability level of ≤ 0.05 was adopted as the level of significance for testing all hypotheses.

Results

Table (2) showed that, 66.7% of the study group and 63.3% of the control group were aged from 40 to less than 60 years with the mean age of 51.4± 10.82 and 49.1 ± 9.97 years respectively. Regarding gender 53.3% of the study and control groups were females. In relation to marital status, 46.7% of the study group and 63.3% of the control group were married. Concerning occupation, 56.7% of both the study and the control groups were working. Regarding level of education, 26.6% of both groups had a university education.

As shown, there were no statistically significant differences between study and control groups regarding personal data variables as age, gender, marital status, level of education, and occupational status.

According to the type of cancer diagnosis, this figure illustrated that the majority of patients in both the study and control groups had a confirmed diagnosis of colorectal cancer representing 66.6% & 73.3% respectively.

Concerning patients' oral mucositis grades during the measurement time, table (3) illustrated that before intervention, no one in both groups suffered from OM (grade 0).While, one week post intervention, half of patients in the control group suffered from grade (1) OM with no significant complaints among the study group. At two & three weeks post intervention, the number of patients suffering from grade (2) OM in the control group increased dramatically reaching more than half of them by the end of the 3rd week representing 36.7% & 53.4% respectively compared to 0.0% & 6.7% in the study group. Grade (3) OM was observed in the control group at the end of 3rd week of intervention and it representing 13.3% compared to 0.0% on the study group. Moreover, there were highly statistical significant differences between study and control group after applying ice ships at the end of 1st, 2nd& 3rd weeks post intervention with a P value= 0.000. Therefore, the first research hypothesis was supported.

Table (4) illustrated that, pre intervention, no one in both groups suffered from oral mucositis symptoms. Moreover, a considerable marked decline was observed in the post intervention OM symptoms mean scores of the study group when compared to the control group at the end of 1st, 2nd & 3rd weeks of intervention. Additionally, there were highly statistical significant differences between the study and control groups during the measurement time (t= 3.97, 6.31& 7.7 respectively at P=0.000). Therefore, the second research hypothesis was supported.

As shown in Table (5) there were highly statistical significant differences between the study and control groups in total pain intensity mean scores at the end of 1st, 2nd & 3rd weeks of intervention (t = 5.34, 5.78 & 6.1 respectively at P = 0.000). Compared to the pre intervention period, it was obvious that, no one in both groups suffered from pain resulted from oral mucositis. Pain intensity mean scores were markedly declined among the study group than the control group along the post intervention measurement time. Therefore, the third research hypothesis was supported.

As apparent from table (6), the study group had fewer totals mean scores regarding oral mucositis grades, pain intensity, and patient reported OM symptoms when compared to the control group during the three measurement times. Highly statistical significant differences were also observed between the study and control groups (p=0.000). Therefore, the three research hypotheses were supported.

Table 2: Frequency and Percentage Distribution of Personal Characteristics among the Study and Control Groups (n=60)

Variable	Study Group (n=30)		Control Group (n=30)		Test	P-value
	No	%	No	%		
Age:						
-18 > 40	3	10.0	6	20.0	t=0.89	0.37
- 40> 60	20	66.7	19	63.3		
-60 and above	7	23.3	5	16.7		
Mean± SD	51.4± 10.82		49.1 ± 9.97			
Gender:						
-Male	14	46.7	14	46.7	X^2=0.00	1.00
- Female	16	53.3	16	53.3		
Marital Status:						0.37
-Married	14	46.7	19	63.3	X^2= 3.1	
-Not married	16	53.3	11	36.7		
Occupation:						
-Working	17	56.7	17	56.7	X^2=0.00	1.00
-Not working	13	43.3	13	43.3		
Education:						
-Can't read & write	5	16.7	11	36.7	X^2= 2.88	0.11
- Primary & Preparatory School	12	40.0	5	16.7		
-Secondary School	5	16.7	6	20.0		
-University	8	26.6	8	26.6		

Variable	Study Group (n=30)		Control Group (n=30)		Test	P-value
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Age:						
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Marital Status:						0.37
-Married	14	46.7	19	63.3	X^2= 3.1	
-Not married	16	53.3	11	36.7		
Occupation:						
-Working	17	56.7	17	56.7	X^2=0.00	1.00
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-Secondary School	5	16.7	6	20.0		
-University	8	26.6	8	26.6		

*Significant at P- value ≤ 0.05 probability level

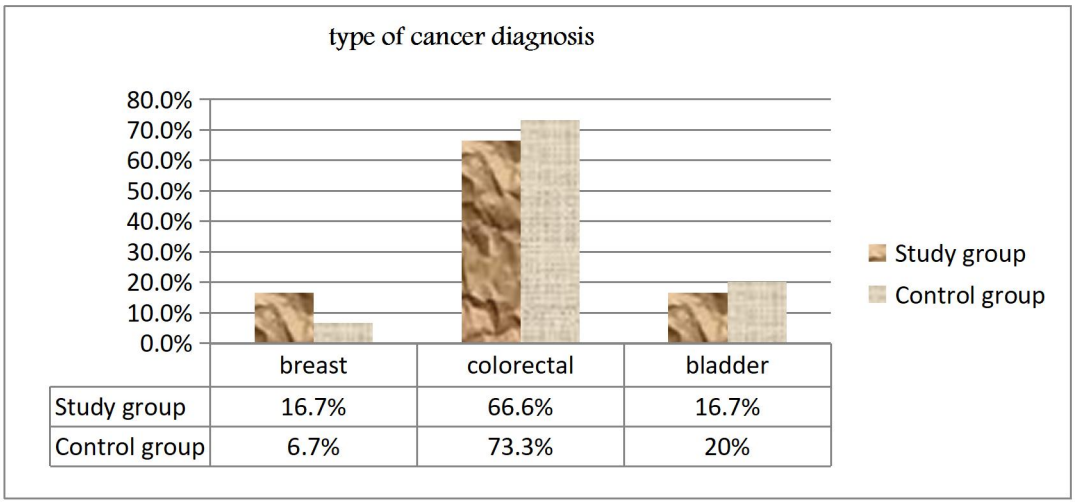

Figure (1): Percentage Distribution Regarding Type of Cancer Diagnosis among the Study and Control Groups (n=60).

Table (3): Frequency and Percentage Distribution of Oral Mucositis Grades Pre and Post Intervention among the Study and Control groups throughout the Measurement Time (n=60)

Variable	Study (n=30)		Control (n-30)		χ2	P-value
	No	%	No	%		
Oral Mucositis Grades						
Pre-Intervention					0.00	1.00
Grade 0 (None)	30	100	30	100		
1st week (Post Intervention 1)					20.0	0.000**
Grade 0 (None)	30	100	15	50.0		
Grade 1 (Mild)	0	0.0	15	50.0		
2nd week (Post Intervention 2)					20.19	0.000**
Grade 0 (None)	25	83.3	9	30.0		
Grade 1 (Mild)	5	16.7	10	33.3		
Grade 2 (Moderate)	0	0.0	11	36.7		
3rd week (Post Intervention 3)					25.57	0.000**
Grade 0 (None)	17	56.6	3	10.0		
Grade 1 (Mild)	11	36.7	7	23.3		
Grade 2 (Moderate)	2	6.7	16	53.4		
Grade 3 (Severe)	0	0.0	4	13.3		

****Highly significant at P- value ≤ 0.001 probability level**

Table 4: Oral Mucositis Symptoms Mean Scores Pre and Post Intervention among the Study and Control Groups Throughout the Measurement Time (n=60)

Variables	Study (n= 30) Mean ± SD	Control (n= 30) Mean ± SD	t-test	P- value
Pre intervention	0.00 ±0.00	0.00 ±0.00	-	-
Post Intervention Oral Mucositis Symptoms Mean Scores				
1st Week	0.00 ±0.00	54.66 ±75.32	3.97	0.000**
2nd Week	16.00 ±42.71	240.00 ±189.60	6.31	0.000**
3rd Week	48.33 ±68.13	421.33 ±256.28	7.7	0.000**

****Highly significant at P- value ≤ 0.001 probability level**

Table 5: Pain Intensity Mean Scores Pre and Post Intervention among the Study and Control Groups throughout the Measurement Time (n=60)

Variables	Study (n= 30) Mean ± SD	Control (n= 30) Mean ± SD	t-test	P- value
Pre Intervention:	0.00 ±0.00	0.00 ±0.00	-	-
Post Intervention Pain Intensity Mean Scores				
1st Week	0.00 ±0.00	1.36 ±1.40	5.34	0.000**
2nd Week	0.60 ±1.24	3.26 ±2.19	5.78	0.000**
3rd Week	1.40 ±1.73	4.83 ±2.56	6.1	0.000**

****Highly significant at P- value ≤ 0.001 probability level**

Table 6: Total Mean Scores of Oral Mucositis Grades, Pain Intensity, and Patient Reported OM Symptoms Post Intervention among the Study and Control Groups (n=60)

Variables	Study (n=30) Mean ± SD	Control (n=30) Mean ± SD	t-test	P-value
Oral Mucositis Grades	0.22±0.31	1.09±0.65	6.61	0.000**
Pain Intensity	0.67±0.88	3.16±1.92	6.46	0.000**
Patient Reported OM Symptoms	21.44±34.53	238.6± 159.38	7.29	0.000**

****Highly significant at P- value ≤ 0.001 probability level**

Discussion

The current study revealed that the majority of the patients' age ranged from 40 to less than 60 with a mean age of the study and control groups representing 51.4± 10.82 & 49.1 ± 9.97 years respectively. Regarding gender, females was the dominant gender among the study sample. In relation to marital status, the largest percentage of the study sample was not married. In addition, more than half of them had work. According to educational level, more than one quarter of the study sample had university education. In addition, the majority of them had a confirmed diagnosis of colorectal cancer.

These results were in line with the findings of **O'Neill, Mirza & Younus (2020),** who examined the management of chemotherapy induced OM among patients with cancer and reported that, the mean age of the study sample was 46.8±6.25, with two-thirds of the sample being between the ages of 40 and 60. From the researchers' perspectives, this outcome may be the result of the expectation that patients within this age group were at higher risk of developing cancer since

they were older, had weakened immune systems, and had inadequate nutrition. Within the same category, **Abd Allah, Gad & Abdel-Aziz (2020),** assessed the nutritional status among older adults with cancer receiving chemotherapy and found that, less than one-third of patients with cancer under study had a high level of education. Additionally, the current study findings aligned with the findings of **Oldenmenger et al., (2018),** who examined cancer-related symptom and reported that, less than 50% of patients with cancer were employed, and received a platinum-based chemotherapy, as a commonly used treatment for colorectal cancer.

Regarding OM grades, the current study findings revealed that, patients in both groups suffered from OM with different grades along the measurement time, while at the end of the third week, it was observed that the highest percentage of the study group had no OM (grade 0), and no one of them developed grade (3) OM along the measurement time. Moreover, merely half of the control group at the end of the third week had grade (2) OM and less than one third of them suffered from grade (3) OM. A systematic review conducted by Khosroshahi, **Talebi, Travica, & Mohmmadi (2023),** examined the effect of oral cooling therapy on occurrence of oral mucositis among patients with cancer, and showed that, with a very little confidence of data, oral cooling therapy appeared to significantly reduce the incidence and severity of OM in patients with cancer. These data could be explained in the light that cooling therapy could reduce blood flow to the cells that make up the oral mucous membrane by constricting the mouth's small arteries, limiting medication distribution, and quieting the basal and epithelial cells' metabolic activity. This could lessen the likelihood and intensity of OM.

Additionally, findings of the current study revealed that, there were statistically significant differences between study and control group regarding OM grades at the end of 1st, 2nd & 3rd weeks of intervention which was expected due to the proved evidence of the study conducted by **Soliman, (2019),** and **Chan, Tay, Yap, Wu, & Klainin-Yobas, (2023),** which illustrated that, the mechanism of ice chips function was activated as holding ice chips in the oral cavity created vasoconstriction and rapid cooling effect of the oral mucosa in addition to reduction in blood supply, which consequently lower the local concentration of chemotherapeutic agents.

Similar studies indicated that, oral cooling therapy was effective in reducing the severity of OM after administering chemotherapy, and more effective than standard hospital care alone **(Erika et al., 2021).** Moreover, **Silaban, Nasution, & Siregar (2020)** concluded that, oral cooling therapy could prevent occurrence of mucositis among patients with cancer receiving chemotherapy. Also, studies conducted by **Bai (2019),** and **Correa et al. (2020),** demonstrated that, oral cooling therapy reduced the grade of OM induced by chemotherapy. Results from these studies gave more plausible explanation regarding the fact that ice ships had a positive effect on reducing the grades of oral mucositis among the study group when compared to the control group who received routine hospital care only.

Concerning patients' oral mucositis symptoms severity scores throughout the measurement time, the present study revealed that a considerable marked decline was observed in the total mean scores among the study group when compared to the control group at the end of 1st, 2nd & 3rd weeks of intervention. Additionally, there were highly statistical significant differences between the study and control groups throughout the measurement time. This outcome may be the consequence of the ice chips' ability to chill the mouth cavity, which may lessen the release of inflammatory cytokines (IL-6), and consequently, lessen the intensity of discomfort. Moreover, when oral mucositis pain subsided, the prevalence of anorexia reduced, and in turn the appetite improved **(Rodrigues et al., 2020).**

Oral cavity is subjected to extremely low temperatures as part of the oral cooling technique. The goals of this therapy were reducing inflammation, cellular metabolism, discomfort, and spasm, while increasing vasoconstriction and cellular survival **(Okamoto et al., 2019).** Numerous investigations have evaluated the impact of oral

cooling therapy on the progression of mucositis. Ice chips were the only preventive measure that was found to be beneficial in preventing oral mucositis out of six agents evaluated in a Cochrane systematic review. It was found that, patients with cancer receiving chemotherapy drugs and applied oral cooling therapy experienced a 50% reduction in the development of oral mucositis. These authors noted that this was not strong and reliable evidence in their studies because of the small number of studies, the patients' unique circumstances, and the subjects themselves **(Erika et al., 2021).**

Another trial which involved 30 cancer patients overall and a chemotherapy regimen, clarified that oral mucositis was not found in most patients receiving oral cooling therapy after 7 and 14 days of intervention. In a similar vein, the experimental group's incidence of Grades 1, 2, and 3 oral mucositis was significantly lower than that of the control group ($p < 0.05$). On day 21, there was no statistically significant difference ($p > 0.05$) in the development of oral mucositis between the experimental and control groups (Nawi, Chui, Ishak & Chan, 2018). A statistically significant difference was found between the mean mucositis scores in the oral cooling therapy group and usual care groups ($p < 0.05$) in another study, which involved 80 patients with colorectal cancer who received Platinol chemotherapy during their first cycle of chemotherapy **(Sianturi1& Irawati, 2019).**

Concerning pain intensity mean score among the study and control groups, the present study indicated that there was a statistically significant difference in pain intensity between the study and control groups throughout measurement time. Positive effect of applying ice chips on reducing the intensity of pain was documented in the study group. This result could indicate that, there was a positive correlation between oral mucositis grads, symptoms and pain; oral mucositis pain intensity increased when the grade and severity of symptoms increased which was clear particularly in the control group. This result was in agreement with **Rodrigues et al., (2020),** and **Chan, Tay, Yap, Wu, & Klainin-Yobas** (**2023**), who studied the effect of oral cooling therapy on the occurrence of mucositis among patients undergoing chemotherapy, and revealed that there was a significant improvement in patients' oral condition and reduction in pain intensity among the study group who applied ice chips than those who did not.

As the pain severity scores were markedly declined among the study group when compared to the control group along the measurement time. This result was supported by the study entitled "Prevention of oral mucositis and pain among patients with colorectal cancer undergoing chemotherapy" **(Nawi, Chui, Ishak &Chan, 2018)** concluded that, pain associated with mucositis was reduced with the use of oral cooling therapy, with the majority of patients in the intervention group who reported no pain by the end of the study period.

Conclusion:

The finding of the current study revealed that there were highly statistical significant differences between study and control group regarding oral mucositis grades, OM symptoms severity mean scores and pain intensity mean scores at the end of 1st, 2nd & 3rd weeks of intervention.

Recommendations:

- Ice ships can be recommended as a safe, cheap, and easy applicable method for reducing the severity of OM among patients with cancer receiving chemotherapy.

-Applying oral cooling technique utilizing ice-chips should be recommended in addition to the routine hospital care as great way to enhance nursing management for patients receiving chemotherapy and reduce the severity of OM.

- Patients receiving chemotherapy should be involved in educational programs which provide information about the benefits of using ice chips as a management therapy in the routine care provided to them.

-Replication of the study on a larger probability sample is recommended.

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