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Effect of Chlorhexidine Mouthwash on Chemotherapy-Induced Oral Mucositis among Patients with Cancer

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Abstract: Background: Oral mucositis (OM) is a painful complication of cancer treatment that starts with inflammation in the oral mucosa and progresses to redness and ulcers. Severe pain from ulcers can affect speaking and eating. **Purpose**: To assess the effect of chlorhexidine mouthwash on chemotherapy-induced oral mucositis among patients with cancer. **Design**: A quasi-experimental research design was utilized for this study. **Setting**: The study was conducted at the Oncology Institute (inpatient department & outpatient clinic) at Menoufia University Hospital in Shebin El Koum, Egypt. **Sample**: A purposive sample of 100 patients who met the inclusion criteria was selected and divided into two equal groups (Study & Control). **Instruments**: Four instruments were used: Structured interview questionnaire, oral assessment guide, WHO oral mucositis assessment scale and visual analogue pain scale. **Results**: The study revealed a statistical significant difference between the study group and the control group in terms of oral cavity functions and grades of oral mucositis, with the study group showing better results post-intervention (P-values <0.001). The study also showed a lower occurrence of oral mucositis in the chlorhexidine group than the control group. Additionally, a highly significant statistical difference was observed between the two groups regarding pain scores in favor of the Chlorhexidine group in the second and third sessions (P-values <0.001). **Conclusions**: The study found that chlorhexidine mouthwash reduced oral mucositis grades, mucositis occurrence, and pain severity in the chlorhexidine group. It also reduced deterioration in oral health in the study group compared to the control group. **Recommendations**: Chlorhexidine mouthwash 0.12% is recommended in combination with routine hospital care to reduce oral mucositis, pain, and improve oral health.

Key words*: Cancer, Chlorhexidine, Chemotherapy, Oral Mucositis*

Introduction

Cancer is a significant issue in the twenty-first century, impacting society, health, and economy. The World Health Organization (WHO) estimates that there will be approximately 20 million new cancer cases and 9.7 million deaths worldwide in 2022, indicating a rise in both the number of cases and fatalities. By 2050, it is estimated that there will be more than 35 million new cancer cases, which is a 77% increase from 2022 (Bray et al., 2024, Ferlay et al., 2024). In Menoufia Governorate, an estimated 45,528 cancer patients were admitted to the oncology hospital out of a total of 322,520 patients with various diseases, accounting for 14.12% of the total patient population (Menoufia University Hospital Medical Record, 2022).

Treatment options for cancer include chemotherapy, radiation therapy, surgery, and biologic response modifier therapy. Chemotherapy is the most frequently used treatment method, targeting cancer cells for elimination. However, it also affects healthy cells with high proliferation rates, such as immune and gastrointestinal epithelium cells. Chemotherapy can result in side effects such as nausea, vomiting, decreased appetite, and diarrhea. Mucositis is a prevalent side effect, impacting approximately 40% of individuals undergoing cancer treatment and nearly all patients with head and neck cancer receiving chemotherapy (Gallotti et al.,2021).

Oral Mucositis (OM) is characterized by redness and swelling in the mouth, progressing to ulcers. It typically develops 3-5 days after chemotherapy and 7-10 days after radiotherapy. Commonly affected areas include the buccal mucosa, tongue, floor of the mouth, and soft palate. Symptoms include severe pain and difficulty with activities like swallowing, chewing, drinking, and speaking, significantly impacting daily life. Oral mucositis worsens the clinical condition due to inadequate food and fluid intake. This lack of consumption can lead to malnutrition, dehydration, and weight loss, impacting both physical and mental health and affecting the quality of life of patients (Erika et al.,2021).

Oral mucositis can significantly affect the physical and psychological well-being of cancer patients. The severity of mucositis can lead to interruptions, reductions, or complete withholding of cancer treatments to facilitate healing and prevent recurrence of mucositis, potentially affecting the patient's overall survival. It is crucial to prevent mucositis, alleviate patient suffering, and decrease the burden of cancer care to ensure that patients can obtain he best possible therapy for optimal chances of surviving the disease (Thornton et al., 2022).

Preventing and treating oral mucositis due to cancer therapy necessitates suitable intervention. Chlorhexidine (CHX) is an antiseptic with bactericidal, fungicidal, and virucidal properties, commonly employed to prevent dental plaque buildup and manage moderate to severe gingivitis. The reversible side effects of CHX may include extrinsic staining of teeth

and tongue. Chlorhexidine acts as a broad-spectrum biocide, capable of eliminating most Gram-positive and Gram-negative bacteria within 30 seconds, thereby reducing the risk of opportunistic infections. (Ana et al., 2020).

Nurses working in oncology departments play a vital role in caring of patients with cancer, particularly in preventing and treating the specific side effects of oncology treatments. Therefore, it is essential for nurses to effectively utilize the nursing process, a method of personalized patient care, in their clinical practice. Without this approach; the care provided by nurses and their team may lack a foundation in nursing science, leading to a routine of repetitive interventions and actions, often limited to following medical orders. Nurses' responsibilities in chemotherapy and radiotherapy include preparing patients for procedures and managing adverse effects such as OM through preventive and supportive measures (Abreu et al., 2021). This study was carried out to assess the effect of chlorhexidine mouthwash on chemotherapy induced oral mucositis among patients with cancer.

Significance of study

Chemotherapy-induced oral mucositis can present with symptoms such as atrophy, swelling, redness, pain, bleeding, ulcers, and difficulty in feeding or swallowing saliva. These symptoms can vary and may lead to reduced nutritional intake, impacting the patient's overall nutritional status (Elliott, 2021). Several studies have assessed the use of Chlorhexidine to reduce the occurrence and grades of oral mucositis in children and adults (Sindhe et al., 2023; Ebrahim et al., 2022). In Egypt, there have been limited studies on the effect of Chlorhexidine mouthwash on chemotherapy-induced oral mucositis. Therefore, in the current study, we aim to assess the effect of chlorhexidine mouthwash on chemotherapy-induced oral mucositis among patients with cancer.

The study purpose

To assess the effect of chlorhexidine mouthwash on chemotherapy induced oral mucositis among patients with cancer.

Research Hypotheses

1) Patients who use chlorhexidine mouthwash (Chlorhexidine group) will show lower score of Oral Assessment Guide scale compared to patients who don't (control group).
2) Patients who use chlorhexidine mouthwash (Chlorhexidine group) will have lower grades of oral mucositis than patients who don't (control group).
3) Patients who use chlorhexidine mouthwash (Chlorhexidine group) will have a lower occurrence of oral mucositis than patients who do not (control group).
4) Patients who use chlorhexidine mouthwash (Chlorhexidine group) will report lower intensity of pain than patients who don't (control group).

Operational Definitions

- **Chemotherapy-induced oral mucositis** is defined as cytotoxic damage to rapidly dividing buccal submucosal basal cells, which usually emerges 5 to 7

days after the initiation of chemotherapeutic agents, resulting in epithelial cell damage and subsequent painful oral lesions or ulcerations. It was assessed using the Oral Assessment Guide (instrument two) and the Oral Mucositis Assessment Scale (instrument three).

- **Chlorhexidine mouthwash** is defined as a mouthwash using a 0.12% oral solution, provided for cancer patients receiving chemotherapy. It should be used three times daily with a rinsing time of at least 30 seconds.

Methods:

Research Design

A quasi-experimental research design (study and control) was utilized to accomplish the purpose of the current study.

Setting

The current study was conducted at Oncology Institute, Menoufia University Hospital, Menoufia, Governorate, Egypt.

Sampling

A purposive sample of 100 patients who met the inclusion criteria was divided into two groups of 50 patients for each group and willing to participate in the study.

Inclusion criteria:

Eligible participants for the study were conscious cancer patients of both genders, between the ages of 18 and 65, receiving their first chemotherapy session at an Oncology Institute. They had not previously used chlorhexidine mouthwash, had no history of sensitivity to it, and were capable of self-care, communication, and providing answers to questions.

Exclusion criteria:

Patients with pre-existing oral mucositis, dental issues, or recent oral surgery should be excluded to eliminate potential confounding factors in the assessment of oral mucositis.

Sample size

The sample size was determined by setting the test power to 80% and the confidence interval to 95%, with an accepted margin of error of 5%, using the equation:

Sample size = $\mathbf{2SD^2 (Z_{\%} + Z_{\beta})^2 / d^2}$

SD = standard deviation (it can be calculated after pilot study or can be taken from previous related studies), in the current study, the SD is calculated based on (Saad et al., 2022)

SD = 1.84

$Z_{\%} = Z_{0.05/2} = 1.96$ (Type I error at 0.95 level)

$Z_{\beta} = Z_{\beta 0.20} = 0.842$ (80% power, from Z table)

d = Effect size (different between means of experimental and control groups)

$n = 2\ (1.84)^2 \text{ X } (1.96 + 0.842)^2 / (0.73)^2 = 99.76$ patients

Based on the above equation, the sample size was 100 patients.

Instruments of the study:

Four instruments were used for collecting the data in this study. These instruments were:

<u>Instrument one</u>: - Structured Interview Questionnaire:

The researcher developed it after reviewing related literature to evaluate

socio-demographic and medical data. It consisted of two parts.

Part 1: Socio-demographic data

- It included questions such as age, gender, marital status, level of education level, occupation, residence, smoking, family income, contact address etc.

Part 2: Medical data

- It included questions about date of admission, diagnosis, site of cancer, stage of cancer, type and number of cycles of chemotherapy.

Instrument two: Oral Assessment Guide (OAG)

This scale was adopted from Eilers et al. (1999), to assess status of the oral cavity by observing the health condition of the buccal cavity at the time of data collection.

Scoring system:

There are eight components included in the assessment: voice, swallowing, lips and the edge of the mouth, tongue, saliva, mucous membranes, gingiva, and teeth. Each component is rated on a scale of 1 to 3, with 1 indicating normal function, 2 indicating mild changes without significant impact on epithelial integrity or overall health, and 3 indicating a clear compromise. The total score ranges from 1 to 24, with scores of 1-8 indicating a healthy oral cavity, 9-16 indicating moderate oral mucositis with mild changes, and 17-24 indicating severe oral mucositis with significant compromise.

Instrument three: WHO Oral Mucositis Assessment Scale

This scale was adopted from Putwatana et al. (2009) and is used to assess the mucositis grades pre and post-intervention.

The scoring system of oral mucositis severity consisted of five grades: 0 (none) indicating no symptoms; 1 (mild) indicating erythema and soreness; 2 (moderate) indicating ulcers, but the patient can still swallow solid food; 3 (severe) indicating ulcers where the patient cannot swallow solid food; and 4 (life-threatening) indicating ulcers where feeding is not possible.

Instrument four: - Visual Analogue Pain Scale (VAS)

It was developed by Bain et al., (2005) to rate the subject's level of pain intensity.

Scoring system:

The measurement ranged from zero (no pain), 1-3 (mild pain), 4-6 (moderate pain), 7-9 (severe pain) and 10 (the worst pain).

Validity of the instruments: -

The instruments underwent face validity testing by a panel of eleven experts in Medical Surgical Nursing and oncology medicine to ensure relevance, completeness, and clarity. Adjustments were made as needed to enhance relevance and completeness.

Reliability of the instruments: -

Test-retest methodology was used to determine consistency with the first instrument. There was a two-week interval between the two tests, with r = 0.83. The second and third instruments were proven to be valid and reliable. The value of Cronbach's alpha was 0.84 and 0.86 for the oral assessment guide instrument and the WHO oral mucositis assessment scale, respectively (Saad et al., 2022).

Shafshak & Elnemr (2021) conducted a study to assess the reliability of the visual analogue pain scale and reported a test-retest reliability coefficient of r = 0.84.

Pilot study:

A pilot study involving ten patients (10% of the study sample) was conducted prior to data collection to evaluate the feasibility, clarity, and applicability of the instruments. Adjustments were made as needed based on the pilot study outcomes. The patients involved in the pilot study were subsequently removed from the main study population to avoid bias.

Ethical Considerations:

The researcher obtained approval to conduct the study from the Research Ethics Committee of the Faculty of Nursing, Menoufia University (approval number 914 on 19/1/2022). The participants in the study were provided with a verbal and written explanation of the study's purpose and asked to provide their consent to participate. Each participant was assured that their information would be kept confidential and used only for scientific research. The researcher made it clear that participation in the study was voluntary, and patient anonymity was guaranteed through data coding. Participants were informed that they could withdraw from the study at any time, and their decision not to participate would not affect their care. They were also assured that the study would not cause any physical or emotional harm.

Procedure

- An official letter was submitted from the Dean of the Faculty of Nursing to the director of Oncology Institute at Menoufia University Hospitals including the purpose of the study and the methods of data collection. The data collection period spanned five months from the beginning of May to the end of September 2023.
- Patients who met the inclusion criteria and agreed to participate in the study were assigned to two equal groups (study and control). Data were collected from patients in the control group four days per week (from Sunday to Wednesday) until the required number of subjects was reached to prevent bias and data contamination. After that, the researcher attended with the study group four days per week until the required number of subjects was reached.
- The researcher conducted interviews individually with 10 to 15 eligible patients per day from 11 am to 4 pm with each interview lasting approximately 15 to 20 minutes. The data were collected in either the chemotherapy administering room or the outpatient clinic waiting area. During the initial interview, the researcher introduced himself, explained the nature and purpose of the study, and obtained oral and written consent from each participant. Socio-demographic and medical data were collected individually from patients in both groups using instrument one, and baseline data about the oral cavity status were gathered using instrument two.
- Patients in both groups were followed up for three consecutive sessions, starting from the first session of chemotherapy. All study participants were given instructions about avoiding spicy, hard, irritating, salty, acidic, and citrus foods and juices that may

aggravate oral mucositis and increase pain. The patients in the control group were instructed to follow the routine hospital care, which included brushing their teeth with toothpaste using a soft toothbrush and rinsing with water. Patients in the study group were instructed to follow the routine hospital care in addition to using 0.12% chlorhexidine mouthwash three times daily, with 10-15 ml per use, without dilution. They were instructed to gargle for 30 seconds, then spit out the solution without swallowing it. They were advised not to rinse with water or other mouthwashes, and to refrain from brushing their teeth or eating for 30 minutes after using the chlorhexidine mouthwash to maximize its effectiveness. They were also informed about the indications and possible side effects of chlorhexidine that may occur.

- The name and telephone number of each participant were obtained to follow up with them for the development of oral mucositis and to confirm upcoming sessions. This was also done to ensure the correct usage of chlorhexidine mouthwash for the study group and to address any complaints about the mouthwash, such as local staining of teeth and alterations in taste.
- All participants in both groups were assessed for the condition of the oral cavity, oral mucositis grades and pain intensity after each session for three consecutive sessions using Instruments two, three and four. The occurrence of oral mucositis was also recorded for the patients in both groups at each session.
- After completing the data collection procedure, a statistical comparison was conducted between the chlorhexidine group and the control group regarding the Oral Mucositis Guide, WHO Oral Mucositis Assessment Scale, the level of experienced pain and the occurrence of oral mucositis to assess the effect of using chlorhexidine mouthwash on chemotherapy-induced oral mucositis among cancer patients.

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 25, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, which describe a categorical set of data by frequency, percentage or proportion of each category, comparison between two groups for qualitative data was done using Chi-square test. For comparison between means of two groups of parametric data of independent samples, a student t-test was used. A statistical significant difference was considered if $P \leq .05$.

Results

Table 1 shows that more than half of the sample (60% in the study group and 56% in the control group) were in the age range of 51 to 65 years., with mean age of 50.640 ±10.680 and 50.180 ±9.931 for the chlorhexidine group and control groups, respectively. In terms of gender, 70% of the study group and 58% of the control group were females. Additionally, 82% of the participants in the study group and 90% of those in the control group were married, while 50% of the study group and 42% of the control group had secondary education. Furthermore, about two-thirds of both the study and control groups were housewives. The majority of both the study and control

groups (98% and 96%, respectively) were from rural areas. In terms of smoking, 30% of the study group and 42% of the control group were smokers. Income was insufficient for 100% of both groups.

Table 2 shows that 38% of the study group and 34% of the control group had breast cancer. For the stage of the disease, 70% and 58% of the study and control groups, respectively, were in the second stage. Regarding the chemotherapeutic agent, 26% and 38% of the study and control groups, respectively, were using Taxol. Concerning the number of chemotherapy sessions, 36% of the study group and 54% of the control group received six sessions of chemotherapy.

Table 3 shows that in the first session, there was no statistically significant difference between the two groups in relation to the total mean score of the OAG, where the P-value was >0.05. However, highly statistically significant differences were found between the study and the control groups in the second and third sessions regarding the total mean score of the OAG, with P-values < 0.001. These differences were in favor of the study group, with the total mean score of the Oral Assessment Guide Scale in the study and control groups, respectively was 9.04 ± 0.83 and 11.09 ± 1.88 in the second session, and 9.18 ± 1.02 and 14.38 ± 1.89 in the third session.

Figure 1 describes the distribution of the levels of oral mucositis according to OAG between patients in the two groups throughout the study phases. It shows that 44% of the study group had healthy oral cavity in the first session, compared to 28% and 26% in the second and third sessions, respectively. The control group demonstrated a progressive decline in healthy oral cavity from 46% in the first session to 2% and 0% in the second and third sessions, respectively. Moreover, the control group developed a high percentage of moderate oral mucositis, 98% and 86% in the second and third sessions, respectively. However, 14% of the control group developed severe oral mucositis.

Table 4 reveals that In the first session, there were no statistically significant differences between the two groups. For WHO Oral Mucositis Grading, where P-value = 0.39. However, highly statistically significant differences were observed between the study group and control group in the second and third sessions for WHO Oral Mucositis Grade, where the P-values < 0.001.

Figure 2 indicates a lower occurrence of oral mucositis in the study group than in the control group throughout all sessions of the study. In the first session, the occurrence of OM was 10% in the chlorhexidine group and 18% in the control group. In the second session, the occurrence of OM was 42% and 80%, and in the third session, they were 36% and 100% respectively.

Table 5 shows that there was no statistically significant difference in the mean pain scores between the study and control groups during the first session (P=0.45). However, a statistically significant difference was observed between the two groups in

the second and third sessions (P=0.004 and 0.000, respectively).

Figure 3 describes pain levels among patients in the study and control groups and shows that the majority of both group had no pain in the first session (90% of the study group and 92% of the control group. In the second session, more than half of study group (58%) had no pain while 20%, 30% and 50% the of control group had no pain, mild and moderate pain respectively. In the third session, nearly two thirds of chlorhexidine group had no pain, while most of control group (72%) had moderate pain.

Table 1: Distribution of Patients in the Study and Control Groups According to Socio-Demographic Characteristics (N =100).

Socio-demographic characteristics	Study group (N=50)		Control group (N=50)		X2	P-value
	n	%	n	%		
Age						
• 18 ≥30 years	4	8.0	3	6.0		
• 31 ≥40 years	6	12.0	7	14.0	0 .471	0.925
• 41 ≥50 years	10	20.0	12	24.0		
• 51 ≥ 65 years	30	60.0	28	56.0		
Mean ± SD	50.640 ± 10.680		50.180 ± 9.931			
Gender						
• Male	15	30.0	21	42.0	1.563	0.211
• Female	35	70.0	29	58.0		
Marital Status						
• Single	2	4.0	1	2.0		.
• Married	41	82.0	45	90.0	1.338	0.512
• Widowed	7	14.0	4	8.0		
Education level						
• Uneducated	16	32.0	15	30.0		
• Read and write	8	16.0	10	20.0	8.752	0.068
• Secondary education	25	50.0	21	42.0		
• University education	1	2.0	4	8.0		
Occupation						
• Housewife	34	68.0	30	60.0		
• Manual work	5	10.0	11	22.0	4.500	0.212
• Employee	1	2.0	3	6.0		
• Not working or retired	10	20.0	6	12.0		
Residence						
• Rural	49	98.0	48	96.0	0.344	0.558
• Urban	1	2.0	2	4.0		
Smoking						
• Yes	15	30.0	21	42	2.852	0.091
• No	35	70.0	29	58		
Income						
• Enough	0	0.0	0	0	Not enough	Not enough
• Not enough	50	100.0	50	100		

P ≤ 0.05 is statistically significant.

Table 2: Distribution of Patients in the Study and Control Groups According to Medical Data (N=100).

Medical History	Studied subjects(N=100)				X^2	p-value
	Study group(N=50)		Control group(N=50)			
	n	%	n	%		
Diagnosis						
• Breast cancer	19	38.0	17	34.0		
• Colorectal cancer	8	16.0	10	20.0		
• Liver cancer	7	14.0	4	8.0		
• lymphoma	3	6.0	7	14.0	9.681	0.288
• Bladder cancer	6	12.0	3	6.0		
• Lung cancer	5	10.0	3	6.0.		
• Laryngeal cancer	2	4.0	6	12.0		
Stage of disease						
• First stage	12	24.0	19	38.0	2.756	0.421
• Second stage	35	70.0	27	54.0		
• Third stage	3	6.0	4	8.0		
Chemotherapy agent						
• Taxol	13	26.0	19	38.0		
• Carboplatin	10	20.0	9	18.0		
• Cisplatin	9	18.0	4	8.0	6.103	0.528
• Endoxan	6	12.0	3	6.0		
• Taxotir	5	10.0	6	12.0		
• Holoxan	5	10.0	4	8.0		
• Adriamycin	1	2.0	4	8.0		
• Gemzar	1	2.0	1	2.0		
Number of prescribed chemotherapy sessions.						
• Three sessions	2	4.0	4	8.0		
• Four sessions	7	14.0	7	14.0	6.046	0.196
• Six sessions	18	36.0	27	54.0		
• Seven sessions	10	20.0	6	12.0		
• Eight sessions	13	26.0	6	12.0		

$P \leq 0.05$ is statistically significant.

Table 3: The Comparison Between Study and Control Groups Regarding the Oral Assessment Guide (OAG) Throughout the Study Sessions (N=100).

Session/ Group	The first session		The second session		The third session	
	Study group (N=50)	Control Group (N=50)	Study group (N=50)	Control group (N=50)	Study group (N=50)	Control group (N=50)
Mean Score of the OAG (M ±SD)	8.64± 0.63	8.88 ±1.06	9.04± 0. 83	11.09± 1.88	9.18± 1. 02	14.38± 1.89
T	0.755		2.97		5.22	
p- value	0.45		0.004*		0.000**	

(*)$P \leq 0.05$ is statistically significant (**) High significance at P value ≤ 0.001.

Figure 1: Distribution of patients in the Study and Control groups According the Levels of Oral Mucositis Throughout the Study Sessions (N=100).

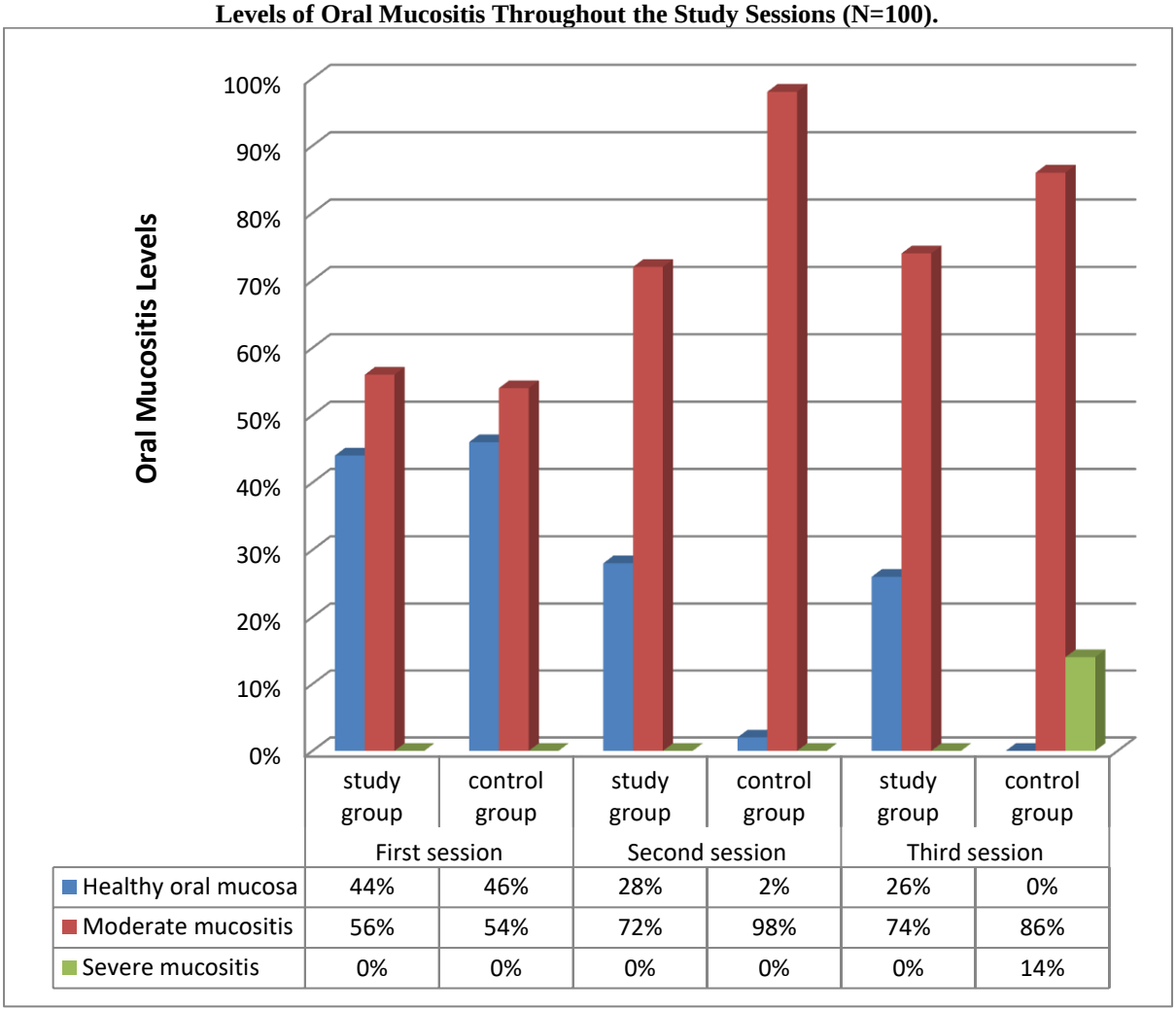


Table 4: Grades of Oral Mucositis among Patients in the Study and Control Groups Throughout the Study Sessions (N= 100).

Grades of oral mucositis	The first session				The second session				The third session			
	study Group (N=50)		Control Group (N=50)		Study group (N=50)		Control group (N=50)		Study group (N=50)		Control group (N=50)	
	n	%	n	%	n	%	n	%	n	%	n	%
Grade 0	45	90.0	41	20.0	29	58.0	10	20.0	32	64.0	0	0.00
Grade I	5	10.0	8	16.0	21	42.0	27	54.0	12	24.0	29	58.0
Grade II	0	0.00	1	2.0	0	0.00	12	24.0	6	12.0	19	38.0
Grade III	0	0.00	0	0.00	0	0.00	1	2.0	0	0.00	2	4.0
Grade IV	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
X^2 p- value	1.88 0.39				23.01 0 .000**				47.809 0.000**			

(*)P ≤ 0.05 is statistically significant (**) High significance at P value <0.001

Figure 2: The Occurrence of Oral Mucositis among the Study and Control Groups Subjects Throughout Study sessions (N=100).

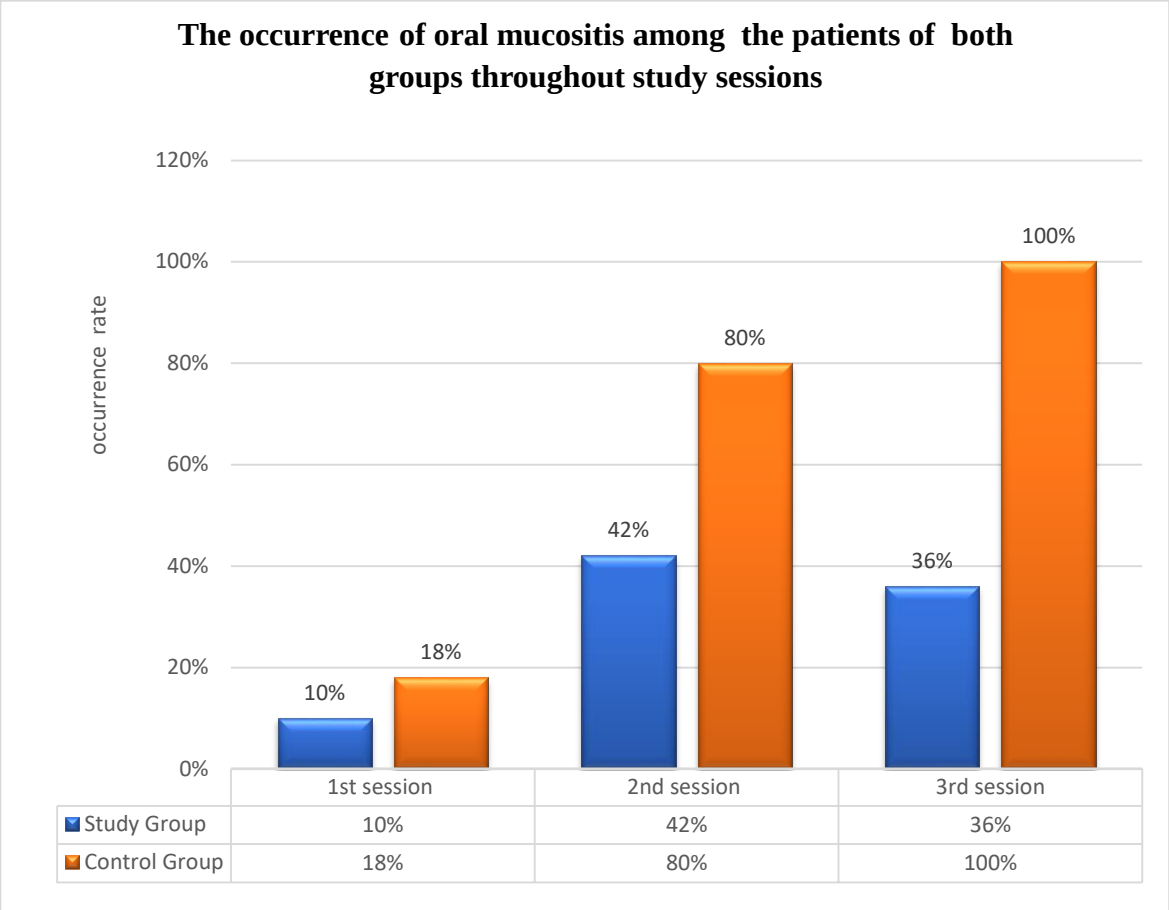
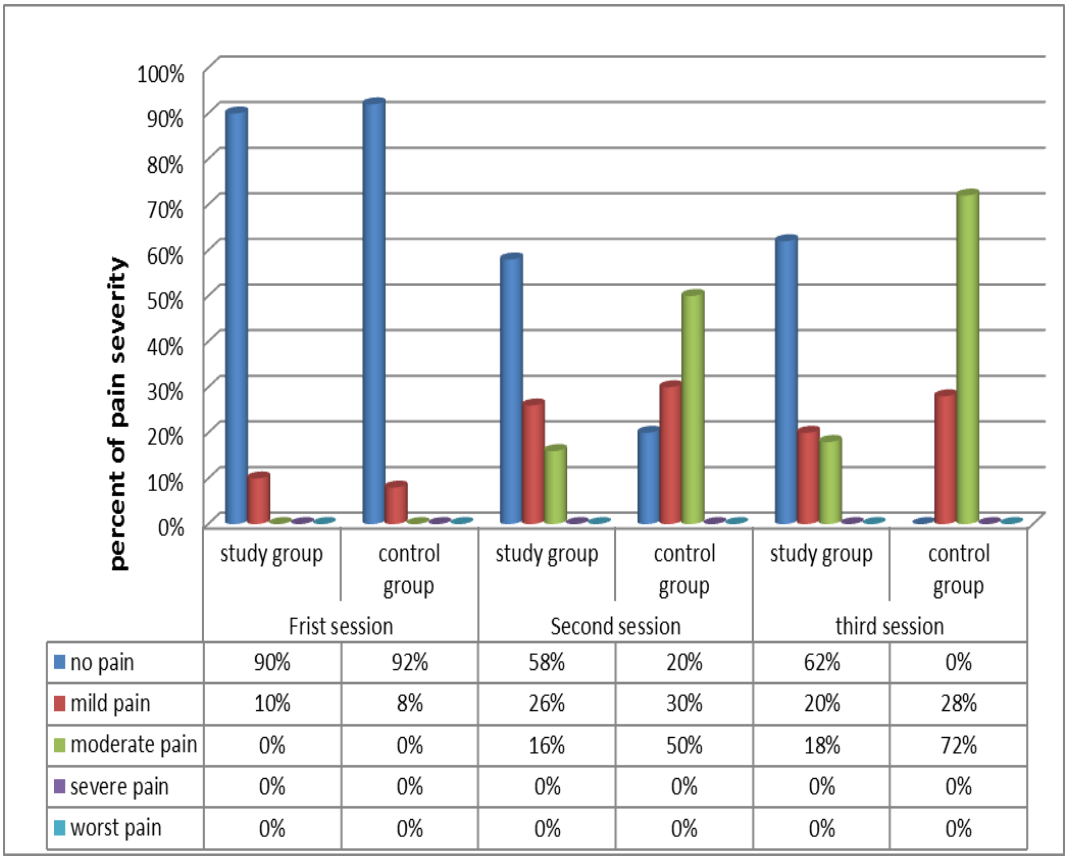


Table 5: Mean Scores of Pain Intensity among Patients in the Study and Control Groups Throughout the Study Sessions (N=100).

Session/ Group	The first session		The second session		The third session	
	Study group (N=50)	Control Group (N=50)	Study group (N=50)	Control group (N=50)	Study group (N=50)	Control group (N=50)
Mean score of pain (M ±SD)	0.36 ±0.98	0.52 ±1.13	1.26 ±1.49	2.13 ±1.33	1.32 ±1.83	2.86 ±.0.99
T	0.755		2.97		5.22	
p- value	0.45		0.004*		0.000**	

(*)P ≤ 0.05 is statistically significant (**) High significance at P value <0.001

Figure 3: Distribution of Patients in the Study and Control Groups According to Pain Severity Throughout the Study Sessions (N=100).



	Frist session		Second session		third session	
	study group	control group	study group	control group	study group	control group
no pain	90%	92%	58%	20%	62%	0%
mild pain	10%	8%	26%	30%	20%	28%
moderate pain	0%	0%	16%	50%	18%	72%
severe pain	0%	0%	0%	0%	0%	0%
worst pain	0%	0%	0%	0%	0%	0%

Discussion

Oral mucositis (OM) is a common and painful complication of cancer treatments such as chemotherapy and radiation therapy. It can significantly affect patients' daily lives, quality of life, and ability to tolerate treatment. Severe cases of OM can increase mortality rates. The lesions associated with OM are often very painful and may not be effectively managed with standard pain relief methods (Elad et al., 2022). Nurses play a crucial role in preventing and managing oral OM to minimize its impact on patients' health. This involves regular oral assessments, patient education, and providing oral care (Raymond & Agyeman, 2023). Oral hygiene and mouth rinses, like chlorhexidine mouthwash, are important in preventing and treating oral mucositis caused by chemotherapy (Sindhe et al., 2023). In this study, the purpose of the researchers was to assess the effect of using chlorhexidine mouthwash on chemotherapy-induced oral mucositis among cancer patients.

It was hypothesized that patients who use chlorhexidine mouthwash (Chlorhexidine group) will show lower score of Oral Assessment Guide scale compared to patients who don't (control group). (hypothesis 1). The current study revealed that no

statistical significant differences were found between the studied groups during the first session between. However, there were statistically significant differences between the study and control groups in the total mean score and levels of OAG during the second and third sessions in favor of the study group. These results are supported by Bahrololoomi et al. (2020), who studied "Evaluating the additive effect of persica and chlorhexidine mouthwashes on the oral health status of children receiving chemotherapy for their haemato-malignancy" and found that the oral health of the study group improved more than that of the control group, with a statistically significant difference according to the OAG. From the researchers' point of view, the use of chlorhexidine mouthwash in the study group is responsible for these results, as it lessened the decline of the oral mucosa in the study group compared to the control group.

Furthermore, these results are consistent with Ebrahim et al. (2022), who conducted a study at Assiut University Hospital entitled "Role of chlorhexidine in preventing oral mucositis among ventilated children at the pediatric intensive care unit" and revealed that the mean score of oral cavity assessment before intervention was not significant. However, after the intervention, the mean score of oral cavity assessment improved, and the patients in the study group had better oral health conditions than those in the control group.

It was hypothesized that patients who use chlorhexidine mouthwash (study group) will have a lower occurrence rate of oral mucositis than patients who do not (control group) (hypothesis 2). The current investigation stated that no statistically significant difference was found in OM grades between the two groups at the first session. In contrast, there were statistically significant differences between the two groups in the second and third sessions. In the second session, more than half of the study group subjects had Grade 0 and more than two-thirds had Grade I, while in the control group, one-third of subjects had Grade 0 and half of them had Grade I. However, in the third session, two-thirds of the study group had Grade 0, one-third of them had Grade I, and few had Grade II. On the contrary, in the control group, more than half of the participants had Grade I, two-thirds of them had Grade II, and very few had Grade III. These findings indicated that the study group had lower grades of OM than the control group. From the researchers' point of view, these results are attributed to the use of chlorhexidine mouthwash in the study group, which helped reduce the development of chemotherapy-induced oral mucositis..

These results are consistent with a recent study by Sindhe et al. (2023) who studied the "Comparison of chlorhexidine and benzydamine mouth rinses in the management of radiotherapy or chemotherapy-induced oral mucositis" and concluded that chlorhexidine mouthwash was more effective in preventing and treating chemotherapy-induced oral mucositis. This is also in line with Afrasiabifar's

(2020) study, which was carried out over three weeks and entitled "Oral mucositis: examining the combined solution of grape vinegar and rose water versus chlorhexidine mouthwash". The study revealed that both grape vinegar and rose water, as well as chlorhexidine, were effective in treating oral mucositis, particularly in the second and third weeks.

The present study hypothesized that patients who use chlorhexidine mouthwash (study group) will have a lower occurrence of oral mucositis than patients who do not (control group) (hypothesis 3). The current research indicated that the occurrence of oral mucositis increased in the control group compared to the study group in the first, second, and third sessions. This result is in line with Bhargava et al.'s (2018) study, which lasted over 1 month and was entitled " The impact of chlorhexidine mouthwash on mucositis caused by chemoradiotherapy in patients with head and neck cancer." The study found that the incidence of oral mucositis in the study group was lower than that in the control group. Furthermore, supported by Erden & Ipekcoban (2017) who studied "Comparison of the efficacy of cryotherapy and chlorhexidine to oral nutrition transition time in chemotherapy-induced oral mucositis" and found that the incidence of stomatitis in the study group was 36.7% compared to 90% in the control group, concluding that chlorhexidine mouth rinse must be considered for the prevention and treatment of oral mucositis. On the other hand, a study by Latha et al. (2020) entitled "Effect of povidone iodine versus chlorhexidine mouthwash on oral mucositis among cancer patients" revealed that povidone iodine mouthwash was more effective than chlorhexidine mouthwash in reducing oral mucositis.

The current research hypothesized that patients who use chlorhexidine mouthwash (study group) will report lower intensity of pain than patients who don’t (control group) (hypothesis 4). The present research showed that there were statistically significant differences between the two groups regarding the pain score and the pain level in the second and third sessions in favor of the study group. These findings are supported by Hurrell et al. (2019), who studied "The management of pediatric oncology inpatients with oral mucositis" and showed that patients who used an oral care protocol including 0.12% chlorhexidine mouthwash had a lower pain level throughout the study period compared to the control group who only used teeth brushing. These findings are in agreement with Afrasiabifar et al. (2023), who studied the “Effect of grape vinegar and rosewater versus chlorhexidine on oral health-related quality of life in patients undergoing chemotherapy" and showed that there was a statistically significant difference in physical pain between baseline and post-intervention. Moreover, a recent study by Sarfaraz et al. (2023) entitled “Assessment of the effect of honey and chlorhexidine on radiation-induced oral stomatitis with head and neck cancer patients"

summarized that the use of honey and chlorhexidine significantly improved oral and pharyngeal pain.

On the contrary, these results are inconsistent with El-Tohamy & Abusaad (2021) who studied the "Effectiveness of flavored oral cryotherapy on the prevention and management of stomatitis induced by chemotherapy" and stated that the group who used cryotherapy developed mild stomatitis compared to the chlorhexidine group, in which two-thirds developed severe stomatitis at the end of the second week.

It is suggested that healthcare providers should consider incorporating Chlorhexidine mouthwash as part of the oral care regimen for these patients to help improve their quality of life during treatment. Further research is needed to explore the long-term effects of Chlorhexidine mouthwash in this patient population and allow for greater generalization of the findings.

Conclusion

The study concluded that there were There were significant statistical differences between the study and control groups in terms of health condition of the oral cavity, oral mucositis grades and pain severity. The study group had a significantly lower occurrence of oral mucositis compared to the control group.

Recommendations

A. Recommendations for patients:

- Patient should have education about the use of Chlorhexidine mouthwash 0.12% along with routine hospital care.

B. Recommendations for practice:

- Collaborating with other institutions to implement mouthwash for oral care, such as chlorhexidine, as an effective nursing intervention to reduce and alleviate painful oral lesions and ulcerations for patients undergoing chemotherapy.

C. .Recommendation for further research:

- The findings of this study can be replicated in various settings and on larger probability samples to enhance the generalizability of the results.

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