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Role of Chlorhexidine in Preventing Mucositis among Ventilated Children at Pediatric Intensive Care Unit

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Abstract:
Providing oral care hygiene for children at intensive care unit and protecting oral mucosa are important in the promotion of healthy nutrition, comfort, and improving patients' quality of life, as well as preventing mucositis. **Aim:** to evaluate the role of chlorhexidine in preventing mucositis among ventilated children. **Subjects and Method:** design**:** Quasi-experimental research design was used in this study **Sample:** The study included 60 children (>6 years age) admitted to PICU and needed mechanical ventilation. They were divided into two groups: group one (30 children) who had oral care intervention (tooth brushing and 0.12% Chlorhexidine gluconate solutions) and group two (30 children) who received routine hospital care. **Setting:** This study was conducted in pediatric intensive care Units at Assiut University Children Hospital**. Data collection tools** included: socio-demographic and clinical data structured interview questionnaire, oral mucositis assessment scale, and oral cavity assessment tool. **Results:** The majority of children (93.3%) in group one (study) had a normal oral condition after intervention, compared to 10.0% had normal oral condition in group two (control) after intervention with a highly statistically significant difference between the study and control groups. **Conclusion:** In mechanically ventilated children, oral care interventions such as tooth brushing and CHX gluconate dramatically reduced the prevalence of mucositis. **Recommendations:** Chlorhexidine gluconate 0.12% is recommended as a mouth rinse for patients who are intubated orally.

Keywords: Children, Chlorhexidine, Mucositis, Mechanical Ventilation, & Pediatric intensive care units

Introduction:
Oral health is a condition of being free from oral disease, pain, or infection that affected an individual's ability to eat, talk and socialize. Periodontitis is one of the most frequent diseases in the world, and it is connected to poor oral hygiene and the development of major non-communicable diseases (NCDs). Dental health and oral hygiene should be acknowledged as important aspects of a healthy lifestyle, yet they are rarely discussed. Hospitalized patients' oral health has been observed to deteriorate globally, with an increase in the quantity of dental plaque and gingival infection occurring within 7–20 days of admission **(Dagnew et al., 2020).**

Mucositis is one of the most prevalent mouth issues connected with numerous illnesses and therapies. Although children therapies are improving, they still have negative side effects include oral mucositis (OM) which is a painful inflammation of the mucous membrane, and ulceration of the mucous membrane **(Mazhari et al., 2018).**

Mucositis is linked to a high rate of clinical morbidity, including discomfort, malnutrition, and infections both locally and systemically. Mucositis is more common and severe in children with mechanical ventilation who spend a lot of time in children's care; however, mucositis can have a substantial influence on treatment results and quality of life in patients undergoing various therapies **(Cinausero et al., 2017; Carreón-Burciaga et al., 2018).**

The goal of oral hygiene for patients undergoing intubation and mechanical ventilation has shifted from patient comfort to infection prevention. The benefits of oral hygiene outweigh the risks; however, careful oral care techniques and sufficient evidence to support these processes are required. Oral health should be regarded as an important and critical component. of pediatric intensive care nursing because it can keep children' teeth healthy, reduce the occurrence of problems, and improve other result indicators by providing regular oral care with dental brushing and chlorhexidine **(Moustafa et al., 2016).**

Chlorhexidine keep mouth health through its ability to inhibiting the growth of Gram-positive and Gram-negative bacteria, as well as yeasts. As a result, this is advantageous since it lowers dental plaque, which minimizes dental cavities while also reducing gingivitis and periodontitis. Chlorhexidine fulfill this by adsorption (as chlorhexidine is positively charged and the structures of the mouth cavity, including teeth and salivary proteins, have a negative charge).

So, chlorhexidine is bound to the surface of the oral tissues and released slowly over an 8-24 hour period. This needs just infrequent chlorhexidine treatments. As a result, chlorhexidine has long been used as part of the dental care regimen of a population with a weakened immune system, such as cancer and bone marrow transplant patients **(Hua et al., 2016; Düzkaya et al., 2017)**

Nurses in intensive care units play an important role in the prevention or reduction of mucositis and increasing patients' quality of life because their role as health care providers is to continuously follow up with patients and implement oral care. There are still no generally accepted standard treatment and care applications for preventing or managing mucositis. In accordance with standards of nursing practice and quality clinical care, nurses are encouraged to use evidence-based clinical guidelines **(Qutob et al., 2013).**

Significance of the study:

Oral hygiene (OH) research has largely been undertaken in pediatric patients detected that mucosal integrity deteriorated and function loss occurred at a medium level in 62.6% of children after endotracheal tube intubation **(Mohammed & Hassan, 2015).**

Providing oral care for children in the intensive care unit and protecting oral mucosa are important in the promotion of healthy nutrition, comfort, and increasing patients' quality of life, as well as preventing infections that might develop in the oropharynx and respiratory tract **(Düzkaya et al., 2017).** Although–pediatric patients in intensive care require frequent oral care, this is commonly overlooked by nurses **(Yarbro et al., 2022).**

Most studies refer to using chlorhexidine in oral care to decrease the bacterial load by oral decontamination, because of its high level of antibacterial, antiviral, and antifungal activities and high substantivity and ability to bind to oral tissues with a subsequent slow release of antiseptic properties and therefore along period of antibacterial action **(Azimi et al., 2016; Nicolatou-Galitis et al., 2013).**

Aim of study: This study aimed to evaluate the role of chlorhexidine in preventing mucositis among ventilated children.

Research hypothesis:

H: Children who are orally cared by using chlorhexidine have less degree of mucositis.

Subjects and Method:

Research design: A quasi- experimental research design was used in the study.

Study setting: The present study was conducted at the pediatric Intensive Care Unit (PICU) of Assiut University Children Hospital

Study subjects: Convenience sampling of 60 children (>6 years age) admitted to PICU and needed mechanical ventilation matchable of both sexes. They were divided into two groups: Group one 30 children for each. Included children who received oral hygiene intervention from the researcher (tooth brushing and 0.12 % Chlorhexidine solution).Group two received routine hospital care comparable to age and sex with group one. Children stayed in the research for a maximum of 7 days.

The inclusion criteria are:

- Children who were intubated and connected to mechanical ventilation (MV) for > 48 h.
- Age > 6 years **(6-12** and from **12** to **18** years school children and adolescents.

Tools of data collection:

The present study data were gathered using the following tools:

Tool I: Socio-demographic and clinical characteristics structured questionnaire:

This tool was developed by the researcher and consists of two parts:

Part 1: Socio-demographic Characteristics:

It includes: age, gender, residence and date of admission.

Part 2: Clinical characteristics:

a- Diagnosis, neuromuscular-blocking-drugs, duration of ventilation, mode of ventilation, and duration in pediatric intensive care unit stay.

b- Feeding types: Enteral feeding, parenteral feeding and nasogastric tube feeding

Tool II: Oral Mucositis Assessment Scale (OMAS): Oral Mucositis Assessment Scale: This tool was developed **Eilers et al.,1999.** It is commonly used for the assessment of oral mucositis. In this scale:

Grade (o): A mouth with a healthy appearance and no mucositis.

Grade (1): points, erythematous lesions observed in the oral cavity.

Grade (2): Red zones with increased mucosa, and lesions separated from each other.

Grade (3): Reddening of the entire oral mucosa with a large number of combined ulcers.

Grade (4): If ulcers, hemorrhage and necrosis were present in the mouth **(World Health Organization, 1979).** Each category of the oral mucositis the assessment grade was calculated based on 4 point scale: A score of 0 indicated a normal result, while a score of 1 indicated a mild alteration; 2 was a moderate alteration, 3 and 4 indicated severe abnormality.

Tool III: Oral Cavity Assessment Tool:

Oral cavity assessment tool includes: mucous membranes, saliva, tongue, lips, gums, teeth, ability to maintain nutrition (normal diet, soft diet and fluids only or nil by mouth), analgesic requirements, and

evidence of infection. This tool was developed by (**Harris et al., 2008).** It was modified by the researcher by removing **4** items (voice, swallow, taste, and self-care assessment because of intubation)**.** Each item has a score range from 1 to 3. The total score was 27. Each item is treated as a sub-scale, and the overall score is the sum of 9 sub-scales. Total scores range from 9 to 27. The score is arranged as follows 9-16 indicating a slight change in the mouth. **17-22** denotes moderate alteration, and **23-27** denotes severe alteration of mouth.

Methods:

After obtaining permission from the hospital's administrative authority, the study was carried out after clarifying the objective of the study.

This study was conducted in pediatric intensive care Units at Assiut University Children Hospital during the period from November (2018) to September (2019).

Ethical considerations

- The research proposal was approved by the Ethical Committee in the Faculty of Nursing.
- There was no risk for study subjects during the application of the research.
- The study followed common ethical principles in clinical research.
- Oral consent was obtained from parents who were willing to participate in the study, after explaining the nature and purpose of the study.
- Confidentiality and anonymity were assured.
- Parents have the right to refuse to participate or withdraw from the study without any rationale at any time.
- Parents were assured that the data of this research were not reused without second permission.

All children included in the study were subjected to three stages (assessment and preparation, implementation, and evaluation).

Phase one: Assessment and preparation:

During this stage, a first assessment was performed on day 1 of to protect the safety of all mechanically ventilated infants that they did not have mucositis when they used tool one to enter

Using tool two, the lips, mucous membrane, gums, teeth, tongue, and gingiva were inspected for any abnormalities or loss of function.

The seventh day after the study ended, a reassessment was performed to identify changes in oral health status. Because the supine position predisposes to aspiration and infection development, all patients sat in a semi-recumbent position as much as feasible the entire period. As needed, deep oral suction was used.

Phase two: Implementation

The dental care intervention technique: For group two, mechanical cleaning for seven days, the teeth, tongue, and gums were examined twice a day (at 9 a.m. and 9 p.m.). The American Dental Association's recommendations were used to develop the teeth brushing intervention for group one. The mouths of each patient were divided into four dental quadrants (Right upper, Right lower, Left upper, Left lower) and brushed in a precise pattern.

Every tooth on the lingual, buccal, and biting surfaces of each quadrant, 5 strokes were applied. The brush was then dipped in water, then a small bit of toothpaste applied. For one minute, the teeth were brushed. The soft pediatric toothbrush was positioned at a 45-degree angle. As needed, a suction catheter was utilized, and the ventral surface of the tongue and palate were gently washed. The endotracheal tube was incorporated in the dental treatment, and debris was carefully scraped away with a toothbrush and gauze. It was replaced from one side to the other.

A foam swab was used to apply fifteen mL of 0.12 percent (CHX) gluconate to all oral surfaces. Brush the teeth at least half an hour before applying the chlorhexidine solution.

Oral Care Guidelines:

- Evaluate/assess mouth daily
- Use disposable sponge sticks and solutions containing 0.12% chlorhexidine in oral care.
- Brush gums and teeth gently
- To keep the tissues moistened, the mucous membrane should be coated with a moisturizer gel.
- Toothpaste or secretions should be removed by rinsing the mouth using an irrigation syringe or sponge, and if necessary, secretions may be removed using suction at low negative aspiration pressure (50–80 mm Hg).
- Use soft fasteners in securing the intubation tube, continuously watching the contact area of the skin, protect against damage to the skin when removing fasteners, and to sustain circulation by applying massage to the zones where tube securing is present.

During the oral care process, extra fluids and secretions were suctioned from the mouth, and a thin layer of mouth moisturizer was applied to the mucous membranes, buccal cavity, and lips.

- Apply moisturizer after oral care to prevent lips from drying,

Group two got dental care twice daily during routine hospital care, during morning and evening baths, by briefly swabbing the mouth with N/S 0.9 percent on a tongue depressor covered in gauze. During routine dental care, group two did not employ tooth brushing or CHX.

Phase three: Evaluation

On day one, the oral health condition of both groups was assessed using the oral mucositis evaluation scale and oral cavity assessment instrument, and this was

repeated at the end of the study on day seven of intervention (for group one) unless extubated, it was be done just before extubation following that, the changes in the oral health state will be determined.

Pilot Study:

A Pilot study was done on 10% (6 children) of the study sample from the previously mentioned setting to test the clarity, feasibility and applicability of the tool. It was modified by the researcher by removing **4** items **(**voice, swallow, taste, and self-care assessment because of intubation**),** modified accordingly, and make ready for use. The data obtained were excluded from the study sample.

Validity:

Validity was done for tool two by five experts from faculty members in the nursing and medical field of Assiut University. Three of them were from pediatric nursing and two from pediatrics represented different academic categories, i.e., professor and assistant professors, to confirm the accuracy and relevance of the information and tools. The content validity index (CVI) for oral cavity assessment and oral mucositis was found to be 0.8 & 0.83 respectively.

Reliability:

The internal consistency of reliability was carried out using the Cronbach alpha coefficient test to the oral cavity assessment tool (OCAT) and oral mucositis scale. It was found to be (r= 0.92 & 0.89). respectively.

Statistical Design:

The data were tested for normality using the Anderson-Darling test and for homogeneity variances prior to further statistical analysis. Categorical variables were described by **number and percent** (N, %), where continuous variables described by **the mean and standard deviation (mean ± SD), Chi-square test,** and fisher exact test were used to compare between categorical variables while comparison between continuous variables was done by **t-test.** All analysis was performed with the **IBM SPSS 20.0** software, Test of significance of < 0.05 was considered significant.

Results:

Table (1): Personal data of the studied groups

Variables	Group 1 (study) (n= 30)		Group 2 (control) (n= 30)		P-value
	No.	%	No.	%	
Age: (years)					
6 - < 12	19	63.3	18	60.0	0.791
12 - 18	11	36.7	12	40.0	
Mean ± SD	**10.40 ± 3.12**		**10.47 ± 3.14**		0.935
Sex:					
Male	17	**56.7**	18	**60.0**	0.793
Female	13	43.3	12	40.0	
Residence:					
Urban	12	40.0	20	66.7	0.069
Rural	18	60.0	10	33.3	

Independent t-test for mean, Chi-square test for numbers

Table (2): Percentage distribution of the studied groups according to their diagnosis

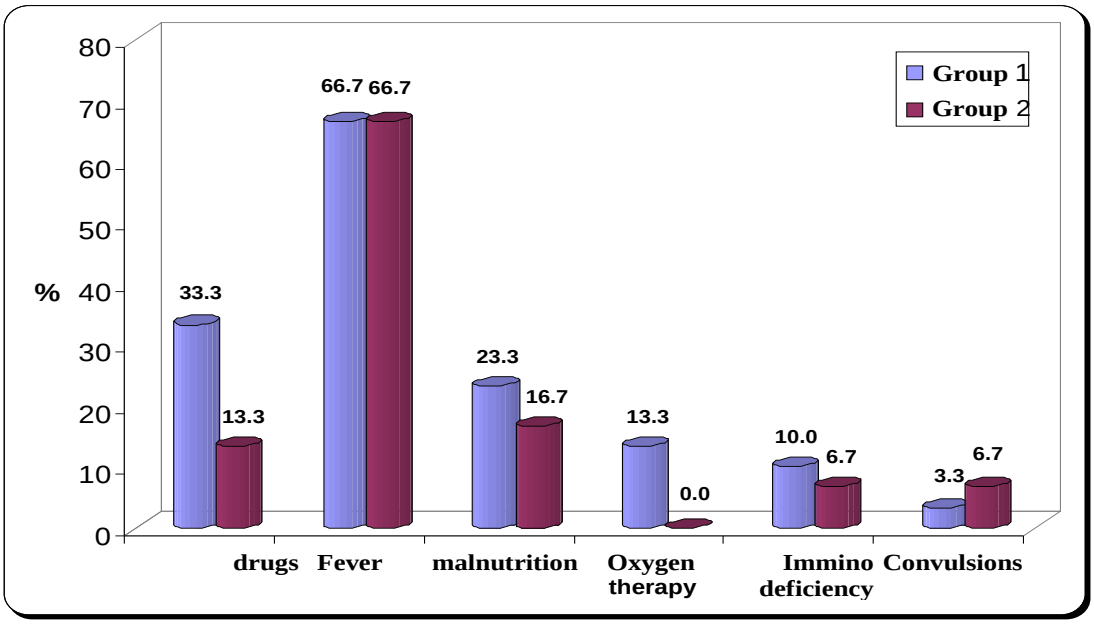
Diagnosis	Group 1(Study) (n=30)		Group 2 (Control) (n=30)		P. value
	No	%	No	%	
Cardiovascular	3	10.0	4	13.3	0.284
Central Nervous System	6	20.0	9	30.0	
Diabetes mellitus	2	6.7	2	6.7	
Liver Disease	1	3.3	2	6.7	
Poisoning	0	0.0	3	10.0	
Renal disease	11	36.7	4	13.3	
Respiratory Disease	7	23.3	6	20.0	

Chi-square test was used

Table (3): Distribution of clinical data of the studied groups

Variable	Group 1 (study) (n= 30)		Group 2 (control) (n= 30)		P-value
	No.	%	No.	%	
Nutrition type:					
Parenteral feeding	3	10.0	3	10.0	1.000
Nasogastric tube (NGT) feeding	27	**90.0**	27	**90.0**	
Type of laryngeal tube:					
Cuffed	22	**73.3**	10	33.3	**0.002****
Uncuffed	8	26.7	20	**66.7**	
Mode of ventilation:					
SIMV	25	**83.3**	21	**70.0**	0.222
PSV	5	16.7	9	30.0	
Tube size:					
Mean ± SD (Range)	**5.85 ± 0.72(5-7)**		**5.82 ± 0.76(5-7)**		0.608
Less than 6 mm	20	66.7	20	66.7	
More than 6 mm	10	33.3	10	33.3	
Duration of ventilation:					
Mean ± SD (Range)	**9.93 ± 3.76 (6–21)**		**8.90 ± 3.52(5–20)**		0.766
5-10 days	22	73.3	23	76.7	
>10 days	8	26.7	7	23.3	
Duration of PICU stay:					
Mean ± SD (Range)	**11.80 ± 4.37(6– 25)**		**10.67 ± 3.40(5– 20)**		0.151
5-10 days	13	43.3	18	**60.0**	
>10 days	17	**56.7**	12	40.0	

Chi-square test was used
Independent t-test for mean,
*** Highly statistically significant difference (p<0.01)* ** Statistically significant difference (p<0.05)*
SIMV: synchronized intermittent mandatory ventilation
PSV: pressure support ventilation



#more than answer
**Drugs = steroid,immune supplement,Atropin,Neuromuscular-blocking-drugs.*

Figure (1): Risk factors of mucositis among the studied groups (N=60)

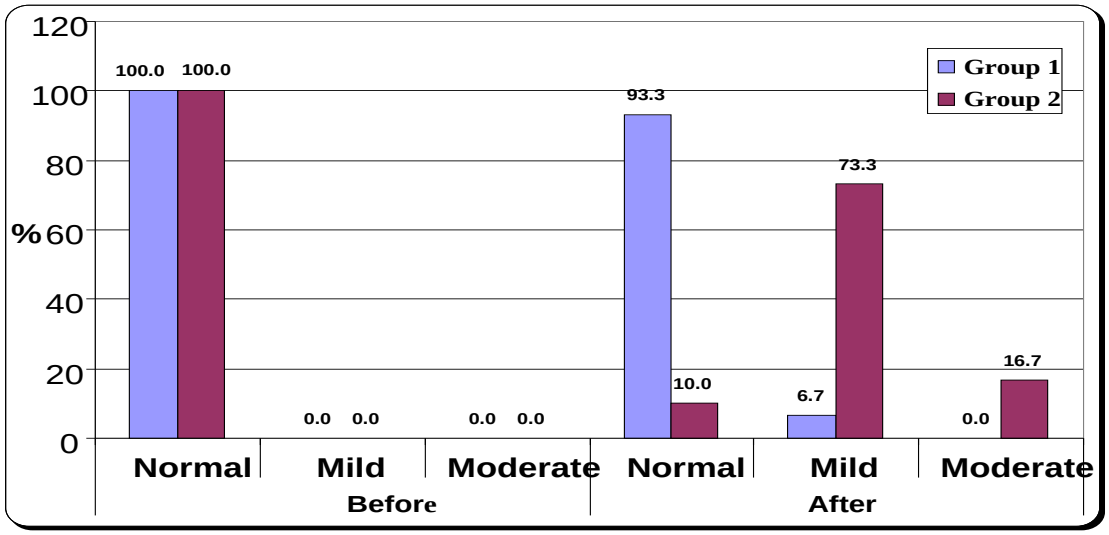


Figure (2): Oral mucositis level before and after the intervention

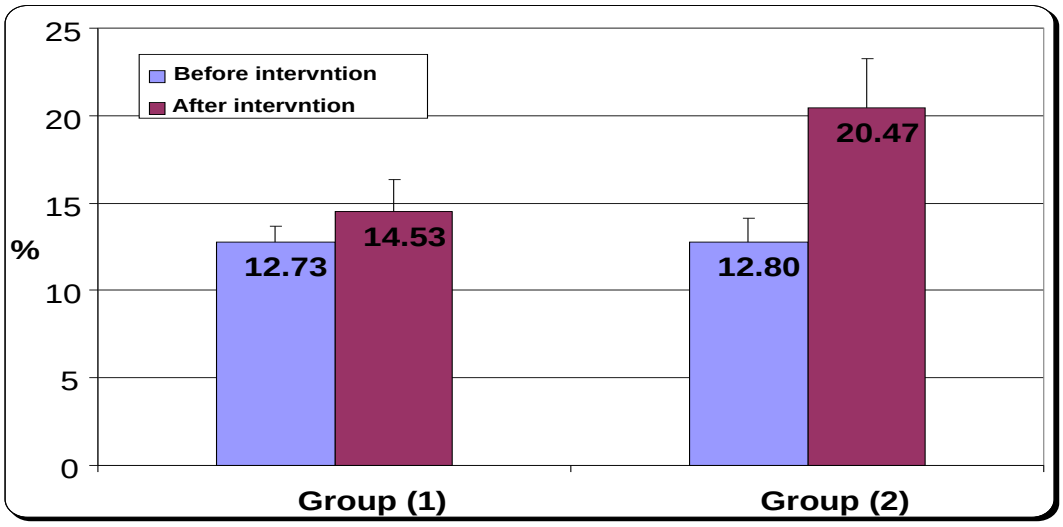


Figure (3): Comparison of mean score of oral cavity assessment among the studied groups

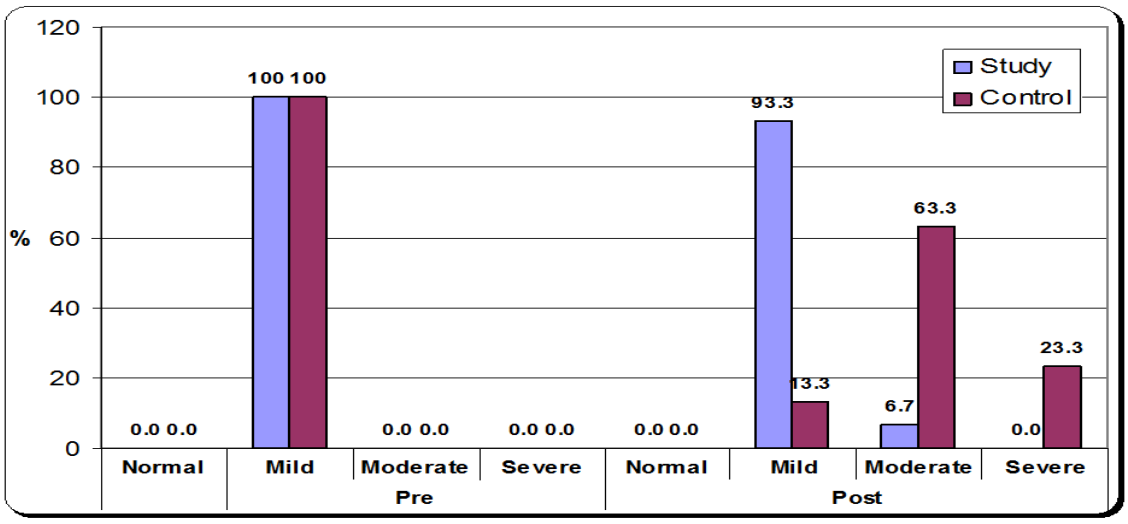


Figure (4): Oral cavity assessment level before and after the intervention

Table (4): Distribution of oral cavity condition among the studied groups regarding mucous membranes, tongue, and lips using oral cavity assessment tool (OCAT)

Oral Cavity Assessment Tool (OCAT)	Group 1 (study) (n= 30)		Group 2 (control) (n= 30)		P-value[1]
	No.	%	No.	%	
Mucous membranes					
Before the intervention					
Pink and moist	28	93.3	29	96.7	0.221
Red or coated	2	6.7	0	0.0	
Ulcerated+/- bleeding	0	0.0	1	3.3	
After the intervention					
Pink and moist	28	**93.3**	1	3.3	**0.000****
Red or coated	2	6.7	20	**66.7**	
Ulcerated +/- bleeding	0	0.0	9	30.0	
P-value[2]	1.000		**0.000****		
Tongue					
Before the intervention					
Pink and moist	29	96.7	30	100.0	1.000
Coated or shiny +/- bleeding	1	3.3	0	0.0	
Ulcerated+/- bleeding	0	0.0	0	0.0	
After the intervention					
Pink and moist	28	**93.3**	2	6.7	**0.000****
Coated or shiny +/- bleeding	2	6.7	24	**80.0**	
Ulcerated +/- bleeding	0	0.0	4	13.3	
P-value[2]	1.000		**0.000****		
Lips					
Before the intervention					
Smooth, pink and moist	29	96.7	22	73.3	**0.028***
Dry/ cracked	1	3.3	8	26.7	
Bleeding/ ulcerated	0	0.0	0	0.0	
After the intervention					
Smooth, pink and moist	9	30.0	0	0.0	**0.000****
Dry/ cracked	20	**66.7**	19	**63.3**	
Bleeding/ ulcerated	1	3.3	11	36.7	
P-value[2]	**0.000***		**0.000***		

** Statistically significant correlation (p<0.05)*
***Highly Statistically significant correlation (p<0.01)*
Chi-square test was used
P-value1:group[1] vs. group[2]
P-value2: pre vs. post

Table (5): Distribution of oral cavity condition among the studied groups regarding saliva, gums, and teeth using oral cavity assessment tool (OCAT)

Oral Cavity Assessment Tool (OCAT)	Group 1 (study) (n= 30)		Group 2 (control) (n= 30)		P-value[1]
	No.	%	No.	%	
Saliva					
Before the intervention					
Watery	28	93.3	27	90.0	1.000
Thick or ropy	2	6.7	3	10.0	
Absent	0	0.0	0	0.0	
After the intervention					
Watery	23	**76.7**	0	0.0	**0.000****
Thick or ropy	7	23.3	17	**56.7**	
Absent	0	0.0	13	43.3	
P-value[2]	0.145		**0.000****		
Gums					

Oral Cavity Assessment Tool (OCAT)	Group 1 (study) (n= 30)		Group 2 (control) (n= 30)		P-value[1]
	No.	%	No.	%	
Before the intervention					
Pink and firm	29	96.7	30	100.0	1.000
Oedamatous +/- redness	1	3.3	0	0.0	
Spontaneous bleeding	0	0.0	0	0.0	
After the **intervention**					
Pink and firm	28	**93.3**	4	13.3	**0.000****
Oedamatous +/- redness	2	6.7	24	**80.0**	
Spontaneous bleeding	0	0.0	2	6.7	
P-value[2]	1.000		**0.000****		
Teeth					
Before the intervention					
Clean, no debris	17	56.7	22	73.3	0.176
Localized plaque, debris	13	43.3	8	26.7	
Generalized plaque and debris	0	0.0	0	0.0	
After the intervention					
Clean, no debris	15	**50.0**	12	40.0	0.436
Localized plaque, debris	15	50.0	18	**60.0**	
Generalized plaque and debris	0	0.0	0	0.0	
P-value[2]	0.605		**0.009****		

** Statistically significant correlation (p<0.05)*
***Highly Statistically significant correlation (p<0.01)*
Chi-square test was used
P-value1:group[1] vs. group2
P-value2: pre vs. post

Table (6): Distribution of oral cavity condition among the studied groups regarding the ability to maintain nutrition, analgesic requirements, and evidence of infection using oral cavity assessment tool (OCAT)

Oral Cavity Assessment Tool (OCAT)	Group 1 (study) (n= 30)		Group 2 (control) (n= 30)		P-value[1]
	No.	%	No.	%	
Ability to maintain nutrition					
Before the intervention					
Normal diet	0	0.0	0	0.0	--
Soft diet	0	0.0	0	0.0	
Fluids only or nil by mouth	30	100.0	30	100.0	
After the intervention					
Normal diet	0	0.0	0	0.0	--
Soft diet	0	0.0	0	0.0	
Fluids only or nil by mouth	30	100.0	30	100.0	
P-value[2]	--		--		
Analgesic requirements					
Before the intervention					
None	10	33.3	11	36.7	**0.640**
Topical analgesia	8	26.7	5	16.7	
Systemic analgesia	12	40.0	14	46.7	
After the intervention					
None	0	0.0	2	6.7	**0.032***
Topical analgesia	7	32.3	1	3.3	
Systemic analgesia	23	**76.7**	27	**90.0**	
P-value[2]	**0.001****		**0.001****		

Oral Cavity Assessment Tool (OCAT)	Group 1 (study) (n= 30)		Group 2 (control) (n= 30)		P-value[1]
	No.	%	No.	%	
Evidence of infection					
Before the intervention					
No evidence of infection	30	100.0	30	100.0	--
Some evidence visible	0	0.0	0	0.0	
Infection (viral/ fungal)	0	0.0	0	0.0	
After the intervention					
No evidence of infection	27	**90.0**	5	16.7	**0.000****
Some evidence visible	3	10.0	21	**70.0**	
Infection (viral/ fungal)	0	0.0	4	13.3	
P-value[2]	0.237		**0.000****		

** Statistically significant correlation (p<0.05)*
***Highly Statistically significant correlation (p<0.01)*
Chi-square test was used
P-value1:group[1] vs. group[2]
P-value2: pre vs. post

Table (1): Shows personal data of the studied groups. The table summarized that, the mean age of the studied groups was 10.40 ± 3.12 & 10.47 ± 3.14 among children in the study and the control groups respectively. About two-thirds of the studied children 63.3% & 60.0% in the study and the control group respectively their age were less than 12 years. As regarding sex, 56.7 % of children in the study group compared with 60.0% of them in the control group were male. Regarding residence 60% of children in group one were from rural area, while two-thirds 66.7% of them in group two were from urban areas. There were no statistically significant differences between the studied groups related all items of the table.

Table (2): Presents diagnoses of the studied groups. It was found that the most common diagnoses of children in-group one was: Renal disease 36.7%, Respiratory Disease 23.3%, Central Nervous system (CNS) 20.0 %, and Cardiovascular 10.0%. While the most common diagnoses of those in group two were: Central Nervous system 30.0%, Respiratory Disease 20.0%, and Renal disease 13.3%. Also, there were no statistically significant differences between the studied groups.

Table (3): Shows clinical data of the studied groups. It was shown that the majority (90.0%) of studied children were taking their nutrition by nasogastric tube (NGT). As regards the type of laryngeal tube, nearly three-quarters 73.3% of children in group 1 were intubated with cuffed laryngeal tube (LT), but two-thirds of them in group two 66.7% were intubated with uncuffed laryngeal tube. Also there were 83.3%&70.0% of children in group 1 and 2 respectively used mode of ventilation synchronized intermittent mandatory ventilation (SIMV). As regarding tube size, two-thirds of the studied groups used tube less than 6mm with a mean ± SD tube size 5.85 ± 0.72 & 5.82 ± 0.76, among the study and the control groups respectively. Mean ± SD duration of ventilation was 9.93 ± 3.76 & 8.90 ± 3.52 days among children in the study and the control groups, respectively. Also three quarters of them spent 5-10 days on mechanical ventilation. About more than half (56.7%) of them in group one stayed >10 days in PICU. While three-fifths (60.0%) of them in group two stayed 5-10 days in PICU. There were no statistically significant differences between the studied groups regarding all clinical data except there was a highly statistically significant difference between studied groups regarding the type of laryngeal tube (P= 0.002**).

Figure (1): Illustrates risk factors of mucositis among studied groups. It was found that the most common risk factors of children in the study group were fever, drugs and malnutrition (**66.7%** & **33.3% & 23.3%),** respectively**.** While the most common risk factors of them in the control group were fever, malnutrition and drugs (**66.7%** & **16.7% & 13.3%),** respectively**.**

Figure (2): Shows level oral mucositis among studied groups using oral mucositis assessment scale (OMAS) after the intervention. This figure illustrates that the majority **(93.3%)** of children in-group one had normal oral condition (OC), **73.3%** of group two had mild mucositis.

Figure (3): Shows mean score of oral cavity assessment among the studied groups. Before the intervention, the two groups were nearly matchable regarding mean score of oral cavity assessment, however, after the intervention, mean score of oral cavity assessment of children in group one (study)

had a better oral condition than those in group two (control) (14.53±1.81 & 20.47±2.75) respectively.

Figure (4): Presents level of oral cavity assessment among the studied groups. This figure shows that all of the studied groups had mild oral cavity assessment before the intervention. However, after the intervention, **93.3%** of children in the group one (study) had mild oral cavity assessment. Moreover**, 63.3%** of them in group two (control) had moderate oral cavity assessment.

Table (4): Shows the distribution of oral cavity condition among the studied groups regarding mucous membranes, tongue, and lips using oral cavity assessment tool (OCAT) before and after the intervention. There were statistically significant differences between both groups of children after intervention related to all items of assessment as mucous membranes, tongue, and lips P1= 0.000. No statistically significant differences were found between the groups before the intervention related all items except lips p1=0.028. This table illustrates that majority of children in the studied groups had normal mucous membranes before the intervention (93.6% and 96.7% in group 1(study) and 2(control) respectively. While 93.3% of them in group 1(study) compared to 3.3% of them in group 2(control) had pink and moist mucous membranes, 6.7% and 66.7% of children in group and 2 had red or coated mucous membrane after the intervention with statistical significance difference p^1=0.000. As for children tongue, there was no statistically significant difference between groups before intervention 96.7% of children in the group one (study) compared with 100% of them in group two (control) had a pink and moist tongue before the intervention, while 6.7% and 80% of children in group 1and 2 respectively had coated or shiny+/- bleeding. Also, it was found that there was a statistically significant difference between before and after intervention in group two. Regarding lips, there was a statistically significant difference between groups before intervention. However, after intervention 66.7% of children in group one and 63.3% of group two had dry/cracked lips. Also, it was found that there statistically significant difference between before and after intervention in both groups p2= 0.000

Table (5): Shows the distribution of oral cavity condition among the study and the control groups regarding saliva, gums and teeth using oral cavity assessment tool (OCAT). This table shows that there were no statistically significant differences between the studied groups before intervention. However, after intervention more than three quarters 76.7% of children in the group one(study)compared to 0.0% of them in group two (control) had watery saliva. And 56.7% and of them in the group two had thick or ropy saliva level p^1=0.000. As well as, it was found that there was a statistically significant difference between before and after intervention in group two p^2=0.000.

Regarding gums, (OCAT).This table shows that thee was no statistically significant difference between studied groups before intervention. However, after intervention the majority 93.3% of children in group one had gums pink and firm. While eighty percent 80% of the children in group two had oedematous ± red gums. Also, it was found that there were statistically significant differences between before and after intervention in group two (control).

Whereas teeth condition (OCAT), this table shows that there was no statistically significant difference between the studied groups neither before nor after the intervention. However, after the intervention, 50.0% of children in group one had clean, no debris, and 60.0%, of group two had localized plaque, debris their regarding teeth. Also, it was found that there was a statistically significant difference between before and after intervention only in group two p^2=0.009.

Table (6): Shows distribution of level of oral cavity condition among the studied groups regarding the ability to maintain nutrition, analgesic requirements, and evidence of infection using oral cavity assessment tool (OCAT). It was found that all the studied groups had fluids only or nil by mouth before and after the intervention, with no statistically significant difference.

Whereas, analgesic requirements, (OCAT). the table illustrates that there was no statistically significant difference between the studied groups before. However, after the intervention, 76.7% of children in group one compared to 90% of those in group two needs systemic analgesia. With statistically significant difference p1=0.032. As well as, statistically significant differences were found between before and after intervention in both groups p2=0.001.

Lastly, regarding evidence of infection, this table shows that all of the studied groups had no evidence of infection before the intervention. However, after the intervention, 90.0% of children in the group one had no evidence of infection compared to 16.7 of them in group two. Seventy percent of children in the group two had some evidence of infection with statistically significant difference p^1=0.000. In addition, it was found that there was a statistically significant difference between before and after intervention in group two only p^2=0.000.

Discussion

It is critical to prevent mucositis before it develops considering its burden to the person and healthcare expenses because treatment of oral mucositis is

intractable. The most important actions in avoiding oral mucositis are using an evidence-based oral care guide (OCG) and monitoring patients on a regular basis. Nurses working in acute care units have a critical role in preventing or reducing mucositis **(Düzkaya et al.,2017).**
Regarding the oral mucositis, the current study clarified that the majority of children in the group one had normal oral condition. While, more than two-thirds of them in the group two had mild oral mucositis after the intervention with a highly statistically significant difference between the studied groups. This observation is reported by many other previous studies **(Ahmed, 2013; Mohammed & Hassan, 2015 & Khalaf et al., (2020)** who found that majority of participant (90%) of the study group had normal oral condition . While more than two thirds, (70%) of them in the control group had mild oral mucositis after intervention with a highly statistically significant difference between the studied groups.
In this regard, a prior study by **Moustafa et al., (2016)** found that the majority of the study group had mild oral mucositis. While the majority of control group had severe oral mucositis after intervention with a highly statistically significant difference between the studied groups. From the viewpoint of the researcher, this finding might be attributed to the fact that mouth care intervention with chlorhexidine plays an important role in avoiding mucositis in pediatric patients admitted to PICU and receiving mechanical ventilation.
As regards oral cavity assessment, the present study showed that the mean score of OCAT in group one was 14.53±1.81. While the mean score of OCAT in group two was 20.47±2.75 after the intervention. Also, it was found that there was a highly statistically significant difference between before and after intervention in both groups.
This finding is similar to a previous study done by **Ames, (2011)** who found that the mean score of oral cavity assessment tools in the study group was 7.07±0.58. While the mean score of OCAT in control group was 11.0±0.51 after the intervention with a highly statistically significant difference between the studied groups. From the viewpoint of the researcher, this result may be related to ventilated patients in PICU who received CHX for oral care improve significantly better than those who did not receive it.
When studying the sub-items of oral cavity assessment tools (OCAT) regarding PICU under mechanical ventilation, the majority of the group one had normal oral condition, whereas group two had mild oral mucositis after intervention as regard mucous membranes, tongue, teeth, gums, saliva and evidence of infection with a highly statistically significant difference between the studied groups
These findings are consistent with **(Düzkaya et al., 2016)**, who reported that the majority of the study group had normal oral condition, whereas the control group children had mild oral mucositis after the intervention, with a statistically significant difference between the studied groups for the above sub-items of oral cavity assessment tools. From the viewpoint of the researcher, this result could be due to using the oral care guide 0.12% CHX hydrochloride oral solution better than used routine care in PICU.
The current study revealed that all of the group one and the group two had fluids only or nil by mouth. This finding was supported by **Blevins, (2011),** who documented that entire patients in PICU had fluids only or nil by mouth. From the viewpoint of the researcher, this finding is due to that most of children in the PICU were unconscious and unable to control swallowing so any food or fluid by mouth might cause aspiration, pneumonia, and death.
Regarding evidence of infection, the current work concluded that, the majority of the group one showed no evidence of infection, whereas in the group two, more than two-thirds had some evidence of infection after intervention. Also, the current study mentioned that there was a statistically significant difference after intervention among group one and group two concerning oral cavity assessment scores. These findings are consistent with previous studies conducted by **(Grap et al., 2014 & Singh et al., 2015)** who reported that most mentioned that the majority of the treatment group showed no evidence of infection after oral care with chlorhexidine.
From the viewpoint of the researcher, this result might be related to using of toothbrushes over swabs and the use of chlorhexidine mouth rinses in the group one helps in reducing the count of microbes and reduce the prevalence of these infections in the PICU.

Conclusion

Based on the current study it was concluded that:
Oral care implemented in line with the oral care guide in this study markedly decreased oral mucositis. An oral care intervention using dental brushing and Chlorhexidine gluconate significantly reduced the incidence of mucositis in children undergoing mechanical ventilation.

Recommendations

Based on the current study findings, the following recommendations are suggested

1. Application of oral care guide for children not connected to the ventilator and children under six years.
2. Chlorhexidine gluconate 0.12% is recommended as a mouth rinse for patients who are intubated orally.
3. Oral care tools and equipment should be supplied in all pediatric intensive care units.

4. Nurses should be trained at pediatric intensive care on how to assess the condition of the mouth and using chlorhexidine each to determine the effectiveness of oral care intervention for ventilated patients and the damage caused by failure to do so.

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