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CHANGING IN ORAL MICROFLORA IN ICU PATIENTS AT ADMISSION AND AFTER 5 DAYS OF ADMISSION

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ABSTRACT

Background: There is no established standard of oral care for the prevention of developing oral pathogens in patients undergoing critical care, and the technique for delivering oral care and routine oral swabs is debatable. **Aim of study:** To test the changes in oral microflora in intensive care unit patients at admission and after 5 days of admission. **Patients & Methods:** oral swaps were taken from 20 patients with other clinical data on the first day and fifth day of intensive care unit admission. All these swabs were sent to the clinical laboratory investigation, to determine whether there was a change in oral normal flora or not. **Results:** Of 20 patients, 20 (100%) were diagnosed with oral bacterial contamination on the first day of intensive care unit admission, 10 males and 10 females, age range 18-97 years old, with no statistical differences between the first and fifth of admission in the number of bacterial infections with p. value more than 0.05. **Conclusions**: Using distilled water with oral non-adherent sterile pads three times daily, demonstrated no significant decrease in oral bacterial contamination five days following ICU admission.

KEYWORDS: Microflora; Oral swab; Critical ill patient.

INTRODUCTION

In the intensive care unit (ICU), patients in critical condition receive constant monitoring and specialized care. Data indicates that 62.2% of ICU patients experience complications while hospitalized.[1-2]

Hospitalized patients, especially those in intensive care units (ICUs), require specialized care. Most of these individuals are unable to perform even the most basic responsibilities like maintaining their oral hygiene. Therefore, it is essential to give these people orthodontic care.[3-4]

The accumulation of bacteria in dental plaque, which leads to the oral microbial environment, affects oral health. These organisms have little living space in dental plaque, which gives them a chance to attach to teeth or other microorganisms. The mouth cavity may contain possibly dangerous germs in seriously ill people. In the lungs, these oral microorganisms can spread and establish themselves, which could result in ventilator-dependent pneumonia.[5]

These patients have oral problems as a result of dehydration, malnutrition, and the use of stomach and endotracheal tubes. Inadequate oral care has been related to several other problems, including gum inflammation, dental plaque formation, dry mouth, decreased salivation, oral mucosal irritation, and the accumulation of dangerous bacteria in the mouth and throat.[6]

Bacteria present in dental plaques create ventilator-dependent pneumonia (VAP). As the most common and dangerous hospital infection in ICUs, VAP causes 50% mortality.[7]

Often, gram-positive bacteria make up the oral microflora of healthy people. However, patients who stay in ICUs for longer than 48 hours are likely to have a different balance of oral microbiota. Gram-positive bacteria such as *Staphylococcus aureus*, *Streptococcus*

pneumoniae and gram-negative bacteria such as *Acinetobacter baumanii*, *Haemophilus influenzae*, and *Pseudomonas aeruginosa* become more prevalent as a result of these alterations. Each of these bacteria has been linked to nosocomial pneumonia.[9]

ICU patients have oral issues as a result of a variety of conditions, such as malnutrition, the use of endotracheal and stomach tubes, and decreased fluid intake. According to studies, poor oral hygiene contributes to further problems such as oral mucosal dryness, decreased saliva flow, oral mucosal inflammation, dental plaque formation, gum inflammation, and a buildup of dangerous bacteria in the mouth and throat.[23]

The endotracheal tube may act as a conductor of bacteria from the oral cavity to the lower airway in patients receiving mechanical breathing in intensive care units (ICU), resulting in the development of pneumonia.[24]

The mouth's natural flora changes in favor of harmful bacteria when it is in an impolite state. As a result, oral fibronectin drops in these people. Similarly, enhancing the ability of germs to adhere to the tongue and teeth leads to the development of oral sores.[27]

PATIENTS AND METHODS

Around February 2023 and August 2023, this comprehensive research was carried out. The research was initially assumed after being confirmed by the chairman of the scientific advisory committee, also the study has been validated by the scientific counsel of Arab board.

Twenty Patient's data from a single intensive care unit, were involved in this study.

Each patient's relative provided their informed consent.

Twenty patients were enlisted in the prospective randomized study, for both sexes with middle to old age group admitted to twelve intensive care unit beds in Al_Sder Medical City for the mixed medical and surgical causes. All the patients were intubated with mechanical ventilation either volume or pressure modes, and monitoring was under the protocol of management with patients. Renal, and liver function with complete blood count and Arterial blood gas analysis (ABG) were routinely investigated at the timeline of ICU admission according to patients' state. Crystalloid fluid, nutrition, antibiotics, sedative agents, and inotropic agents were taken part in the rules of stabilizing patients.

Oral hygiene was performed 3 times daily using distilled water with oral nonadherent sterile pads.

All intubated patients who are under mechanical ventilation in both genders with ages above 18 years old were included in this study.

The exclusion criteria were:
1. Patients who are below the age limit of 18.
2. Pregnant women.
3. Referral patients from other ICUs.
4. Immunosuppression patients other than ICU admission such as (HIV or drugs, such as long-term steroid medication or organ transplant recipients); return to the intensive care unit.

Microbiological methods

The sample swabs were collected from buccal mucosa using Microbiological Specimen Collection and Transport which have properties of preservative media, One hour later the swabs were transferred to the lab test, MacConkey agar is used to select gram-negative bacteria and differentiate lactose fermenting bacteria from nonfermenting bacteria. Blood agar is enriched with blood nutrients. Hence, it is used to grow fastidious bacteria and differentiate them according to their hemolytic patterns using the Vitek machine. Swab specimens were taken at the following intervals: the first day of admission and 5 days of admission to the intensive care unit.

The statistical package for social sciences (SPSS) software for Windows, version 26, was used for entering and analyzing the information that was collected. Rates and percentages (%) are used to show descriptive statistics. Unrelated t-tests were used to compare categories of variables across the study groups. The threshold for any variation or relationship to be considered significant was set at (0.05). Finally, using the 2016 edition of Microsoft Word, the findings are shown in tables and figures with an explanation for each.

RESULT

The leading causes of admission were: post craniotomy (n = 4); Diabetic ketoacidosis (DKA)(n = 2); sepsis (n = 4); Cerebral vascular accident (n = 4); sub-Dural hemorrhage (SDH) (n=2); and hemorrhage stroke (n = 4).

All of them have a past medical history of either hypertension or diabetes mellitus. 30% of them have a Glasgow coma scale (GCS = 3) and the others were between (GCS = 6-9). 50% of them were on sedation of either midazolam, propofol, or fentanyl. 40% of them were on noradrenaline, and all of them were on feeding after 24 hours of admission.

The table below shows the allocation of age and gender, 50% for each male and female, with no homogeneous age, p.value <0.05, 50% (18-39yrs), 40% 60yrs and older, and 10% for middle adults (40-59yrs).

Table 1: Demographics data.				
Variable	**Level**	**N=20**	**%**	**p.value**
Age	Young Adult 18-39 y	10	50.0%	0.044
	Middle Adult 40-59	2	10.0%	
	Older Adults 60 and more	8	40.0%	
gender	Male	10	50.0%	--
	Female	10	50.0%	

On the first day of admission, while performing the first oral examination, all patients had an oral pathogen, divided into two types of bacteria of either gram-positive 80% contributed to; 20% *Pseudomonas aeruginosa*, 40% *Klebsiella pneumoniae* ssp pneumonia, 10% *Streptococcus pneumonia*, and 10% *Staphylococcus aureus* or gramnegative bacteria 20% contributed to; 10% *Acinetobacter baumannii* complex, and 10% *Escherichia coli*.

On the fifth day of admission, the second oral examination is conducted, all patients had an oral pathogen with either gram-positive 70% such as 20% *Pseudomonas aeruginosa*, 30% *Klebsiella pneumoniae* ssp pneumonia, and 20% *Streptococcus pneumonia*, or gram-negative 30% which are more lethal like 30% *Acinetobacter baumannii* complex.
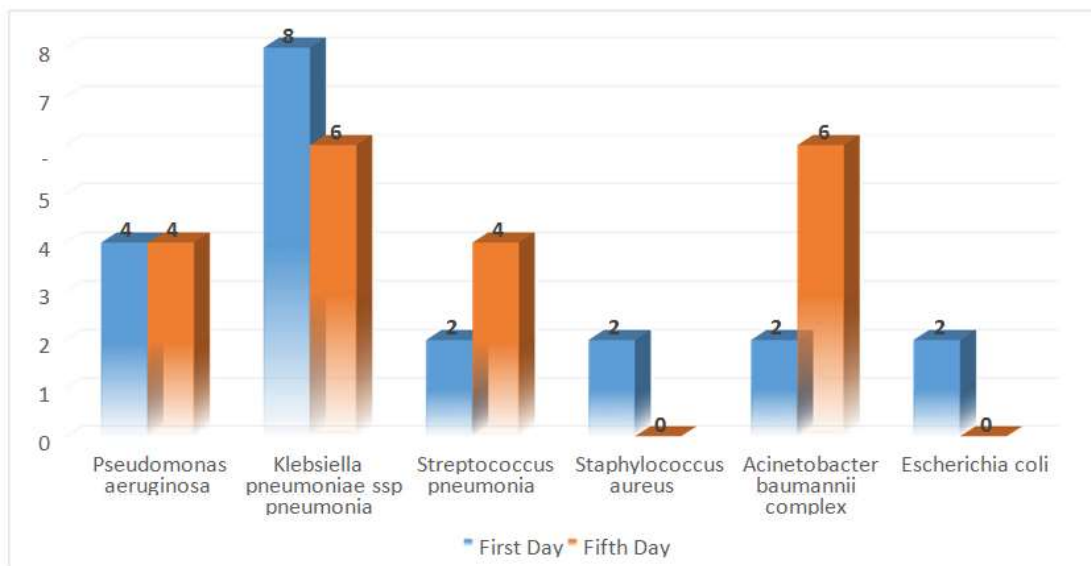

Figure 1: Shows the distribution of gram-positive and negative at two different times during the ICU stay.

The gram-positive *Staphylococcus aureus* on the fifth day of admission in 37 years male patient who had open craniotomy under sedation of propofol-midazolam, converted to gram-negative bacteria, *Acinetobacter baumannii* complex.

The gram-negative *Escherichia coli* on the fifth day of admission in 97 years who had brain ischemic stroke, GCS=3, without sedation, modified to *Acinetobacter baumannii* complex.

Pseudomonas aeruginosa is presented in 20% of 32-year-old male patients who had open craniotomy with a negative past medical history, and a 75-year-old female with brain ischemic stroke had both DM and HT, this oral pathogen still the same in the fifth day of admission, both patients were on midazolam and fentanyl.

The majority of gram-positive bacteria was *Klebsiella pneumoniae* ssp pneumonia 40% on the first day of the following patients.

A 60-year-old male with brain ischemia and had a past medical history of DM, and HT, with GCS=3.

A 40-year-old female with poorly controlled DM was admitted due to DKA on sedation (Midazolam + Fentanyl).

A 55-year-old female with a history of DM was admitted due to sepsis after a hydatid cyst, bowel resection, and colostomy, GCS=3.

An 18-year-old male was admitted to the general ICU after an open craniotomy, GCS=6, on sedation (Midazolam + Fentanyl).

These patients still carry this infection. on the fifth day of admission, but decreased to 30%.

Streptococcus pneumonia is presented in 10% of patients on the first day of admission. A 72 years old male with

history of IHD, HTN and DM admitted to ICU after cerebral vascular accident.

A 27-year-old female with a history of DM was admitted due to DKA, on sedation (Midazolam + Fentanyl), and the patient still carries this infection. on the fifth day of admission with an increase number of patients from 2 to 4.

Acinetobacter baumannii complex is presented in 10% of patients on the first day of admission. A 39-year-old male was admitted to the general ICU after an open craniotomy, GCS=3, on sedation (Midazolam + Propofol).

A 67-year-old male with a history of DM was admitted due to CVA, GCS=3. and the patient still carries this infection. on the fifth day of admission with an increased number of patients from 2 to 6 patients.

There were no statistical differences in the number of patients who had been infected with gram-negative and positive on the first day of admission as compared with the fifth day of admission, p. value > 0.05.

DISCUSSION
The presence of a tracheal tube, tracheal tube fixers, a reduced degree of awareness, a high body temperature, and dehydration may all cause oral contamination in ICU patients.[37-38] Additionally, neglecting oral hygiene and using an inaccurate nursing checklist to evaluate the state of the oral condition are other causes.

With a variety of underlying medical conditions including diabetes, decreased consciousness, or Use of endotracheal tubes, and hypnotic agents, these patients have an almost high incidence of gum and oral bacteria.[39] The research we conducted mentions several variables.

Older people are often more susceptible to a wide range of illnesses because of metabolic and pathological changes such as compromised immune systems, chronic illnesses, and prolonged drug usage. An additional aspect that impacts these people's oral mucosa is the usage of dentures.[40-41] 40% of participants are older than 60 in the present study.

Based on this study's findings, conditions such as DKA, SDH, post-open craniotomy, and brain ischemic stroke are associated with a decreased level of consciousness which might alter the mouth health condition due to time consumption in the wards, emergency department, and nursing home care, who they are unfamiliar with standard mouth care in low GCS patients. According to a review of research, sweeping the oral cavity dramatically minimizes oral bacteria growth.[42-43]

A significant source of disease and fatality in older people communities is pneumonia. Aspiration is a significant pathogenic process that causes pneumonia in the elderly, and poor oral hygiene and health are now understood to be significant risk factors.[44] VAP still affects 10 to 40% of patients receiving ventilatory support, making it one of the most prevalent infections encountered in the ICU.[45-46]

There are numerous publications associating the existence of oral biofilm with the appearance of VAP, and the oral cavity is a significant source of germs that might cause lung infections. Critically ill individuals' oral cavities quickly fill with dental plaque, a complex biofilm that is usually impervious to chemical management.[47-48] A collection of germs that cause nosocomial pneumonia in those at risk may be found in dental calculus in admitted patients who have chronic lung illnesses.[49]

Significant levels of respiratory-associated pathogens such as Staphylococcus aureus, Pseudomonas aeruginosa, and gram-negative bacteria are found in the oral cavity among patients receiving invasive mechanical ventilation.[50]

Insufficient oral hygiene was strongly associated with a higher likelihood of developing early-onset VAP, according to Saenson et al.[51] According to Munro et al.[52], higher rates of pneumonia are associated with reduced salivary volume and greater dental plaque. Additionally, Azarpazhooh and Leake[53] discovered that having poor dental health greatly raises the risk of pneumonia. Oral candidiasis was substantially correlated with bacterial pneumonia, poor oral care, and extreme dry mouth, according to Nakajima et al.[54]

Additionally, individuals receiving invasive ventilatory support who practice regular oral hygiene using chlorhexidine are shown to have minimal Staphylococcus aureus colonization in their oral plaque.[55] Participants in the presented study had their regular oral care with distal water only.

CONCLUSION
Participants with previous medical history predominately involving diabetes had been admitted to the general ICU in both sexes and across a range of ages with low levels of consciousness, including cerebral vascular accident, hemorrhagic stroke, sepsis, post-open craniotomy, subdural hemorrhage, and DKA, which are associated with oral pathogens on their initial day of admission.

Using distilled water with oral non-adherent sterile pads three times daily, demonstrated no significant decrease in oral bacterial contamination five days following ICU admission.

Recommendation
We advise using oral swabs on the majority of patients who are semi-conscious while spending days in nursing homes, emergency rooms, and wards without prior oral

care training to avoid complications associated with oral contamination in critically ill patients receiving mechanical ventilation.

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