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A study to assess the effectiveness of oral care intervention on the occurance of ventilator associated pneumonia in ICU patients

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Abstract
The Health Care Providers and Patients face multiple challenges, where new treatment modalities and technology interfere with the continuing effort to strive for quality care and expected outcomes. Efficiency and Cost effectiveness must go hand in hand, to satisfy the patients and to improve the quality of care. While encouraging the innovations, it makes a sense; their drastic effects need to be screened. The development of sophisticated technology, support and elaborate medical interventions, which help many patients to walk out of the hospital, which was unimaginable a few decades back. In order to gain maximum benefits out of advanced technologies, it is mandatory for the health care professionals to follow standard guidelines to prevent nosocomial infections. So the present study aim is to assess the effectiveness of oral care intervention on the occurrence of ventilator associated pneumonia in ICU patients. A quantitative approach with Pre-experimental design with one group pre-test & post-test design was adapted to conduct the study among 30 ICU patients who were selected by Non-Probability convenient sampling technique. Semi-structured interview was used to collect the demographic data and the Ventilator associated diagnostic criteria, ventilation data and oral assessment sheet was assessed by structured questionnaire. This results of the study shows pretest on effectiveness of oral care this data reveals that 4(13%) had mild level, 18(60%) had moderate level, 8(27%) had severe level. Post-test on effectiveness of oral care this data reveals that 19(63%) had mild level, 6(20%) had moderate level, 5(17%) had severe level. This study proves that oral care is effective among occurrence of ventilator associated pneumonia patients and it prevents from Ventilator Associated Pneumonia complication. And also it helps the patients to improve to the knowledge and to provide better quality of life to patients.

Keywords: Oral care intervention, Ventilator Associated Pneumonia

Introduction

The Health Care Providers and Patients face multiple challenges, where new treatment modalities and technology interfere with the continuing effort to strive for quality care and expected outcomes. Efficiency and Cost effectiveness must go hand in hand, to satisfy the patients and to improve the quality of care. While encouraging the innovations, it makes a sense; their drastic effects need to be screened. The development of sophisticated technology, support and elaborate medical interventions, which help many patients to walk out of the hospital, which was unimaginable a few decades back. In order to gain maximum benefits out of advanced technologies, it is mandatory for the health care professionals to follow standard guidelines to prevent nosocomial infections.

Rello *et al.* (2007) the prevalence of nosocomial infection is higher in Intensive Care Units (ICU) than in the general hospital wards. Catheter related infections, Ventilator Associated Pneumonia and surgical site infections cause the majority of these nosocomial infections. Nosocomial infection increases the mortality, morbidity and cost. The length of hospital stay, stay in ICU, and duration of mechanical ventilation are higher in those patients. Utilization of invasive devices is the major risk factors for the development of nosocomial infections in ICUs. But the critical conditions of many patients in ICUs warrant the support of invasive devices. Adherence to preventive measures by ICU staffs is crucial in reducing nosocomial infections. Implementation of evidence based infection control measures should be the basis for the prevention of nosocomial infection.

Berry *et al.* (2007) ventilator Associated Pneumonia (VAP) is one of the common nosocomial infections in ICU.

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VAP is the second leading cause of morbidity and mortality in the intensive care unit after urinary tract infection. The incidence of VAP was 86% and mortality rates exceed 59%. Once the patient has developed VAP, additional requirement of treatment increases the length of stay by up to 22 days and raises the cost of care. 86% of nosocomial pneumonia was associated with intubation and mechanical ventilation. The most frequent isolates from pneumonia were Gramnegative aerobic organisms (64%) such as Pseudomonas Aeruginosa (21%) and Acinetobacter (18%). Staphylococcus aureus (20%) was also isolated with similar frequency, among hospitalized patients in United States (Mehta *et al.* 2003). Removing bacteria from oropharynx requires the removal of dental plaque, and proper oral hygiene is the only way to remove plaque. Majority of nurses use a soft toothette instead of tooth brushing and the toothettes do not remove plaque as effective as toothbrushes; consequently, oral bacteria can proliferate.

Cutler *et al.* (2005) aspiration is a potential hazard for the patient with an endotracheal tube. Oral intubation increases salivation and swallowing is difficult, causing pooling of secretions. So proper oral hygiene, frequent oral suctioning and subglottic aspiration is very essential to prevent oral colonization of microorganisms and their transduction to lung tissue. Nursing education regarding oral care practices for mechanically ventilated patients has not been updated or modified recently. Oral care is often considered as an intervention for patient comfort rather than a need to promote health. This contributes to the decreased attention, priority and frequency of plaque removal. Hence attention to the oral care of intubated patients using a modified oral care protocol is emphasized. Microbial colonization of the oropharynx and dental plaquehas been associated with systemic and respiratory diseases, most notably ventilator-associated pneumonia (VAP). VAP affects 8% to 28% of patients receiving mechanical ventilation, with mortality rates ranging from 24% to 50%. Mortality ratesmay be as high as 76% for infections caused by high-risk pathogenssuch as Pseudomonas or Acinetobacter. Prolonged ICU and hospitalstays result in increased costs.

Grap *et al.* (2009) quoted that bacteria reside in plaque and are transmitted to the lungs via micro aspiration. Dental plaque can be removed only by tooth brushing. The study demonstrated that tooth brushing is an effective way to reduce the incidence of VAP as it removes the plaque that harbors bacteria.

Ventilator Associated Pneumonia is one of the leading causes of mortality and morbidity in critically ill patients. Proper implementation of the prevention protocol is essential in preventing VAP and thereby reducing the economical, personnel and material resources. So the investigator felt the definite need for oral care protocol for intubated patients. The purpose of the study [1] To assess the demographic variable of the patient with Ventilator Associated Pneumonia [2]. To assess the pre-test level of patient with Ventilator Associated Pneumonia [3]. To determine the effectiveness of oral care among patient with ventilator associated pneumonia [4]. Association between the post-test level of oral care patient with ventilator associated pneumonia.

Methods and materials
A quantitative research approach with pre-experimental research design with one group pre-test & post-test design

was used to conduct study in ICU patients of Saveetha Medical College and Hospital. 30 samples were selected by using a Non-probability convenient sampling technique. The inclusion criteria for samples were who need mechanical ventilation, critically ill patients with any medical and surgical problems, both male and female patients, aged 18-65 years, patients receiving mechanical ventilation in any mode, both patients receiving and not receiving relaxant and sedation. The exclusion criteria for the samples were patients having CPIS $\geq$ 6 within 48 hours of intubation, patients intubated in hospitals other than SMCH, patients for whom frequent oral suctioning was contraindicated, patients with facial injury or fascio maxillary surgeries. The data collection period was done with prior permission from the ICU head of the department, Saveetha Medical College and Hospital and ethical clearance was obtained from the institution. The purpose of the study was explained to the samples and written informed consent was obtained from them. The demographic data were collected using a structured questionnaire. And the Ventilator associated diagnostic criteria, ventilation data and oral assessment sheet was assessed by structured questionnaire. After collecting the data oral care (0.12% CHLORHEXDINE GLUCONATE) should be given to the ICU patients is on ventilator for one week. Later the post test will be assessed. Pearson's correlation and coefficient was used to assess the effectiveness of oral care intervention on the occurrence of ventilator associated pneumonia in ICU patients pretest and post-test levels. Chi square was used to association of post-test level of oral care among patients with ventilator associated pneumonia with their selected demographic variables.

Results and Discussion
Section A: sample characteristics
Frequency and percentage distribution of demographic variable of Out of 30 samples, the age group 20 (33%) members were belongs to the age group (25-30 years), 13 (22%) members were belongs to the age group (31-35 years), 13(22%)members were belongs to the age group (36-40years), 14(23%) members were belongs to the age group (above 40years).,That Regarding Religion Among 60 Samples. 36(60%) members were Hindu, 22 (37%) members were Christian, 2 (3%) members were Muslim, regarding educational status. 1 (2%) member were non formal education, 30 (50%) members were primary education, 19 (37%) members were secondary education, 10 (17%) members were graduated, that regarding occupation. 27 (45%) members were self-employed, 15 (25%) members were government employee, 18(30%) members were private employee., regarding income. 15 (25%) members were belongs to (10000-15000), 27(45%) members were belongs to (15000-20000), 17(28%) members were belongs to (20000-25000), 1(2%) member were belongs to (above 25000), regarding washing technique. Total 60 sample (100%) were belongs to machine washing, regarding duration of using washing machine. 15 (25%) members were using washing machine for (one year), 14(23%) members were using washing machine for (two years), 14(23%) members were using washing machine for (three years), 16 (27%) members were using washing machine for (more than five years), regarding family history of skin infections. 5(8%) members were having family history of skin infections. 55(92%) members were not having family

history of skin infection, regarding previous skin infection. 28 (47%) members were had rashes, 2 (3%) members were had psoriasis, 2 (3%) members were had urticaria, 28 (47%) members were had itching.

The present study was supported by Haniyeh Irani, Gholamhoseein Sargazi, Alireza Rahat Dahmardeh and Zahra Pishkar Mofrad (2019), conduct a study on the effect of oral care with miswak versus chlorhexidine on the incidence of ventilator associated pneumonia: A clinical trial study. Inadequate oral care in ICU patients can lead to lethal complications such as ventilator-associated pneumonia (VAP). The purpose of this study was to compare the effect of oral care using miswak and chlorhexidine mouthwash on the incidence of VAP in ICU patients. This single-blind randomized clinical trial was carried out in 2018 on 70 patients undergoing mechanical ventilation in the intensive care units of Khatam-al-Anbia Hospital in Zahedan, Iran. The inclusion criteria were the insertion of endotracheal tube, scoring 10 or below based on Beck oral assessment scale (BOAS), scoring below 5 based on the modified clinical pulmonary infection score (MCPIS) at the beginning of the study, absence of chronic pulmonary disease, and no history of pulmonary aspiration. The subjects were selected through convenience sampling and randomly divided into the intervention (n: 35) and control (n: 35) groups. For five days, oral care was administered using miswak in the intervention group and chlorhexidine mouthwash in the control group. Data were collected through a demographic and clinical information questionnaire, MCPIS, and BOAS. After normality tests, the obtained data were analyzed in SPSS 22 using independent t-test, chi-square test, and Fisher's exact test at the significance level of $P < 0.05$. The two groups were similar in terms of age, gender, cause of hospitalization, level of consciousness, administered antibiotics, history of ICU admission, and smoking. After oral care with miswak, none of the patients in the intervention group developed VAP, but 6 patients in the control group (17.1%) were diagnosed with this condition. The results of Fisher's exact test showed a significant difference between the two groups in terms of VAP incidence ($P = 0.01$). In addition to promoting the oral health of ICU patients, miswak can mitigate the incidence of ventilator-associated pneumonia. Therefore, because of its availability, cost-effectiveness, and fewer side effects compared to chlorhexidine mouthwash, it is strongly recommended to be administered to ICU patients.

Section B: Frequency and percentage distribution of ventilator associated pneumonia diagnostic criteria
Regarding temperature 23% (7 members) of patients are >36.5 to <38.4, 40% (12 members) of patients are > 38.5 to <38.9, 37% (11 members) of patients are >39 to <36.0. Regarding blood leukocytes 17% (5 members) of patients are >4000 to< 11000, 33% (10 members) of patients are <4000, 50% (15 members) of patients are >11000.Regarding tracheal secretion 57% (17 members) of patients are Moderate level tracheal secretion, 27% (8 members) of patients are presence of non-purulent tracheal secretion, 17% (5members) of patients are presence of purulent tracheal secretions. Regarding pulmonary radiography 17% (5 members) of patients are No infiltrate, 43% (13 members) of patients are Diffuse infiltrate, 40% (12 members) of patients are Localized infiltrate. Regarding culture of tracheal aspirate 30% (9 members) of patients are

Negative, 70% (21 members) of patients are positive.

Section C: Frequency and percentage distribution of oral assessment sheet
Reveals that regarding lymph nodes 23% (7 members) of patients are no enlargement, 40% (12 members) of patients are enlarged and not tender, 37% (11members) of patients are enlarged and tender. Regarding lips 30% (9 members) of patients are smooth pink moist, 47% (14 members) of patients are Dry, chapped red at corners, 235 (7 members) of patients are white or red patch, bleeding or ulcer for 2 weeks. Regarding tongue 13% (4 members) of patients are normal roughness pink and moist, 57% (17 members) of patients are coated tongue, 30% (9 members) of patients are red smooth white or red patch ulcer for two weeks. Regarding tissue inside cheek, floor and mouth 17% (5 members) of patients are pink and moist, 33% (10members) of patients are Dry, shiny, rough, red or swollen, 50% (15 members) of patients are White or red patch bleeding hardness or ulcer for two weeks. Regarding gums between teeth and under artificial teeth 17% (5members) 0f patients are pink, small, smooth and pink under artificial teeth, 27% (8 members) of patients are Redness at border around on to six teeth, 57% (17 members) of patients are swollen or bleeding gums, redness at border around 7 or more teeth, loose teeth, generalized redness or sore under artificial teeth. Regarding saliva 20% (6 members) of patients are Tissue moist, saliva free flowing and watery, 27% (8 members) of patients are Tissue dry and sticky, 53% (16members) of patients are Tissues patched and red, no saliva regarding condition of Natural teeth 27% (8 members) of patients are No decayed or broken teeth, 30% (9 members) of patients are one to three decayed or broken teeth, 43% (13 members) of patients are four or more decayed or broken teeth. Regarding oral cleanliness 17% (5 members) of patients are Clean, no food particles in the mouth, 27% (8 members) of patients are Food particles in one or two places in the mouth, 57% (17 members) of patients are Food particles in most places in the mouth.

Section D: Frequency and percentage distribution of pretest and post-test level of oral care among patients with ventilator associated pneumonia.

Table 1: Pretest

Oral care	Frequency	Percentage
Mild	4	13%
Moderate	18	60%
Severe	8	27%

Table 1 shows the frequency and percentage distribution of Pretest on effectiveness of oral care. This data reveals that 4(13%) had mild level, 18(60%) had moderate level, 8(27%) had severe level.

The present study was supported by Garcia *et al.* (2009), conduct a study on determined the effect of a comprehensive oral and dental care protocol on the rate of VAP by pre-post interventional study. Adults' receiving mechanical ventilation more than 48 hours in Brookdale University Hospital was studied in a two consecutive 24-month periods. Pre-interventional group (n = 779) had no oral assessments, no subglottic suctioning, no tooth brushing, and suctioning of secretions in oral cavity as needed. The interventional group (n = 759) was treated with

a protocol which included oral assessment, deep suctioning every 6 hours, oral tissue cleansing every 4 hours or as needed and tooth brushing twice daily. VAP rate was determined using Clinical Pulmonary Infection Score (CPIS) (CPIS > 6). The rate of VAP was found to be 12% per 1000 ventilator days before the intervention and decreased to 8.0% per 1000 ventilator days during the intervention (p = 0.06). Researcher concluded that the implementation of comprehensive oral care protocol and staff compliance significantly reduced the VAP rate and its associated costs.
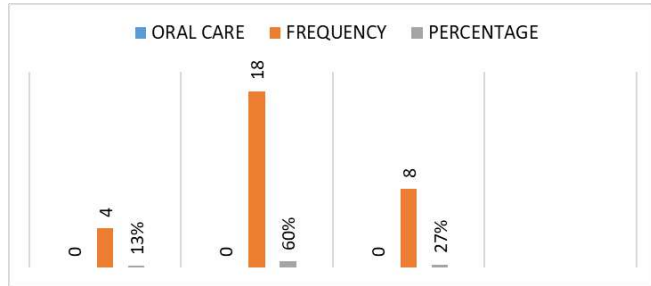

Fig 1: Post Test

Table 2: Post Test

Oral care	Frequency	Percentage
Mild	19	63%
Moderate	6	20%
Severe	5	17%

Table 2 shows the frequency and percentage distribution of post test on effectiveness of oral care. This data reveals that 19(63%) had mild level, 6(20%) had moderate level, 5(17%) had severe level.

The present study was supported by Munro *et al.* (2009), conducted a study on to evaluate the effects of mechanical (toothbrushing), pharmacological (topical chlorhexidine), and combination oral care (toothbrushing plus chlorhexidine) in reducing the VAP rate using randomized controlled clinical trial with a 2×2 factorial design. He enrolled 249 intubated patients within 24 hours of intubation from three ICUs. Patients with clinical diagnosis of pneumonia at the time admission were excluded. Patients were randomized to one of the four treatment groups, 0.12% chlorhexidine swab twice daily, tooth brushing thrice daily, both tooth brushing and chlorhexidine, and usual care. Data were collected using Clinical Pulmonary Infection Score (CPIS). Results proved that chlorhexidine in combination with tooth brushing significantly reduced the incidence of VAP (CPIS <6) by day 3.

The present study was supported by Sona *et al.* (2009), conducted a pre-post intervention observational study to determine the effect of a simple low-cost oral care protocol on VAP rate, in 24 bedded Surgical ICU of BarnesJewish Hospital, Missouri. All mechanically ventilated patients for a time period of one year were enrolled in the study. The oral care protocol involved tooth brushing and subsequent application 0.12% Chlorhexidine gluconate twice daily in 12 hours interval. During pre-intervention period there was 24 infections in 4606 ventilator days (rate = 5.2 infections per 1000 ventilator days). There was a reduction in the incidence of infection to 10 in 4158 ventilator days resulting in a lower rate of 2.4 per 1000 ventilator days. There was a statistical significance in this 46% reduction of VAP (p =

0.04). The fewer cases of VAP led to a decrease in cost of US$140,000 to US$560,000 based on estimated cost per case of VAP. There was a overall reduction of VAP rate by implementation of a low-cost oral care protocol.

Section E: Effectiveness of oral care among patients with ventilator associated pneumonia

Table 3: Effectiveness of oral care

Oral care	Pretest	Post Test	Paired 't' Test
Mean	13.433	8.366	2.84699
Standard Deviation	1.1538	2.1173	S***

Table 3 Reveals that, the post test mean value is higher than pre - test. The paired 't' value found statistically significant and it shows that oral care is effective in patients with ventilator associated pneumonia.

Section F: Determine the association between post test level of oral care among patients with ventilator associated pneumonia

It shows association between post test level of oral care among patients with ventilator associated pneumonia.

Chi square was calculated to find out the association between post test level of oral care among patients with ventilator associated pneumonia with their selected demographic variables.

Non-significant association was found between post test level of scores regarding oral care among patients with ventilator associated pneumonia with the selected demographic variables such as Age, sex, marital status, income, Geographical location, composition of family.

Educational status, Occupation is Significant.

Conclusion

This study proves that oral care is effective among occurrence of ventilator associated pneumonia patients and it prevents from Ventilator Associated Pneumonia complication. And also it helps the patients to improve to the knowledge and to provide better quality of life to patients.

Author's contribution

All the authors actively participated in the work of the study. All authors read and approved the final manuscript.

Conflicts of interest

The authors declare no conflicts of interest.

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