THE EFFECT OF CLINICAL NURSING PRACTICE GUIDELINE UTILIZATION FOR CARE OF ORAL CAVITIES ON ORAL STATUS AND VENTILATOR-ASSOCIATED PNEUMONIA (VAP) RATE IN CRITICALLY ILL ADULT PATIENTS WITH ENDOTRACHEAL TUBE

PETCHARAT RUJIPONG

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Petcharat Rujipong
.....
Miss Petcharat Rujipong
Candidate

Sauvaluck Lekutai
.....
Assoc.Prof.Sauvaluck Lekutai,
M.Sc. (Physiology)
Major-Advisor

Wanpen Pinyopasakul
.....
Assist.Prof.Wanpen Pinyopasakul,
Ph.D. (Nursing)
Co-Advisor

.....
Assist.Prof.Suthat Rungruanghiranya,
M.D. (Certificate in Critical Care
Medicine)
Co-Advisor

B. Mahaisavariya
.....
Prof.Banchong Mahaisavariya,
M.D.
Dean
Faculty of Graduate Studies
Mahidol University

Yajai Sitthimongkol
.....
Assoc.Prof.Yajai Sitthimongkol,
Ph.D. (Nursing)
Chair
Master of Nursing Science
Faculty of Nursing
Mahidol University

Thesis
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for the degree of Master of Nursing Science (Adult Nursing)
on
May 4, 2009

Petcharat Rujipong
Miss Petcharat Rujipong
Candidate

Usavadee Asdornwised
Assist.Prof.Usavadee Asdornwised,
Ph.D. (Nursing)
Chair

Assist.Prof.Suthat Rungruanghiranya,
M.D. (Certificate in Critical Care Medicine)
Member

Sauvaluck Lekutai
Assoc.Prof.Sauvaluck Lekutai,
M.Sc. (Physiology)
Member

Assist.Prof.Chanokporn Jitpanya,
Ph.D. (Nursing)
Member

Wanpen Pinyopasakul
Assist.Prof.Wanpen Pinyopasakul,
Ph.D. (Nursing)
Member

B. Mahaisavariya
Prof.Banchong Mahaisavariya,
M.D.
Dean
Faculty of Graduate Studies
Mahidol University

Fongcum Tilokskulchai
Assoc.Prof.Fongcum Tilokskulchai,
Ph.D. (Nursing)
Dean
Faculty of Nursing
Mahidol University

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Petcharat Rujipong

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PETCHARAT RUJIPONG 4936715 NSAN/M

M.N.S. (ADULT NURSING)

THESIS ADVISORY COMMITTEE: SAUVALUCK LEKUTAI, M.Sc. (PHYSIOLOGY), WANPEN PINYOPASAKUL, Ph.D.(NURSING), SUTHAT RUNGRUANGHIRANYA, M.D.

ABSTRACT

This was an experimental study aiming to study the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube. The participants were 24 critically ill patients with oral endotracheal intubation, aged 15 years and above. They were admitted to the medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center. They were not previously diagnosed with pneumonia. They were divided into the control group and the experimental group, each with 12 cases, by matched pair technique. The control group received routine oral care whereas the experimental group received oral care based on the clinical nursing practice guidelines for care of oral cavities. The instruments for data collection consisted of a demographic data form, the Oral Assessment Form and the VAP development assessment form. Statistical analyses used in this study were Chi-square test and Mann-Whitney U-test.

The results from this study showed that before receiving oral care, all participants in both groups had mild abnormality of oral status. After receiving oral care, the participants in the experimental group had a significant lower mean score of abnormality of oral status than the participants in the control group ($p = 0.001$). However, VAP rates in both groups were not significantly different ($p = 0.478$).

From this study, the researcher recommends that nurses should take care of oral cavities in critically ill patients with endotracheal tube based on clinical nursing practice guidelines for care of oral cavities to reduce the abnormality of oral status. Further research may include various mouth care methods in order to compare or determine which method is most effective for oral care in this group of patients.

KEY WORDS: CLINICAL NURSING PRACTICE GUIDELINE/ ORAL CARE/ ORAL STATUS/ VENTILATOR-ASSOCIATED PNEUMONIA (VAP)/ CRITICALLY ILL PATIENTS

116 pages

ผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อสภาพช่องปาก และอัตราการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจในผู้ป่วยผู้ใหญ่วิกฤตที่ใส่ท่อช่วยหายใจ

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เพชรัตน์ รุจิพงศ์ 4936715 NSAN/M

พย.ม. (การพยาบาลผู้ใหญ่)

คณะกรรมการที่ปรึกษาวิทยานิพนธ์: เสาวลักษณ์ เล็กอุทัย, วท.ม. (สรีรวิทยา), วันเพ็ญ ภิญโญภาสกุล, Ph. D. (NURSING), สุทัศน์ รุ่งเรืองหิรัญญา, พ.บ.

บทคัดย่อ

การศึกษาครั้งนี้เป็นการวิจัยเชิงทดลอง เพื่อศึกษาผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อสภาพช่องปาก และอัตราการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจในผู้ป่วยผู้ใหญ่วิกฤตที่ใส่ท่อช่วยหายใจ โดยกลุ่มตัวอย่างเป็นผู้ป่วยวิกฤตที่ใส่ท่อช่วยหายใจทางปากอายุตั้งแต่ 15 ปีขึ้นไป ซึ่งเข้ารับการรักษาในหออภิบาลอายุรกรรม หออภิบาลศัลยกรรม หอผู้ป่วยอายุรกรรมและหอผู้ป่วยศัลยกรรม โรงพยาบาลศูนย์การแพทย์สมเด็จพระเทพรัตนราชสุดาฯ สยามบรมราชกุมารี และไม่มีภาวะปอดอักเสบติดเชื้อมาก่อน จำนวน 24 ราย แบ่งเป็นกลุ่มควบคุมและกลุ่มทดลองกลุ่มละ 12 รายโดยใช้เทคนิคการจับคู่ กลุ่มควบคุมได้รับการดูแลความสะอาดช่องปากตามปกติ ในขณะที่กลุ่มทดลองได้รับการดูแลความสะอาดช่องปากตามแนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปาก เครื่องมือในการเก็บรวบรวมข้อมูลประกอบด้วย แบบบันทึกข้อมูลส่วนบุคคล แบบประเมินสภาพช่องปาก และแบบประเมินการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ วิเคราะห์ข้อมูลโดยใช้สถิติไคสแควร์ และสถิติทดสอบแมน-วิทนี-ยู

ผลการศึกษาพบว่าก่อนได้รับการดูแลความสะอาดช่องปาก กลุ่มตัวอย่างทั้งสองกลุ่มมีคะแนนความผิดปกติของสภาพช่องปากอยู่ในระดับผิดปกติเล็กน้อย ภายหลังได้รับการดูแลความสะอาดช่องปาก กลุ่มทดลองมีคะแนนเฉลี่ยความผิดปกติของสภาพช่องปากต่ำกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ ($p = 0.001$) ส่วนอัตราการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจของกลุ่มตัวอย่างทั้งสองกลุ่มไม่แตกต่างกัน ($p = 0.478$)

จากผลการวิจัยครั้งนี้มีข้อเสนอแนะ คือ พยาบาลควรนำแนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากไปใช้ในการดูแลความสะอาดช่องปากผู้ป่วยวิกฤตที่ใส่ท่อช่วยหายใจ เพื่อลดความผิดปกติของสภาพช่องปาก การวิจัยครั้งต่อไปอาจจะพิจารณาเปรียบเทียบวิธีทำความสะอาดช่องปากที่หลากหลายขึ้น เพื่อค้นหาวิธีที่มีประสิทธิผลในการทำความสะอาดช่องปากมากที่สุด

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CHAPTER I
INTRODUCTION

Background and Significance of the Study

Ventilator-Associated Pneumonia (VAP) is the second most common nosocomial infection after urinary tract infections (Richards, Edwards, Culver & Gaynes, 1999). Its highest mortality rate ranges between 8-28 percents in mechanically ventilated patients. Furthermore, it is the most frequent infection in intensive care unit (ICU) by 47% of all infections in ICU (Cason, Tyner, Saunders & Broome, 2007).

According to the survey collecting from 300 hospitals in 1992-2004 by National Nosocomial Infections Surveillance (NNIS) system of the United States, VAP rate in adult patients in ICUs was from 2.2-14.7 times per 1,000 ventilator days (US Department of Health and Human Services, 2004). In Thailand, the statistics of infections at Siriraj Hospital in 2006 showed that the mean rate of VAP was 11 times per 1,000 ventilator days (Infection Control Department of Siriraj Hospital, 2006). At the same time, the statistics of infections at HRH Princess Maha Chakri Sirindhorn Medical Center in 2006 showed that the mean rate of VAP was 17.2 times per 1,000 ventilator days (Infection Control Department of HRH Princess Maha Chakri Sirindhorn Medical Center, 2006).

The significant cause of VAP rate is endotracheal intubation (Safdar, Crnich & Maki, 2005). Endotracheal intubation injures tissues in oral cavity and oropharynx leading to the increasingly adhesion, accumulation and colonization of bacteria in oral cavity (Hixson, Sole & King, 1998) and decreases salivary flow that prevents the development of dental plaque serving as a reservoir of pathogenic bacteria and thwarts bacterial colonization in oral cavity (Munro & Grap, 2004). When dental plaque matures, oral status becomes worse till abnormal; gingivitis and ulceration resulting in the overgrowth of pathogenic bacteria in oral cavity in either way (Berry & Davidson, 2006).

As a result, pathogenic bacteria can be colonized in oral and oropharyngeal secretions and eventually be aspirated into the lungs, causing VAP (O'Neal, Brown & Munro, 2002; Munro & Grap, 2004). The study of Mayhall (1996) reported that aspiration of organisms from the oropharynx and oral cavity was considered the most important mechanism leading to VAP.

VAP is one of important problems impacting on patients, hospitals and nations. In terms of its impact on patients, VAP increases mortality rate ranging from 20% to 70% (Cason, Tyner, Saunders & Broome, 2007). Moreover, VAP increases a patient's length of stay in the ICU and hospitalization by approximately 6.1 days (Rollo et al., 2002) and increases requirement of high quality and expensive antibiotics. As a result, healthcare cost of patient's household and hospital increases accordingly. According to a hospital statistics, healthcare cost of patient's household was by approximately 9,938.25 baht per case (Danchaivijitr, Dhiraputra, Santiprasitkul & Judaeng, 2005) and total healthcare cost of hospital rose to 637,000 baht (Infection Control Department of Maharaj Nakorn Chiangmai Hospital, 2003). The VAP rate is also a key performance indicator (KPI) of nursing care quality in aspects of prevention and infection control in hospital and nursing cares for critically ill patients (Trepetchsriurai, Nittayanggoon & Sathiraungkul, 2001).

Therefore, guidelines to reduce VAP have been established and developed from evidence based practice in order to resolve the problems and provide standard nursing quality required for the certification of hospital accreditation. A guideline reducing VAP includes the improvement of oral health by using oral care interventions (Munro & Grap, 2004).

Oral care interventions can prevent the accumulation of dental plaque and stimulate local oral immunity during the early period of hospitalization that may reduce bacterial colonization causing development of VAP (Munro & Grap, 2004). In accordance with Mori and others (2005), VAP rate in the oral care group of mechanically ventilated patients in the ICU was 3.9 times per 1,000 ventilator days. This rate was significantly lower than that in the non-oral care group that was 10.4 times per 1,000 ventilator days ($P > 0.001$). Therefore, the patients should be provided by appropriate oral care methods.

In general, there are 2 oral care methods: toothbrushing and using of cotton swabs. According to the study of Pearson and Hotton (2002), toothbrushing was considered an effective mechanical method to remove dental plaque and debris on sheltered areas of the teeth and stimulate blood circulation of gingival tissues over using of cotton swabs. Moreover, brushing on teeth and gingiva affects on stimulation in salivary flow (Yoshino, Ebihara, Ebihara, Fuji & Sasaki, 2001).

Cleansing agents such as toothpaste, mouth rinse are required in oral care interventions. Two studies in the United States and Thailand found that 0.12% chlorhexidine gluconate was the most effective cleansing agent to reduce both gram-positive and gram-negative bacteria in oral cavity comparing with special mouth wash and fluoride toothpaste. The number of bacteria in experimental group using 0.12% chlorhexidine gluconate was significantly less than that in control groups using special mouth wash and fluoride toothpaste (Elworthy, 1996; Pangsomboon, Kerdpon, Teanpaisan & Geater, 2003).

In addition, other following methods can prevent aspiration, for example, body positioning, checking the appropriateness of inflated cuff pressure, suctioning of oral secretions in both the oral cavity and oropharyngeal area. They can also prevent aspiration of contaminated secretions into the lower respiratory tract (Drakulovic et al., 1999; Schleder, Stott & Lloyd, 2002; Pruitt & Jacobs, 2006).

As a result, the researcher was interested in developing oral care interventions to reduce VAP rate in critically ill patients. The clinical nursing practice guideline for care of oral cavities developed by Supattra Nuchakul (Nuchakul, 2007) is applied for reducing VAP rate resulting in lower healthcare cost, mortality rate and better quality of patient life in the future. The guideline was developed based on valid, reliable and proven evidence based practice. It covers preventive process of the occurrence of VAP caused by the aspiration of organisms from the oropharynx and oral cavity into lungs.

Research Questions

1. Can the utilization of clinical nursing practice guideline for care of oral cavities reduce level of abnormality of oral status in critically ill adult patients with endotracheal tube?

2. Can the utilization of clinical nursing practice guideline for care of oral cavities reduce Ventilator-Associated Pneumonia (VAP) rate?

Research Objectives

1. To compare oral status of critically ill adult patients with endotracheal tube receiving oral care based on clinical nursing practice guideline for care of oral cavities with that of the patients receiving routine oral care.
2. To compare VAP rate of critically ill adult patients with endotracheal tube receiving oral care based on clinical nursing practice guideline for care of oral cavities with that of the patients receiving routine oral care.

Research Hypotheses

1. The mean score of abnormality of oral status after the intervention of critically ill adult patients with endotracheal tube receiving oral care based on clinical nursing practice guideline for care of oral cavities is lower than that of the patients receiving routine oral care.
2. The VAP rate after the intervention of critically ill adult patients with endotracheal tube receiving oral care based on clinical nursing practice guideline for care of oral cavities is less than that of the patients receiving routine oral care.

Conceptual Framework

The conceptual framework of this study was developed from knowledge of the pathophysiology of VAP caused by the aspiration of organisms from the oropharynx and oral cavity into lungs.

In the critical time, endotracheal intubation is often required for patients in order to recuperate respiratory tract. However, during therapeutic period, VAP may be developed because the intubation process could cause injury and inflammation in oral cavity and oropharynx resulting in change of respiratory epithelial cell surfaces. Salivary gland will secrete more proteolytic enzyme leading to lesser fibronectin, which is a glycoprotein involving the adherence of gram-positive bacteria and interfering the adherence of gram-negative ones. As a result, gram-negative bacteria, more virulent than gram-positive ones, increasingly invade in oral cavity and

oropharynx (Young & Ridley, 1999; Safdar, Crnich & Maki, 2005).

Furthermore, intubation may cause less salivary flow preventing development of dental plaque, and less immunoglobulin A (IgA) and Lactoferrin in siliva preventing oral bacterial colonization and interfering the adherence of bacteria. Both reduction introduce dental plague accumulation and proliferation of pathogenic bacteria in oral cavity (Munro & Grap, 2004). Meanwhile, oral status is changed by dental plaque; that is gingivitis and ulceration resulting in the overgrowth of pathogenic bacteria in oral cavity in either way (Berry & Davidson, 2006).

Pathogenic bacteria in oral cavity accumulate in oropharyngeal secretions and are aspirated into the lungs by leakage of virulent oropharyngeal secretions around the endotracheal cuff, causing VAP eventually (Weber, Rutala & Mayball, 1998; O'Neal, Brown & Munro, 2002; Munro & Grap, 2004).

VAP rate can be reduced by effective oral care. In this study, the researcher applied evidenced-based oral care using the clinical nursing practice guideline for care of oral cavities developed by Supattra Nuchakul (Nuchakul, 2007). The guideline involves care of oral cavities by toothbrushing considered as an effective mechanical method to remove dental plaque and debris especially on sheltered areas of the teeth including stimulating blood circulation of gingival tissues and salivary flow in order to increase oral immunity (Yoshino, Ebihara, Ebihara, Fuji & Sasaki, 2001; Pearson & Hotton, 2002). Using the cleansing agent, 0.12% chlorhexidine gluconate, reducing both gram-positive and gram-negative bacteria in oral cavity effectively, semirecumbent position, checking the appropriateness of inflated cuff pressure remaining between 20-30 centimeters of water (cmH_2O), and suctioning of oral secretions in both the oral cavity and oropharyngeal area can also prevent aspiration of contaminated secretions into lungs (Drakulovic et al., 1999; Schleder, Stott & Lloyd, 2002; Pangsomboon, Kerdpon, Teanpaisan & Geater, 2003; Pruitt & Jacobs, 2006). According to the study of Brennan and others (2004), aspiration was considered one of important mechanisms leading to VAP. Detailed conceptual framework is shown in Figure 1 and Figure 2:

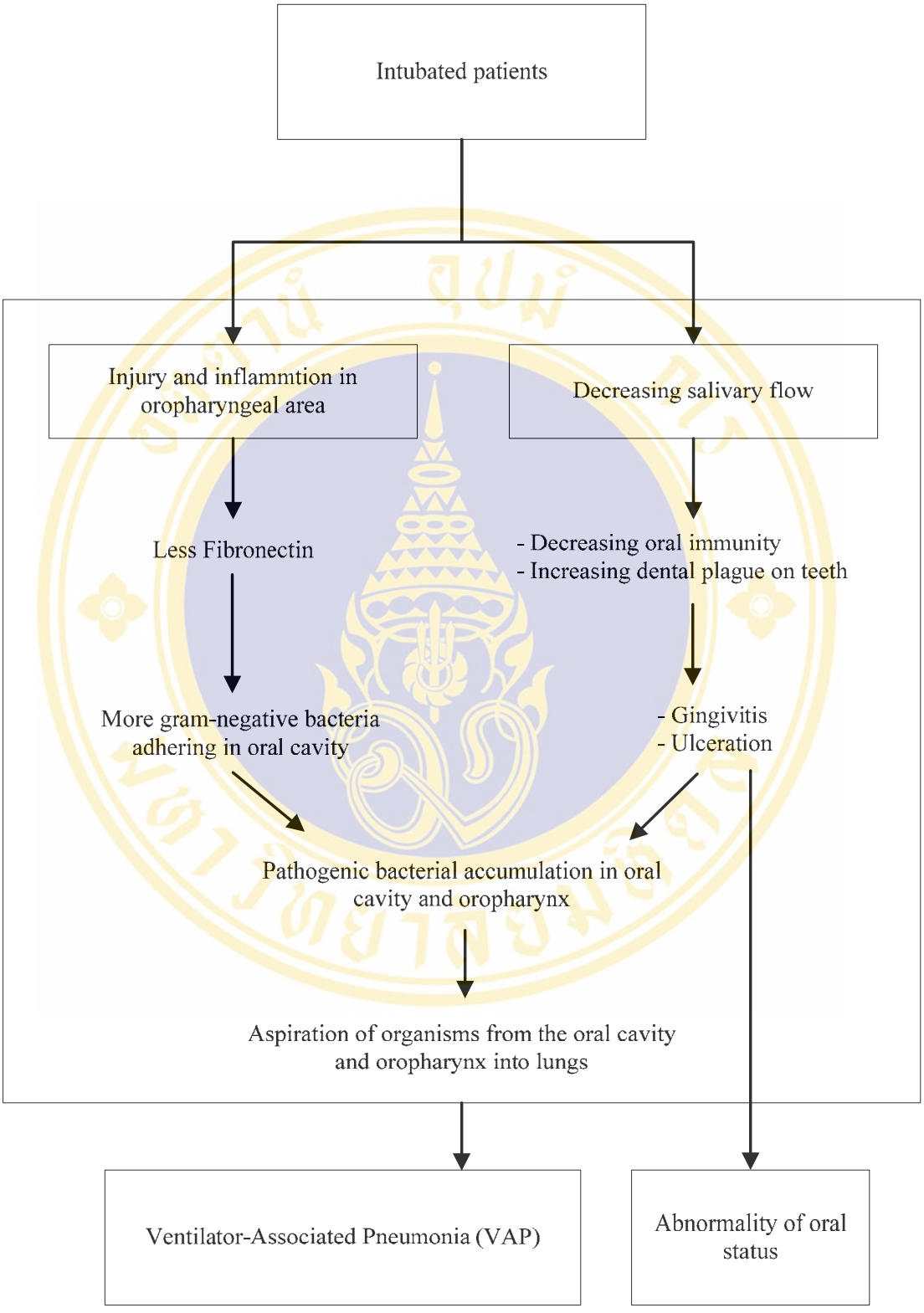


Figure 1: Conceptual framework: Pathophysiology of VAP

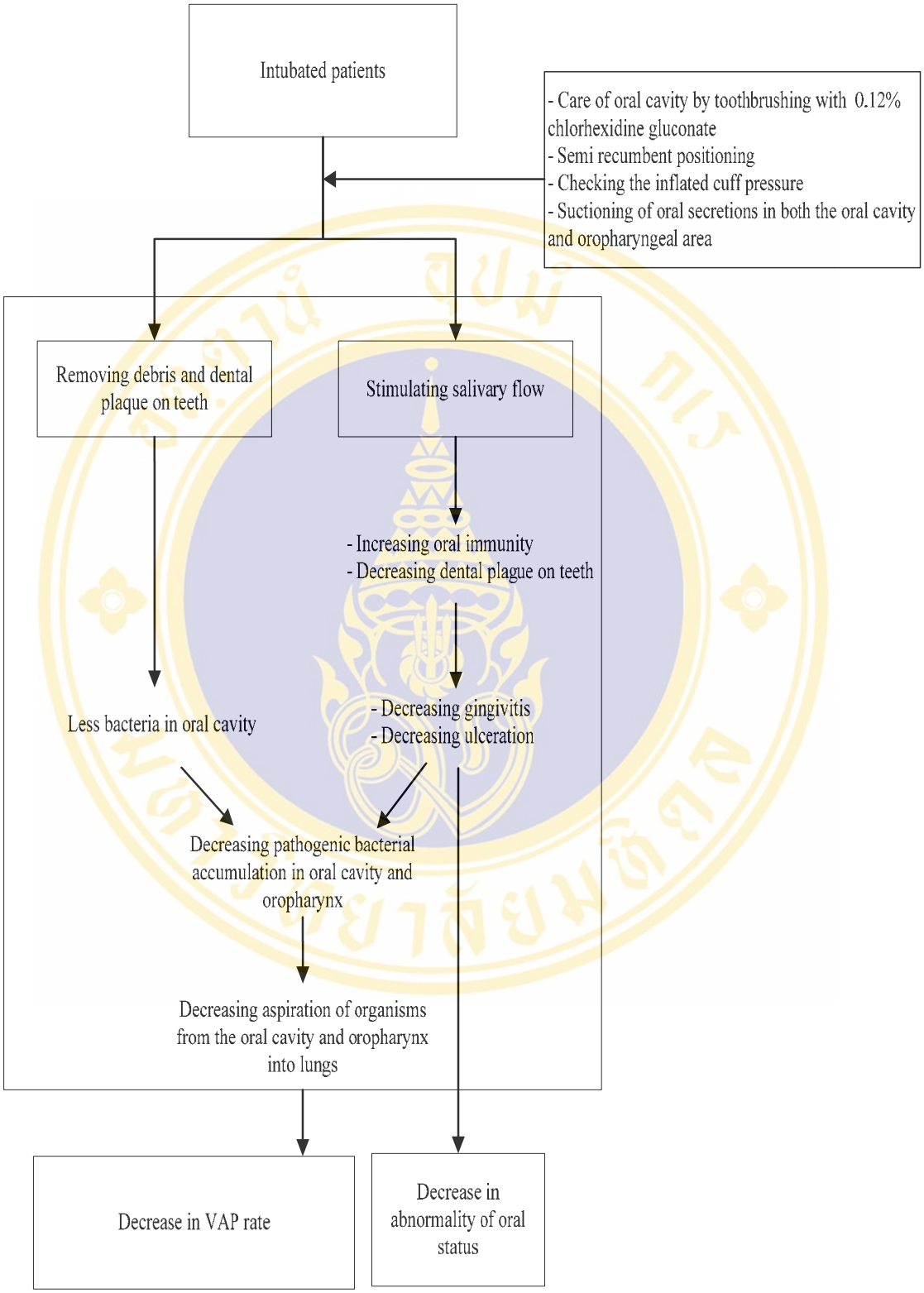


Figure 2: Conceptual framework: Pathophysiology after VAP prevention

Scope of the Study

The research was an experimental study. The purpose was to study the effect of the clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube. Subjects were those with ages 15 years and above, being admitted in medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhonnayok. The data collection period was from August 14, 2008 to December 15, 2008.

Definition of Terms

Clinical nursing practice guideline for care of oral cavities refers to activities for care of oral cavities comprising care of teeth, gingiva, palates, tongue and lips in order to reduce abnormality of oral status and prevent the development of VAP. It is applied from the guideline developed by Supattra Nuchakul (Nuchakul, 2007). Its four main steps are oral assessment, informing patients, cleaning oral cavity, and evaluating outcome.

Routine oral care refers to activities for care of oral cavities provided by registered nurses in ICU/wards. Cotton swabs and special mouth wash (0.004% chloroxylenol) are used in routine oral care, twice a day without using standard Oral Assessment Guide (OAG) for assessing the oral status.

Oral status refers to the appearance of mouth, teeth, gingiva, lips, buccal mucosa and tongue considered by their color, moisture, oral ulcer, bleeding, edema, and oral cleanness.

Ventilator-Associated Pneumonia (VAP) is defined as lung infection after intubating endotracheal tube and onset of mechanical ventilation over 48 hours. The clinical diagnosis of VAP depends on a clinical suspicion defined as the occurrence of a new or progressive and persistent radiographic infiltrate plus at least two of the following criteria: (The American Thoracic Society and the Infectious Diseases Society of America, 2005)

1. Having new or higher fever than normal (Body temperature > 38.3 ^{o}C)
2. Having leukocytosis (> 12,000 white blood cells (WBC)/mm^{3}) or leukopenia

(< 4,000 WBC/mm^3)

3. Having purulent tracheal secretions

Moreover, an additional microbiologic criterion is required by The American Thoracic Society and the Infectious Diseases Society of America (2005): at least moderate growth on sputum culture, 10^4 colony-forming unit (CFU)/ml on bronchoalveolar lavage (BAL) or 10^3 CFU/ml on protected mini-BAL.

Critically ill adult patient is the patient, 15 years old and above, who has been intubated with oral endotracheal tube and admitted in medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhonnayok.

Expected Outcomes/Benefits

1. This evidence based guideline for care of oral cavities in critically ill adult patients with endotracheal tube may be used more widely in order to reduce abnormality of oral status and prevent development of VAP.
2. The guideline may be used as a baseline for further study related to oral care in critically ill adult patients with endotracheal tube such as further development of effective oral assessment or oral cleansing techniques.

CHAPTER II
LITERATURE REVIEW

This study aimed to examine the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube admitted in medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhonnayok. The researcher reviewed relevant literature and research materials covering topics as follows:

1. Oral status and risk factors associated with abnormality of oral cavity in critically ill adult patients with endotracheal tube
2. Guideline for assessing the oral status in critically ill adult patients with endotracheal tube
3. Ventilator-Associated Pneumonia (VAP)

3.1 Mechanisms of Ventilator-Associated Pneumonia development in critically ill adult patients with endotracheal tube

3.2 Diagnosis of Ventilator-Associated Pneumonia in critically ill adult patients with endotracheal tube

3.3 Risk factors associated with Ventilator-Associated Pneumonia (VAP) development in critically ill adult patients with endotracheal tube

4. Impacts of Ventilator-Associated Pneumonia (VAP) on critically ill adult patients with endotracheal tube
5. Standard oral care for reducing abnormality of oral status and preventing Ventilator-Associated Pneumonia (VAP) in critically ill adult patients with endotracheal tube
6. Research studies related to oral care and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube

1. Oral status and risk factors associated with abnormality of oral cavity in critically ill adult patients with endotracheal tube

1.1 Oral status

Oral cavity is an organ as the passage of food to nourish the parts of body, to support grinding food into pieces for easier digestion. It comprises lips, buccal mucosa, gingiva, teeth, hard palate, soft palate, tongue and salivary glands. The characteristics of normal oral status are defined as follows: (Anderson, Persson, Hallberg & Renvert, 1999; Taechaprasertvitaya, 2001)

Lips Smooth, pink, moist, not dry or cracked, and not ulcerated or bleeding

Buccal mucosa, hard palate, soft palate Pink, moist, not change in red/blue red, no white coating, and not ulcerated or bleeding

Gingiva Pink, firm, smooth thin gingival edge attaching with teeth, not edematous with redness, and not gingival bleeding.

Teeth Clean, no debris or dental plaque along gum line or sheltered areas of teeth, and no dental caries

Tongue Moist, pink, not change in red/ blue red, no white coating, not cracked, and not ulcerated or bleeding

Saliva Watery, and not viscous or absent

1.2 Risk factors associated with abnormality of oral cavity

1.2.1 Age

The elderly may have a risk of abnormality of oral cavity due to salivary gland hyposecretion resulting in decreasing of saliva and xerostomia. Xerostomia is defined as dry mouth with unstimulated salivary flow less than 0.1 ml/min. The study of Ship, Pillemer and Baum (2002) found that xerostomia occurred in at least 30% of adults 65 and older may result in ulceration, oropharyngeal colonization with respiratory pathogens and the progression to VAP finally (Berry & Davidson, 2006). Furthermore, the atrophy of oral mucosa and gingival tissues in the elderly causes tooth loss with wearing of dentures afterward. The wearing of dentures may cause inflammation and ulcers such as ulcers of buccal mucosa or palate resulting in bacterial colonization in oral cavity (O'Reilly, 2003; Berry & Davidson, 2006).

1.2.2 Underlying illness

Underlying illnesses are also risk factors associated with abnormality of oral cavity e.g. gingivitis, oral ulcers and gingival bleeding (White, 2000). Examples of underlying disease included:

- Diabetes mellitus
- Acquired immunodeficiency syndrome (AIDS)
- Acute leukaemia
- Respiratory tract infection
- Scurvy

1.2.3 Smoking and alcohol consumption

Smoking and alcohol consumption are risk factors associated with abnormality of oral cavity. Smoking is a known risk factor in the development of periodontal disease caused by dental plaque as a reservoir of pathogenic bacteria. Periodontal disease in the elderly is associated with gingival bleeding, tooth loss and halitosis. Furthermore, it increases elders' susceptibility to VAP (Coleman, 2002). Meanwhile, alcohol consumption might also lead to an increase in bleeding times resulting in gingival bleeding (Taechaprasertvitaya, 2001; O'Reilly, 2003).

1.2.4 Medication

There are few medications causing salivary gland hyposecretion and xerostomia such as diuretics, morphine, antihistamines, anticholinergics. The hyposecretion and xerostomia could increase gram-negative bacteria in oral cavity (White, 2000).

1.2.5 Endotracheal intubation

Endotrachel intubation might keep a patient's mouth continuously open and reduce salivary flow. These situations might contribute to xerostomia leading to bacterial proliferation adhering in oral cavity and teeth and increasing ulceration in oral cavity (Munro & Grap, 2004; Abidia, 2007).

2. Guideline for assessing the oral status in critically ill adult patients with endotracheal tube

A number of assessment tools of oral status in critically ill adult patients with endotracheal tube are developed and standardized e.g. Oral Assessment Guide (OAG), BRUSHED Assessment Model (Hayes & Jones, 1995). In this research, OAG is applied as a guideline for assessing the oral status.

OAG was first developed by Eilers, Berger and Peterson (1988) in order to assess oral status of oncology patients. Then, it was adapted for assessing the oral status of endotracheal intubated patients by Ross and Crumpler (2007). The details of both OAGs are as follows:

OAG by Eilers, Berger & Peterson (1988)

The Oral Assessment Guide (OAG) comprises 8 categories: voice, swallow, lips, tongue, saliva, mucous membranes, gingiva and teeth. Each category is descriptively ranked normal (Score = 1), mild compromise (Score = 2) and definite compromise (Score = 3). The score is the sum of the eight categories with a range of 8-24: a lower score is indicative of better oral health. Categories in details are defined as follows:

Table 1: Oral Assessment Guide (OAG) by Eilers, Berger and Peterson (1988)

Category	Tool for assessment	Method of measurement	Numerical and descriptive rating		
			1	2	3
Voice	Auditory assessment	Converse with patient	Normal	Deeper and raspy	Difficulty talking or painful

Table 1: Oral Assessment Guide (OAG) by Eilers, Berger and Peterson (1988) (cont.)

Category	Tool for assessment	Method of measurement	Numerical and descriptive rating		
			1	2	3
Swallow	Observation	Ask patient to swallow and test gag reflex by gently place blade on back of tongue and depress it	Normal swallow	Some pain on swallow	Unable to swallow
Lips	Visual/ palpatory	Observe and feel tissue	Smooth and pink and moist	Dry or cracked	Ulcerated or bleeding
Tongue	Visual/ palpatory	Feel and observe appearance of tissue	Pink and moist and papillae present	Coated or loss of papillae with shiny appearance with or without redness	Blistered or cracked
Saliva	Tongue blade	Insert blade into mouth, touching the center of the tongue and the floor of the mouth	Watery	Thick or ropy	Absent

Table 1: Oral Assessment Guide (OAG) by Eilers, Berger and Peterson (1988) (cont.)

Category	Tool for assessment	Method of measurement	Numerical and descriptive rating		
			1	2	3
Mucous membranes	Visual assessment	Observe appearance of tissue	pink and moist	Reddened or coated (increased whiteness without ulcerations)	Ulcerations with or without bleeding
Gingiva	Tongue blade and visual assessment	Gently press tissue with tip of blade	Pink and stippled and firm	Edematous with or without redness	Spontaneous bleeding or bleeding with pressure
Teeth, Dentures	Visual assessment	Observe appearance of teeth or denture bearing area	Clean and no debris	Plaque or debris in localized areas (between teeth if present)	Plaque or debris generalized along gum line or denture bearing area

OAG by Ross & Crumpler (2007)

The Oral Assessment Guide (OAG) by Ross and Crumpler was adapted from the original OAG by Eilers, Berger and Peterson (1988). It comprises 5 left categories: lips, mucous membranes/tongue, gums, teeth and saliva, to accommodate endotracheal intubated patients. The scores ranged from 5 to15 and were classified in 3 ranks with 5 being normal, 6-10 representing mild compromise and 11-15 representing definite compromise. Categories in details are defined as follows:

Table 2: Oral Assessment Guide (OAG) by Ross and Crumpler (2007)

Category	Numerical and descriptive rating		
	1	**2**	**3**
Lips	Smooth and pink	Dry or cracked	Ulcerated or bleeding
Mucous membranes /Tongue	Pink and moist	Change in color, redness, blue red or white; patchy white areas, blisters, no ulceration; minimal debris	Very red or thick, white coating, ulceration with/without bleeding; moderate to large debris
Gums	Pink and firm	Edematous and/or redness; white coating	Bleed easily and/or thick white coating
Teeth	Clean, no debris	Plaque or debris in localized areas	Plaque or debris generalized
Saliva	Watery	Viscous	Absent

In addition, the study of Satku (2004) and Kenny (1990) presented nursing interventions based on the rating outcomes as follows:

- Normal findings — Clean oral cavity every 6 hours
- Mild compromise — Clean oral cavity every 4 hours together with closely monitoring changes in oral cavity of observed patient such as inflammation of oral mucosa, gingivitis, dental plaque, dental caries, xerostomia and notify the doctor
- Definite compromise — Carefully clean oral cavity every 2 hours together with finding causes of abnormality of oral status and notify the doctor

3. Ventilator-Associated Pneumonia (VAP)

3.1 Mechanisms of Ventilator-Associated Pneumonia development in critically ill adult patients with endotracheal tube

The mechanisms of organisms' translocation into lungs leading to VAP in critically ill adult patients with endotracheal tube are:

3.1.1 Aspiration of oropharyngeal flora

The aspiration of organisms from the oral cavity and oropharynx into lungs is considered the most important mechanism leading to VAP (Mayhall, 1996). An important cause of the aspiration is endotracheal intubation. Endotracheal intubation increases organisms, especially gram-negative bacteria, in oral cavity and oropharynx because of more proteolytic enzyme and less fibronectin, which is a glycoprotein involving the adherence of gram-positive bacteria and interfering the adherence of gram-negative ones (Safdar, Crnich & Maki, 2005). Intubation also increases organisms in oral cavity and oropharynx because saliva and salivary immune factors, which prevent oral bacterial colonization and interfering the adherence of bacteria, decrease (Munro & Grap, 2004). When organisms increasingly harbor in oral cavity and oropharynx, they habitat in oral and oropharyngeal secretions and are aspirated into the lungs by leakage of virulent oropharyngeal secretions around the endotracheal cuff (Weber, Rutala & Mayball, 1998). The study of George and others (1998) reported that 42% of the pathogens isolated from 26 patients with VAP were previously recovered from the oropharynx. Most of them are *Staphylococcus aureus, Streptococcus pneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa* and *Methicillin-resistant staphylococcus aureus (MRSA)* (Munro & Grap, 2004).

3.1.2 Aspiration of gastric colonization

The aspiration of gastric colonization into lungs may lead to VAP due to potential gastro-esophageal reflux of organisms, which accumulate in gastric contents, into the lungs by leakage around the endotracheal cuff. A contributing factor associated with this mechanism is the use of antacids and H_2 receptor-antagonists, which predispose to pathogenic proliferation in the stomach. The other potential factors are nasogastric tube placement and supine body positioning while the patients receive enteral feeding. Most of the pathogens found are *Enterobacter species* (Safdar, Crnich & Maki, 2005).

3.1.3 Inhalation of infectious aerosols

Organisms can be introduced directly into lungs by the endotracheal tube of patients when patients inhale contaminated aerosols or ambient air caused by a variety of gram negative bacilli in respiratory therapy equipment such as ventilator circuit, ventilator connector, nebulizer, humidifiers including contamination of aerosolized medications. Furthermore, the contamination may be linked to inadequate hand washing of healthcare providers or use of the same gloves from patient to patient (Tablan et al., 1994; Hixson, Sole & King, 1998). Most of the organisms found are *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and *Methicillin-resistant staphylococcus aureus (MRSA)* (Safdar, Crnich & Maki, 2005).

3.1.4 Hematogenous spread from a distant focus of infection

Organisms can infect into lungs through hematogenous spread from distant body sites such as phlebitis due to intravenous infusion, urinary tract infection due to prolonged urinary catheter placement, infective endocarditis, pancrease infection, and other sources of infection (Tablan et al., 1994; Hixson, Sole & King, 1998).

3.2 Diagnosis of Ventilator-Associated Pneumonia in critically ill adult patients with endotracheal tube

The clinical diagnosis of VAP depends on a clinical suspicion defined as the occurrence of a new or progressive and persistent radiographic infiltrate plus at least two of the following criteria: (The American Thoracic Society and the Infectious Diseases Society of America, 2005)

1. Having new or higher fever than normal (Body temperature > 38.3 ^{o}C)
2. Leukocytosis (> 12,000 white blood cells (WBC)/mm^3) or leukopenia (< 4,000 WBC/mm^3)
3. Purulent tracheal secretions

The overall accuracy for the clinical diagnosis of VAP was fairly good; the mean sensitivity was 69% and the mean specificity was 75%.

Moreover, an additional microbiologic criterion is required for more accuracy by culture of specimens, which are sputum, endotracheal aspirate (EA), bronchoalveolar lavage (BAL), protected mini-BAL, protected specimen brush (PSB). The culture is categorized into 3 techniques: qualitative culture, semiquantitative culture and quantitative culture. Usually, semiquantitative or quantitative cultures are used for

diagnosis of VAP because of their more reliability (Torres & El-Ebiary, 2000; The American Thoracic Society and the Infectious Diseases Society of America, 2005). These culture techniques are delineated as follows:

1. The microbiologic criterion using qualitative culture method

Qualitative culture will be performed after organisms are found in sputum culture such as *Staphylococcus aureus, Streptococcus pneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa, Methicillin-resistant staphylococcus aureus (MRSA)*, or other organisms.

2. The microbiologic criterion using semiquantitative culture method

The result of sputum culture shows at least moderate growth (3+) of the organism(s).

3. The microbiologic criterion using quantitative culture method

- Organisms grow at least 10^4 colony-forming unit (CFU)/ml on bronchoalveolar lavage (BAL); BAL quantitative cultures had sensitivity from 42% to 93% and specificity from 45% to 100%.
- Organisms grow at least 10^3 CFU/ml on protected mini-BAL; protected mini-BAL quantitative cultures had the sensitivity from 56% to 70% and the specificity from 69% to 93%.
- Organisms grow at least 10^3 CFU/ml on protected specimen brush (PSB); PSB quantitative cultures had the sensitivity from 33% to 100% and the specificity from 50% to 100%.

The consideration for collecting specimens depends on experience and expertise of physicians including readiness of medical equipment in each hospital. However, some studies found that result of treatments and mortality rate is not significantly different in any groups tested by either invasive or non-invasive technique (Ruiz et al., 2000).

3.3 Risk factors associated with Ventilator-Associated Pneumonia (VAP) development in critically ill adult patients with endotracheal tube

Risk factors contributing to VAP are classified into 3 groups, including factors related characteristics of patients, treatment and environment.

3.3.1 Risk factors related to characteristics of patients

- Age

The elderly are patients who have the highest risk of VAP because their body immunity is depleted resulting in more sensitivity in infections and more medical diseases along with ages (Weber, Rutala & Mayball, 1998). The study of Kollef (1993) found that patients age of 60 or older significantly associated with the development of VAP.

- Underlying illness

Underlying illness of patients such as diabetes, renal disease, chronic obstructive pulmonary disease (COPD), cancer, malnutrition, burn or trauma is a potential risk factor of VAP development. It depletes their body immunity especially malnutrition affecting body immune system directly. The number of lymphocytes and complement substances reduces including lesser fibronectin, resulting in decreasing capability of body's defence against organisms and increasing organisms in oral cavity (Cassiere & Niederman, 1996; Hixson, Sole & King, 1998).

- Severity of illness

Patients with high severity of illness have a risk of VAP because their consciousness is often depressed leading to their inability of eating/drinking, less saliva and less salivary immune factors consequently. When saliva and salivary immune factors decrease, adhering bacteria in oral cavity proliferate (O'Reilly, 2003). Depressed consciousness is also a potential risk factor of aspiration (Safdar, Crnich & Maki, 2005). The study of Drakulovic and others (1999) reported that patients with at least 20 scores of Acute Physiology And Chronic Health Evaluation (APACHE) II significantly associated with VAP development.

- Cleanness of oral cavity

Compromised oral status is an important risk factor of VAP because debris on tooth surface accumulates in dirty oral cavity and consequently changes into dental plaque, containing a rough, porous surface, which allows numerous bacteria to be stored. Moreover, dental plaque leads to gingivitis and ulceration resulting in the overgrowth of pathogenic bacteria in oral cavity. Gingivitis subsequently shifts from primary *Streptococcus* and *Actinomyces species* to increasing numbers of gram-negative bacteria. When oral cavity ulcerates, pathogenic bacteria proliferate due to

enlarged adherence of pathogenic bacteria (Berry & Davidson, 2006). In accordance with the study of Fourrier, Duvivier, Boutigny, Roussel-Delvallez and Chopin (1998), dental plaque correlated with VAP development. It found that the bacteria presenting in cultures of dental plaque of patients with VAP were same as the bacteria presenting in their tracheal aspirates.

In addition, cleanness of the tongue is important because the dorsal posterior aspect of tongue contains layers of debris and numerous bacteria. The study of Christensen (1998) found tongue harbored millions of organisms.

3.3.2 Risk factors related to treatment

- Endotracheal intubation

Nasal or oral endotracheal intubation is the most important risk factor of VAP development because of following reasons:

- Endotracheal intubation impairs host defense mechanism by thwarting function of cilia and cough reflex, resulting in decreasing the ability of organism elimination. Inflated cuff also prevents epiglottis closure of larynx, which may lead to aspiration (Garcia, 2005; Safdar, Crnich & Maki, 2005).
- Endotracheal intubation causes the injury of tissues in oropharynx and oropharyngeal inflammation. Salivary gland will secrete more proteolytic enzyme leading to lesser fibronectin, which is a glycoprotein involving the adherence of gram-positive bacteria and interfering the adherence of gram-negative ones. As a result, gram-negative bacteria, more virulent than gram-positive ones, increasingly invade in oral cavity and oropharynx (Young & Ridley, 1999; Safdar, Crnich & Maki, 2005).
- Endotracheal intubation causes less salivary flow leading to less immune factors that prevent oral pathogenic colonization and interfering the adherence of organisms such as IgA, Lactoferrin. As a result, organisms can adhere and proliferate in oral cavity and teeth easily and increasingly (Munro & Grap, 2004).
- Endotracheal tube serves as a reservoir for organisms. A lot of them attach within the surface of endotracheal tube and are enameled by secretions in respiratory tract forming a bacterial biofilm. It serves as a safe haven from host defense mechanisms and antibiotics, in that they have no access to destroy bacteria. The biofilm may be dislodged into lungs by pressure of mechanical ventilator or suctioning (Hixson, Sole & King, 1998; Brennan et al., 2004).

- Endotracheal intubation causes the aspiration of secretions and sputum into lungs. Intubated patients have secretions and sputum located above their cuff. When they swallow or breathe, the size of endotracheal tube changes based on their swallow or breath. Therefore, pooled secretions and sputum could leak around the cuff and enter into their lungs (Weber, Rutala & Mayball, 1998).

- Nasal endotracheal intubation leads to the accumulation of organisms around sinus resulting in infectious sinusitis. Snot or pus from sinus may move into lungs causing VAP (Hixson, Sole & King, 1998).

In addition, the study of Craven and Steger (1996) found that endotracheal intubation increased the risk of VAP development as 6-21 times. Other supporting studies reported that endotracheal intubation for 7 days and above and reintubation were additional risk factors of VAP development (Drakulovic et al., 1999; Pruitt & Jacob, 2006).

- Nasogastric tube placement

Nasogastric tube placement is a risk factor of VAP development because nasogastric tube inhibits the functions of gastroesophageal sphincter and expands volume of stomach due to enteral nutrition fed by the tube. As a result, gastric contents can reflux along esophagus up to respiratory tract. According to the study of Apostolopoulou, Bakakos, Katostaras and Gregorakos (2003), nasogastric tube placement and enteral feeding as risk factors significantly correlated with VAP development. Furthermore, feeding for patients with supine body position is an additional risk factor of VAP development. The study of Drakulovic and others (1999) reported that the highest frequency of VAP as 50% was patients receiving enteral nutrition in the supine body position (14 of total 28 patients).

- Prior administration of antibiotics

The use of antibiotics within 90 days before intubation, especially broad spectrum antibiotics such as cephalosporins, is a contributing factor associated with VAP. Certain antibiotics eliminate normal flora bacteria, resulting in more pathogenic bacterial proliferation and drug resistance (Hixson, Sole & King, 1998; The American Thoracic Society and the Infectious Diseases Society of America, 2005). According to the study of Kollef (1993), prior administration of antibiotics is a risk factor significantly correlated with VAP development.

- The use of stress ulcer prophylactic drugs

The use of antacid or gastric acid-suppressing drugs for example, H_2 blockers (cimetidine, ranitidine), treating critically ill patients in order to prevent gastric bleeding and stress ulcer is a risk factor associated with VAP. Certain drugs reduce gastric acidity leading to gram-negative bacterial proliferation in the stomach. When patients aspirate gastric contents, these bacteria may enter into their lungs causing VAP (Safdar, Crnich & Maki, 2005; Tobin, 2006).

- The use of sedative drugs and paralytic agents

The use of sedative drugs and paralytic agents is a risk factor associated with VAP. The drugs decrease patients' consciousness and relax patients' muscles, resulting in aspiration (Hixson, Sole & King, 1998). According to the study of Schallom and others (2005), the patients who received paralytic agents significantly had a higher VAP rate than patients who did not receive these agents.

- Surgery

Surgery especially thoracic and abdominal surgery is a risk factor associated with VAP. After thoracic and abdominal surgery, the patients can not effectively cough because of severe pain when cough or receiving analgesics especially narcotic analgesics depressing cough center. As a result, sputum and organisms increasingly accumulate in respiratory tract (Unahalekka, 2002). The study of Beck-Saque, Sinkowitz, Vargo, Kaler and Jarvis (1996) found that thoracic and abdominal surgery as a risk factor increased VAP rate as 2.7 times.

3.3.3 Environmental risk factors

- Medical equipment

Pathogenic contamination of medical peripherals related to endotracheal tube and mechanical ventilator such as ventilator circuit, nebulizer, humidifiers, ambu bag is a risk factor associated with VAP. Organisms can directly enter into lungs as follows: (Hixson, Sole & King, 1998)

- Ventilator circuit may be contaminated by organisms in sputum or throat of patients or exogenous organisms from ventilator circuit changes. As a result, organisms can directly enter into lungs.

- Nebulizer serves as a reservoir of bacteria particularly gram negative bacilli. The study of Young and Ridley (1999) reported that 68% of in-circuit

nebulizers, if used repeatedly in the same patient, became contaminated with high levels of organisms (> 10^3 cfu/ml). Consequently, the bacteria can colonize in oropharynx and directly enter into lungs by aerosols.

- Humidifiers is a device condensing steam into droplets accumulating in ventilator circuit. The droplets serve as a reservoir of bacteria particularly gram negative bacilli. The study of Young and Ridley (1999) reported that ventilator circuit condensate frequently had high bacterial counts with a median level of colonization at 24 hours of 7 x 10^4 /ml. The droplets may directly enter into lungs if raising ventilator circuit higher than height of endotracheal tube.
- Ambu bag may be internally and externally contaminated by sputum and serves as a reservoir of organisms. Organisms can enter into lungs by aerosols of sputum pressed on. The study of Gauthier and Long (1994) found that ambu bag was a device associated with cross-contamination of *Acinetobacter calcoaceticus*.
- Healthcare providers

Healthcare providers are an important part affecting VAP development in patients. Pathogenic organisms can enter into patients' respiratory tract via healthcare provider's hands. The major cause is a lack of carefulness in aseptic technique such as no or inadequate hand washing, no gloves wearing, failure to change gloves that contact to patients' secretions or contaminated devices (Pruitt & Jacobs, 2006). The study of Safdar, Crnich and Maki (2005) found that a major cause of diffusion of *Pseudomonas aeruginosa*, which was an organism causing VAP, was due to improper contact of healthcare providers.

4. Impacts of Ventilator-Associated Pneumonia (VAP) on critically ill adult patients with endotracheal tube

VAP affects patients, healthcare institutes and nations as follows:

4.1 Impact on patients

Patients with VAP could get both physical and socio-economic impacts as follows:

4.1.1 Impact on physical health

- Higher mortality rate

VAP, the common nosocomial infection, causes the most mortality rate in

critically ill adult patients with endotracheal tube. Mortality rates of the patients with VAP can be as high as 20% to 70% (Cason, Tyner, Saunders & Broome, 2007). According to the study of Porzecanski and Bowton (2006), mortality rate of critically ill patients with VAP was double that of the patients without VAP.

- Prolonged length of stay in hospital

Patients with VAP prolong their length of stay in the ICU and hospital. The study of Rollo and others (2002) found that VAP increased a patient's length of stay in the ICU by approximately 6.1 days and hospital by approximately 10.5 days. According to the study of Strausbaugh (2000), length of stay in the hospital of patients with VAP was longer than that of patients without VAP for 1-2 weeks.

4.1.2 Impact on socio-economics of patients

In Thailand, patients with VAP often require antibiotic treatment. VAP increases medical expenses of patients by approximately 9,938.25 baht per case (Danchaivijitr, Dhiraputra, Santiprasitkul & Judaeng, 2005). Particularly, if VAP is developed by antibiotic-resistant pathogens, high quality and expensive antibiotics are required with prolonged their length of stay in the ICU and hospital (Bonnie & Schleder, 2003).

4.2 Impact on healthcare institutes and nations

VAP does have an impact on not only the patients, but also healthcare institutes and nations. The details are described as follows:

4.2.1 Economic impact

VAP increases healthcare cost of hospitals and nations. The United States of America spent US$40,000 per case in average, estimated US$1.5 billion in total (Craven, 2006). In Thailand, according to the summary of healthcare expenditure for patients with VAP of Maharaj Nakorn Chiangmai Hospital in 2003, total healthcare cost rose to 637,000 baht (Infection Control Department of Maharaj Nakorn Chiangmai Hospital, 2003). Moreover, the government has to spend additional healthcare budget because of subsequent complications (Danchivijitr, 2005).

4.2.2 Impact on the quality of healthcare services

Quality assurance in healthcare services is classified in various aspects. VAP is a key performance indicator for nursing quality assurance assessment in terms of prevention and control of nosocomial infections and nursing care for critically ill

patients. Therefore, if VAP rate in any hospitals is higher than predefined standard, hospital accreditation is not certified resulting in reputation and creditability of the hospitals (Trepetchsriurai, Nittayanggoon & Sathiraungkul, 2001).

5. Standard oral care for reducing abnormality of oral status and preventing Ventilator-Associated Pneumonia (VAP) in critically ill adult patients with endotracheal tube

5.1 Common methods and steps for care of oral cavity in critically ill adult patients with endotracheal tube

Oral care is important for reducing abnormality of oral cavity and preventing VAP. Key components of oral care are its methods and steps. The details are described as follows:

5.1.1 Oral care methods in critically ill adult patients with endotracheal tube

Principle methods for care of oral cavity in critically ill adult patients with endotracheal tube are:

- Toothbrushing

Toothbrushing is a widely acceptable method for cleaning oral cavity because of its simple practice and economy. It is an effective method for removing dental plaque and debris and reducing gingivitis occurrences (Bowsher, Boyle & Griffiths, 1999; O'Reilly, 2003).

For cleaning oral cavity, it is advisable to use a soft-bristled 'baby' toothbrush with round ends in order to brush teeth, gingiva and tongue including softly massage oral mucosa and gingiva resulting in salivary flow stimulation at least twice a day (O'Reilly, 2003).

- Using of cotton swabs

Using of cotton swabs is not effective in removing dental plaque and debris. However, if necessary, it can be used with patients that toothbrushing is prohibited such as coagulopathic patients (platelet counts < 40,000-50,000/cu.mm) or patients with gingival bleeding (Buglass, 1995; Miller & Kearney, 2001).

Oral care with cotton swabs should be performed every 2-4 hours or when oral cavity is dirty by swabbing teeth, gingiva and tongue with cotton swabs soaking

in mouth rinse and softly massaging oral mucosa in order to stimulate salivary flow (O'Reilly, 2003; Cutler & Davis, 2005).

Moreover, additional tools recommended for care of oral cavity are:

- Toothpaste: Fluoride toothpastes are often used with toothbrushing for care of oral cavity because it is recognized to be a safe cleansing agent with effective caries prevention and debris removal (Adair et al., 2001). In addition, a study reported that the use of a non-foaming (sodium lauryl sulphate free) toothpaste was preferable to the standard toothpaste when the aim is to improve debris removal and reduce halitosis. Nevertheless, it might have a drying effect on the oral mucosa (Berry & Davidson, 2006).

- Chlorhexidine gluconate mouth wash: This is currently recommended as the most effective antiplaque agent (Elworthy, 1996; Bagg, MacFarlane, Poxton, Miller & Smith, 1999). Chlohexidine suppresses overgrowth of both gram-positive and gram-negative bacteria. It is rapidly absorbed onto the bacterial cell surface and alters the cell osmotic equilibrium allowing leakage of potassium and phosphorous. As a result, damaging the cell contents eventually. It also reduces microbial adherence to the tooth and mucosal surfaces. Therefore, it can effectively reduce existing dental plaque and prevent new plaque formation, gingivitis as well as dental caries (Weitz, Brownstein & Deasy, 1992; Bagg, MacFarlane, Poxton, Miller & Smith, 1999; Abidia, 2007).

In general, the concentration of chlohexidine of 0.1%-0.2% is recommended for care of oral cavity twice a day (Berry & Davidson, 2006). According to the study of DeRiso, Ladowski, Dillon, Justice and Peterson (1996) including that of Houston and others (2002), using 0.12% chlohexidine might reduce VAP rate in the post-operative cardiac surgical intensive care patients by up to 52%-69%.

However, adverse effects due to chlorhexidine, though rare, are noteworthy such as drying or burning of the oral mucosa, often because of its high alcohol content (1:1 dilution). To resolve the adverse effects, chlorhexidine is inactivated by sodium lauryl sulphate in most toothpastes (O'Reilly, 2003). Furthermore, prolonged use of chlorhexidine may result in the formation of superficial yellow, brownish stain on teeth. This stain can be removed by toothbrushing (Witz, Brownstein & Deasy, 1992).

- Special mouth wash: It is another widely acceptable anti-microbial cleansing agent. It consists of 0.004% chloroxylenol, which inhibits vital enzymes of organisms and allows more leakage of essential substances in cell membrane of organisms. As a result, the organisms are dead ultimately (Pangsomboon, Kerdpon, Teanpaisan & Geater, 2003; Enviro Systems Incorporated, 2006).

Special mouth wash can be absorbed onto patient's body through oral mucosa and uvula. However, no studies report that using of special mouth wash has any side effect or toxicity in the body (Enviro Systems Incorporated, 2006).

- Normal saline: It is a solution with a limitation for care of oral cavity in critically ill patients because of its effect in drying of oral mucosa. Therefore, it is only used in patients with ulceration due to its healing promotion and granulation of tissue (Bowsher, Boyle & Griffiths, 1999).

- Water: It is used in oral care for removing debris and moistening oral mucosa because it is inexpensive. However, a study found that using of tap water in oral care could cause nosocomial infections such as *Pseudomonas*. Therefore, it is recommended that small bottles of sterile water are used due to their less probability of contamination (Berry & Davidson, 2006).

- Lip moisturizer: For example, petroleum jelly (vasaline) is used to apply lips in order to moisturize lips including prevent dry and cracked lips, which lead to more pathogenic accumulation (O'Reilly, 2003).

- Suction devices: Usually, suction devices are used for cleansing oral cavity and reducing accumulated oral secretions. For effective care of oral cavity, flexible suction catheter should be used for sucking oral secretions before care of oral cavity and sucking mouth rinse in order to prevent aspiration (Berry & Davidson, 2006).

In summary, the literature revealed in many studies reported that toothbrushing was considered an effective mechanical method to remove dental plaque and debris on sheltered areas of the teeth and stimulate salivary flow over using of cotton swabs (Pearson & Hotton, 2002). In addition, chlorhexidine gluconate mouth wash is more effective than other mouth washes in anti-microbial activity. The study of Elworthy (1996) found that chlorhexidine gluconate mouth wash was the most effective substance in terms of inhibitory effect and length of action comparing with

cetylpyridinium chloride (CPC), fluoride toothpastes and non-fluoride toothpaste. According to the study of Pangsomboon, Kerdpon, Teanpaisan and Geater (2003), using of chlorhexidine gluconate was more efficient in anti-microbial effect than special mouth wash.

5.1.2 Steps for care of oral cavity in critically ill patients with endotracheal tube

After relevant literature review for care of oral cavity in critically ill patients with endotracheal tube (Stiefel, Damron, Sowers & Velez, 2000; Cutler & Davis, 2005), the steps for such care are summarized as follows:

1. Assess oral status on teeth, gingiva, lips, oral mucosa and tongue on a daily basis in the morning in order to assess alteration and abnormality in oral cavity.

2. Position patient's head to the side or place in semi-Fowler position (30-45^{o}).

3. Check that the cuff pressure of endotracheal tube remains between 20-30 centimeters of water.

4. Brush teeth, gingiva, palate and tongue using soft-bristled, pediatric-size toothbrush with fluoride toothpaste or chlorhexidine gluconate mouth wash in up and down motion for approximately 1-2 minutes. Then, massage gingiva to stimulate salivary flow. In case of coagulopathic patients or patients with gingival bleeding, cotton swabs should be used with chlorhexidine gluconate mouth wash or normal saline. Turn them on gingiva, teeth, tongue and palate in clockwise rotation and massage gingiva to stimulate blood circulation and salivary flow.

5. Use suction catheter for sucking mouth wash or water including secretions and saliva in oral cavity and oropharynx.

6. Apply vasaline or lip balm on lips to moisturize them including prevent dry lips at least every 2 hours.

5.2 Clinical nursing practice guideline in oral care for reducing abnormality of oral status and preventing Ventilator-Associated Pneumonia (VAP) in critically ill adult patients with endotracheal tube

In this research, the researcher applies the clinical nursing practice guideline for care of oral cavities developed by Supattra Nuchakul (Nuchakul, 2007). This clinical nursing practice guideline is based on the analysis of 15 research studies and synthesis

processes of evidence based practice. According to mentioned literature review, methods, equipment and steps in oral care are described as follows:

Step 1: Oral assessment

Oral assessment includes assessing oral status, classifying levels of oral status, and considering frequency of oral care.

1.1 Assessing oral status

Assess oral status by using the Oral Assessment Guide (OAG) on a daily basis in the morning.

1.2 Classifying levels of oral status

Classify oral status into 3 levels based on the total points of oral assessment.

5 points	=	normal findings
6-10 points	=	mild abnormality
11-15 points	=	severe abnormality

1.3 Considering frequency of oral care

Consider the frequency to clean oral cavity according to classification of oral status as follows:

- Normal findings — Clean oral cavity every 6 hours
- Mild abnormality — Clean oral cavity every 4 hours together with closely monitoring changes in oral cavity of observed patient such as inflammation of oral mucosa, gingivitis, dental plaque, dental caries, xerostomia and notify the doctor
- Definite abnormality — Carefully clean oral cavity every 2 hours together with finding causes of abnormality of oral status and notify the doctor

Step 2: Informing a patient (in case of awake patient)

Explain to the patient about methods of oral care and their benefits.

Step 3: Cleaning oral cavity

3.1 Positioning patient's head

Position patient's head in semi-Fowler position (45^{o}) and turn it to one side when starts oral cleaning.

3.2 Increasing cuff pressure of endotracheal tube

Check cuff pressure of endotracheal tube to maintain between 20-30 centimeters of water. Then, suck secretions/saliva in oral cavity and oropharynx.

3.3 Method for care of oral cavity

3.3.1 Patients with teeth

Brush using soft-bristled, pediatric-size toothbrush with 0.12% chlorhexidine gluconate mouth wash as follows:

- Brush lower molars on lingual and buccal surfaces and incisors on lingual and labial surfaces using modified Bass technique
- Brush upper molars on buccal and palatal surfaces and incisors on labial and palatal surfaces using modified Bass technique
- Brush upper and lower molars and premolars on occlusal surface using modified Bass technique
- Gently brush the surface of the tongue and palate

3.3.2 Patients without teeth

Massage gingiva in clockwise rotation using cotton swabs and brush palate and tongue using toothbrush with 0.12% chlorhexidine gluconate mouth wash.

3.3.3 Patients with bleeding tendency or gingival bleeding

Massage gingiva in clockwise rotation and clean teeth, palate and tongue using cotton swabs with 0.12% chlorhexidine gluconate mouth wash.

3.4 Moisturizing

Apply vasaline on lips to moisturize them every 2 hours.

3.5 Evaluating outcomes

Evaluate patients' comfort and satisfaction after care of oral cavity by inquiry if possible.

It is noteworthy that the clinical nursing practice guideline for care of oral cavities developed by Supattra Nuchakul, based on previous literature has not been implemented in endotracheal intubated patients in the Thai setting. Therefore, this study aimed to examine the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube. It expected that the utilization of the guideline developed by Supattra Nuchakul would effectively reduce the abnormality

of oral status and VAP occurrence in these patients.

6. Research studies related to oral care and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube

Recent research studies related to oral care and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube were reviewed, especially related clinical nursing practice guidelines on oral care aiming to improve patients' oral status and reduce VAP rate. A few studies in the United States of America reveal the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status.

The study of Stiefel, Damron, Sowers and Velez (2000) implementing a clinical nursing practice guideline for oral care in 8 intubated patients in the ICU reported that oral status of experimental group was significantly improved after the implementation of the clinical nursing practice guideline for oral care in parts of lips, oral mucosa, gingiva and teeth. The study of Fitch, Munro, Glass and Pellegrini (1999) that implemented a clinical nursing practice guideline for oral care in intubated patients in the ICU found that experimental group's oral status was better than the control group's after the implementation of the clinical nursing practice guideline for oral care. Plaque, candidiasis and bleeding scores of experimental group were also lower than that of control group.

There are a few studies in the United States of America and Japan that are related to the effect of clinical nursing practice guideline utilization for care of oral cavities on VAP rate. In the United States of America, the study of Schleder, Stott and Lloyd (2002) that implemented a clinical nursing practice guideline for oral care in 10 intubated patients in medical and surgical ICUs reported that the VAP rate of experimental group dropped from the baseline, 5.6 times/1,000 ventilator days to 2.2 times/1,000 ventilator days after the implementation of the clinical nursing practice guideline for oral care. It is in accordance with a Japanese study by Mori and others (2005) found that VAP rate of intubated patients admitted to the ICU in oral care group was significantly lower than in the non-oral care group (3.9 VS 10.4 times/ 1,000 ventilator days).

However, no direct studies related to the effect of clinical nursing practice guideline utilization on oral status and Ventilator-Associated Pneumonia (VAP) rate have been found in Thailand. Therefore, the researcher in this study is interested in examining the effect of clinical nursing practice guideline utilization on oral status and Ventilator-Associated Pneumonia (VAP) rate.

CHAPTER III
METHODOLOGY

Research Design

This study was an experimental study aiming to examine the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube.

Population

The population of this study was critically ill patients with oral endotracheal intubation, aged 15 years and above, who had not been previously diagnosed with pneumonia, admitted in medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhonnayok. The data collection period was from August 14, 2008 to December 15, 2008.

Sampling

The participants were enrolled by using inclusive criteria as follows:

Inclusion Criteria

1. No ulceration in oral cavity particularly gingiva, palate, oral mucosa
2. No broken teeth
3. No edema and ulceration on tongue
4. Agreed and/or were permitted by patients/their relatives and primary physician to participate in the study (informed consents were given by patients or their relatives)

Exclusion Criteria

1. Can not be placed in semi-Fowler position i.e. spinal cord injury, spinal cord surgery, shocked
2. Got burned > 20% of total body surface (electric or chemical burns)
3. Be intubated ≤ 48 hours
4. Be re-intubated
5. No teeth
6. Be coagulopathic (platelet counts < 40,000-50,000/cu.mm) or had scurvy
7. Had history of having allergy to chlorhexidine gluconate mouth wash

Sample size was determined from score of oral status that was evaluated based on 20 patients in the pilot study. They had the same characteristics as the expected patients in the research. The sample size formula for comparing two means of dependent groups was illustrated as follows: (Rakpao, 1996)

formula $n = \frac{(Z_{\alpha} + Z_{\beta})^2 \, sd^2}{(d)^2}$ by

n = required minimum sample size (pairs)

Z_{α} = Two-tailed value of z related to α

Z_{β} = One-tailed value of z related to β

sd^2 = Pooled variance = $s_1^2 + s_2^2 - 2rs_1s_2$

r = Correlation coefficient between control group and experimental group

d = Mean of differences in score of abnormality of oral status = $(d_1 + d_2 + d_3 + \ldots + d_n) /n$

Based on the above assumption and formula, the required minimum sample size was 10 pairs or 20 cases.

During the research, there were 24 participants who met inclusion criteria. They were divided into 2 groups: experimental and control groups, 12 cases/group. They were randomized by lottery method. Matched pair technique was performed to control confounding variables. The conditions necessary to constitute a matched pair were as follows: (1) Duration of intubation before the experiment (< 7 VS ≥ 7 days);

(2) Use of antibiotics prior to intubation (Yes or No) (Kollef, 1993; Drakulovic et al., 1999); and (3) same rank of the OAG.

Setting

This study took place at medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhonnayok. The medical ICU has 7 beds and admitted approximately 20 critically ill patients/month. The surgical ICU has 4 beds and admitted approximately 25 critically ill patients/month. Medical wards were divided into male and female ones. Each has 30 beds and admitted approximately 6 critically ill patients/month. General surgical ward has 30 beds and admitted approximately 12 critically ill patients/month. According to previous hospital statistics, approximately 75% of critically ill patients in the medical ICU were intubated (15 cases/month); approximately 80% of those in the surgical ICU were intubated (20 cases/month). In addition, 100% of those in medical wards and general surgical ward were intubated (12 cases/month in each ward). Therefore, total potential patients within 4 months are 236 cases covering targeted sample size.

In all units, routine care for VAP prevention were implemented in accordance with infection control standards of the hospital. The routine care for VAP prevention included hand washing, suctioning, body positioning and turning, enteral feeding, care for endotracheal tube and medical peripherals related to mechanical ventilator (See standard procedure for prevention of lower respiratory tract infection in Appendix D), and care of oral cavity and teeth by using cotton swabs with special mouth wash twice a day.

Instruments

The instruments applied in this study consist of:

1. Instruments implementation for oral care

1.1 Clinical nursing practice guideline for care of oral cavities in critically ill patients with endotracheal tube: This particular guideline in this research was applied from the original guideline developed by Supattra Nuchakul (Nuchakul, 2007).

Its four main steps are (1) Oral assessment; (2) Informing a patient; (3) Cleaning oral cavity; (4) Evaluating outcome. Their details are described as follows:

Step 1: Oral assessment

Assess oral status using applied Oral Assessment Guide (OAG) on a daily basis in the morning.

Step 2: Informing a patient (in case of awake patient)

Explain to the patient about methods of oral care and their benefits.

Step 3: Cleaning oral cavity

3.1 Positioning patient's head

Position patient's head in semi-Fowler position (45^{o}) and turn it to one side when starts oral cleaning.

3.2 Increasing cuff pressure of endotracheal tube

Check cuff pressure of endotracheal tube to maintain between 20-30 centimeters of water. Then, suck secretions/saliva in oral cavity and oropharynx.

3.3 Method for care of oral cavity

Brush using soft-bristled, pediatric-size toothbrush with 0.12% chlorhexidine gluconate mouth wash as follows:

3.3.1 Brush lower molars on lingual and buccal surfaces and incisors on lingual and labial surfaces using modified Bass technique

3.3.2 Brush upper molars on buccal and palatal surfaces and incisors on labial and palatal surfaces using modified Bass technique

3.3.3 Brush upper and lower molars and premolars on occlusal surface using modified Bass technique

3.3.4 Gently brush the surface of the tongue and palate

3.4 Moisturizing

Apply vasaline on lips to moisturize them

Step 4: Evaluating outcome

Reassess oral status using applied Oral Assessment Guide (OAG) on a daily basis in the evening.

2. Instruments for data collection included:

2.1 Demographic data form: This form recorded information of gender, age, type of unit, admission date, clinical problem, underlying illness, surgery, scores of the

OAG, history of smoking, alcohol consumption, use of antibiotics prior to intubation, use of certain drugs (anticholinergics, antihistamines, diuretics, stress ulcer prophylactic drugs and sedative drugs), date of intubation, date of extubation, duration of intubation, date participating in the experiment, discharge date of the experiment, duration of participation, reasons for discharge.

2.2 Oral Assessment Form: This form was developed from Oral Assessment Guide to assess the oral status of endotracheal intubated patients. The Oral Assessment Form used in this study was adapted by Supattra Nuchakul (Nuchakul, 2007) based on the original ones developed by Ross and Crumpler (2007) and Eilers and others (1988). This form comprises 5 categories: lips, mucous membranes/tongue, gums, teeth and saliva; being assessed by observation and palpation. The scores of each category were classified in 3 ranks.

Score interpretation was measured by total scores of each category in Oral Assessment Form ranging from 5 to 15 (Ross & Crumpler, 2007) and was classified in 3 ranks as follows:

5 points	=	normal findings
6-10 points	=	mild abnormality
11-15 points	=	severe abnormality

2.3 VAP development assessment form: This form was established referring to relevant research studies, which were reviewed based on evidence based practice. The clinical diagnosis of VAP depends on a clinical suspicion defined as the occurrence of a new or progressive and persistent radiographic infiltrate plus at least two of the following criteria: (The American Thoracic Society and the Infectious Diseases Society of America, 2005)

1. Having new or higher fever than normal (Body temperature > 38.3 ^{o}C)
2. Having leukocytosis (> 12,000 white blood cells (WBC)/mm^3) or leukopenia (< 4,000 WBC/mm^3)
3. Having purulent tracheal secretions

Moreover, an additional microbiologic criterion is required: at least moderate growth on sputum culture, 10^4 colony-forming unit (CFU)/ml on bronchoalveolar lavage (BAL) or 10^3 CFU/ml on protected mini-BAL (The American Thoracic Society and the Infectious Diseases Society of America, 2005).

Validity and Reliability of the Instruments

1. Content validity

Following instruments that were the clinical nursing practice guideline for care of oral cavities in critically ill patients with endotracheal tube, demographic data form, Oral Assessment Form, and VAP development assessment form were reviewed for content validity and appropriateness of language by 5 experts composed of one physician specializing in respiratory tract, one dentist, one nursing lecturer specializing in infection control and two nurses specializing in care of critically ill patients in respiratory tract. The researcher modified and corrected them according to their recommendations.

2. Reliability and the possibility of application

After the authorization of the Ethics committees for researches related to Human subjects of Mahidol University and HRH Princess Maha Chakri Sirindhorn Medical Center, test for reliability of the instruments and the possibility of application was performed. To assess interrater reliability of the Oral Assessment Form, two nurses were required for the observation in oral status of 30 patients, who had similar conditions as the sample, in the same patient and at the same time. The interrater reliability of this form was 0.86.

Regarding test for the possibility of application, the clinical nursing practice guideline and Oral Assessment Form were tried out with such 30 patients. Its result was that both were applicable to use in this research.

Data Collection

1. The researcher requested an introduction letter and permission for data collection from the Faculty of Graduate studies, Mahidol University and sent it to the Director of HRH Princess Maha Chakri Sirindhorn Medical Center.

2. The research project was proposed and authorized by the Ethics committees for researches related to Human subjects of Mahidol University and HRH Princess Maha Chakri Sirindhorn Medical Center.

3. After permission had been granted, the researcher met the nurse director of nursing division, head nurses and registered nurses of medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward

to explain the objectives and procedures of the research and ask for their collaboration in data collection.

4. The researcher collected the data for 7 consecutive days or until patients were extubated as following steps:

4.1 Surveyed list of patients who were treated with mechanical ventilator and intubation and selected qualified samples from the patients' chart according to the inclusion criteria.

4.2 The researcher introduced herself to patients or relatives (in case of unconscious patients) in order to inform the subjects on research objectives, expected outcomes and benefits, research procedures and then asked for research participation with the assurance of protection of human subjects and data confidentiality. If patients agree to participate in the research, they or their relatives have to sign a consent form. The researcher informed them that they could withdraw from the participation any time without any effects on their treatment.

4.3 The researcher collected data of 12 participants in control group as follows:

- The researcher recorded demographic data of participants e.g. gender, age, type of unit and clinical problem in day one.
- The researcher assessed scores of oral status of participants by using Oral Assessment Form in day one (Note: Oral Assessment Form is actually part of assessment process in clinical nursing practice guideline utilization for care of oral cavities. However, the researcher needed to use this form in the control group, as well as the experimental group, so as to compare the difference of the scores of oral status in both group).
- The researcher assessed participants' oral status using Oral Assessment Form and took photographs at 5.20 a.m. for participants in the medical ICU, surgical ICU, medical wards and general surgical ward every morning.
- Registered nurses cleaned participants' oral cavity according to routine procedures at 5.30 a.m. and 2.00 p.m. by using cotton swabs with special mouth wash.
- The researcher assessed participants' oral status again using Oral Assessment Form and took photographs at 5.00 p.m. for participants in all units after cleaning the oral cavity.

- The researcher followed up the result of VAP development assessed by responsible physicians on a daily basis.

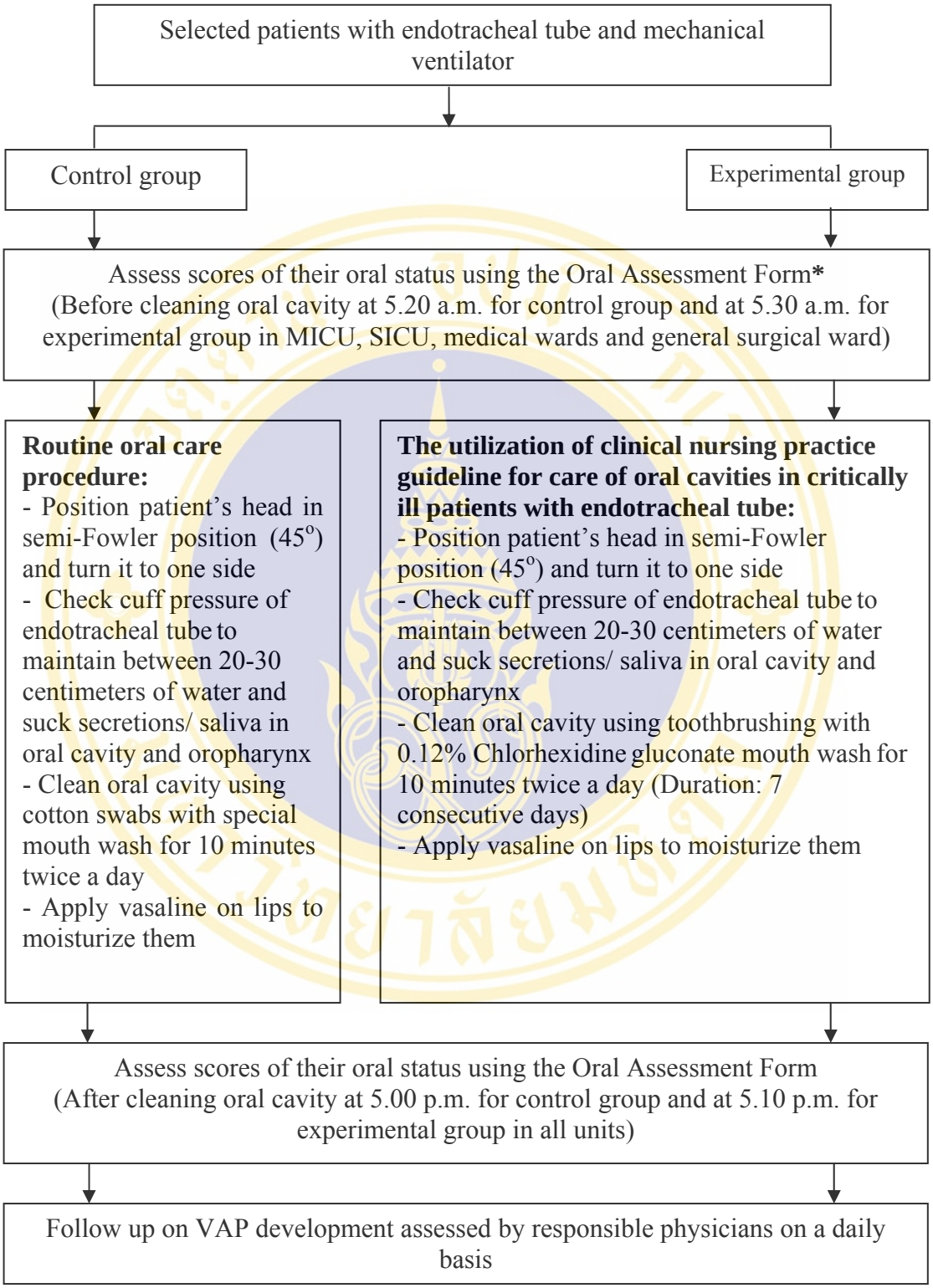
4.4 The researcher collected data of 12 participants in experimental group as follows:

- The researcher recorded demographic data of participants e.g. gender, age, type of unit and clinical problem in day one.
- The researcher assessed scores of oral status of participants by using Oral Assessment Form in day one.
- The researcher cleaned participants' oral cavity according to the clinical nursing practice guideline for care of oral cavities in critically ill patients with endotracheal tube on a daily basis at 5.40 a.m. and 2.00 p.m. for participants in the medical ICU, surgical ICU, medical wards and general surgical ward. Firstly, the assessment of oral status was performed before cleaning the oral cavity in every morning at 5.30 a.m.
- The researcher assessed participants' oral status again using Oral Assessment Form and took photographs after cleaning the oral cavity at 5.10 p.m. for participants in all units.
- The researcher followed up the result of VAP development assessed by responsible physicians on a daily basis.

Conditions for Termination

1. Participants had aspiration or vomiting.
2. Participants were allergic to chlorhexidine gluconate mouth wash as certain symptoms such as edematous tongue, superficial burn on mucosa in oral cavity.
3. Participants or their relatives rejected to participate in this research.

The process of data collection is shown in figure 3:



NB: Use of Oral Assessment Form is part of clinical nursing practice guideline for care of oral cavities. This form was used to assess scores of patients' oral status for both control group and experimental group in this study.

Figure 3: The process of data collection

Protection of Human Subjects

Patients and relatives were informed about the subjects on research objectives, expected benefits and potential effects, rights to voluntary accept or reject research participation, rights to withdraw from the participation without any effects on their treatments and the hospital's services. Furthermore, in consent form, statements to assure themselves of their data confidentiality were included. They were also informed about standard nursing resolutions in case of potentially adverse effects. For example, in case of aspiration and vomiting, trendelenburg position and turning their head to one side were performed including sucking the residual in their oral cavity by suction catheter and rinsing them out by water. In case of the allergy to chlorhexidine gluconate mouth wash, their oral cavity was swabbed by cotton or gauze soaking with water meanwhile expert physicians were co-ordinated to assess and consider appropriate treatments for potential adverse effects and symptoms. In addition, the researcher followed up other changing symptoms of participants on a daily basis and co-ordinated with expert physicians to provide appropriate treatments until they recovered. However, no participants in this study had any adverse effects i.e. aspiration, vomiting and allergy to chlorhexidine gluconate mouth wash.

Data Analysis

After the data had been collected, they were statistically analyzed by using a statistical software as follows:

1. Compute the frequency and percentage of both groups classified by gender, age, type of admission, clinical problem, underlying illness, surgery, baseline scores of the OAG, rank of the OAG, smoking, alcohol consumption, use of antibiotics prior to intubation, use of anticholinergics, use of antihistamines, use of diuretics, use of stress ulcer prophylactic drugs, use of sedative drugs, duration of intubation before the experiment and total duration of intubation, and compute their means and standard deviations classified by age, duration of intubation before the experiment and total duration of intubation.

2. Evaluate the difference of the demographic data and relevant characteristics between the experimental group and control group using Chi-square test.

3. Compute the frequency of OAG rank before and after care of oral cavity in the experimental group and control group each day.

4. Compute the frequency of OAG rank in both experimental group and control group before care of oral cavity in first day and after care of oral cavity in last day.

5. Calculate means and standard deviations of scores of oral status (before and after care of oral cavity) in both experimental and control groups.

6. Perform test for significant difference of mean scores of oral status (before and after care of oral cavity) in both experimental and control groups using Mann-Whitney U-test.

7. Compare VAP rate of experimental and control groups using Chi-square test.

CHAPTER IV
RESULTS

This experimental study was conducted to study the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube. The participants were 24 critically ill patients with endotracheal tube in medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhonnayok. The data were collected during August 14, 2008 to December 15, 2008. The results of this study were presented in three parts as follows:

Part 1: Demographic data and relevant characteristics of the participants

Part 2: The results related to oral status before and after care of oral cavity in the experimental group and control group

Part 3: The result related to Ventilator-Associated Pneumonia (VAP) rate in the experimental group and control group

Part 1: Demographic data and relevant characteristics of the participants

Table 3: Frequency, percentage and Chi-square test of participants in the experimental group and control group classified by gender, age, type of admission and clinical problem (n = 24)

Demographic data	Experimental group (n = 12)		Control group (n= 12)		P-value (χ^2)
	Frequency	%	Frequency	%	
Gender					0.414^{ns}
Male	5	41.7	7	58.3	
Female	7	58.3	5	41.7	
Age (years)					0.025
15-29	-	-	-	-	
30-44	3	25.0	-	-	
45-59	6	50.0	3	25.0	
≥ 60	3	25.0	9	75.0	
	Min= 31, Max= 76		Min= 51, Max= 80		
	Mean= 51.9, SD= 15.1		Mean= 67.0, SD= 11.2		
Type of admission					1.000^{ns}
Medicine	5	41.7	4	33.3	
Surgery	7	58.3	8	66.7	
Clinical problem					0.158^{ns}
Neurological problem	4	33.3	4	33.3	
Pulmonary problem	1	8.3	2	16.7	
Cardiovascular problem	2	16.7	-	-	
Gastrointestinal problem	1	8.3	4	33.3	

Table 3: Frequency, percentage and Chi-square test of participants in the experimental group and control group classified by gender, age, type of admission and clinical problem (n = 24) (cont.)

Demographic data	Experimental group (n= 12)		Control group (n= 12)		P-value (χ^2)
	Frequency	%	Frequency	%	
Clinical problem					
Haematological problem	3	25.0	-	-	
Gynecological problem	1	8.3	-	-	
Genitourinary problem	-	-	1	8.3	
Immunological problem	-		1	8.3	

Table 3 showed that more than half of the participants in the experimental group (58.3%) were female whereas more than half of the participants in the control group (58.3%) were male. The major age range of the participants in the experimental group (50%) was 45-59 years whereas the major age range of the participants in the control group (75%) was 60 years and above. The mean age in the experimental group was 51.9 years with S.D. = 15.1 while the mean age in the control group was 67 years with S.D. = 11.2. More than half of the participants in both groups admitted in surgery department (58.3% and 66.7% of the experimental group and control group, respectively). The major clinical problem of the participants in the experimental group (33.3%) was neurological problem whereas the major clinical problems of the participants in the control group (33.3% of each clinical problem) were neurological problem and gastrointestinal problem.

The Chi-square test indicated that there was no statistically significant difference in gender, type of admission and clinical problem ($p > 0.05$) but there was statistically significant difference in age ($p < 0.05$).

Table 4: Frequency, percentage and Chi-square test of participants in the experimental group and control group classified by underlying illness (n = 24)

Characteristics	Experimental group (n= 12)		Control group (n= 12)		P-value (χ^2)
	Frequency	%	Frequency	%	
					0.317^{ns}
Underlying illness	8	66.7	11	91.7	
No underlying illness	4	33.3	1	8.3	

Table 4 showed that the majority of the participants in both group had underlying illnesses (66.7% and 91.7% of the experimental group and control group, respectively) with no statistically significant difference ($p < 0.05$).

Table 5: Frequency and percentage of participants in the experimental group and control group classified by disease of underlying illness (n = 24)

Characteristics	Experimental group (n= 12)		Control group (n= 12)	
	Frequency	%	Frequency	%
Underlying illness*				
Hypertension	6	50.0	6	50.0
Diabetes	2	16.7	4	33.3
Gout	3	25.0	1	8.3
Cirrhosis	1	8.3	2	16.7
Asthma	-	-	2	16.7
Chronic obstructive pulmonary disease (COPD)	-	-	2	16.7
Tuberculosis (TB)	-	-	2	16.7
Chronic kidney disease (CKD)	2	16.7	1	8.3
Ischemic heart disease	2	16.7	-	-
Cancer	1	8.3	-	-
Peptic ulcer	-	-	1	8.3
No Underlying illness	4	33.3	1	8.3

***** One participant had more than one disease of underlying illness

Table 5 showed that the most underlying illnesses found in the participants of the experimental group were hypertension (50%) and gout (25%), whereas the most common underlying illnesses found in the participants of the control group were hypertension (50%) and diabetes (33.3%).

Table 6: Frequency, percentage and Chi-square test of participants in the experimental group and control group classified by surgery, baseline scores of the OAG, rank of the OAG, smoking and alcohol consumption (n = 24)

Characteristics	Experimental group (n= 12)		Control group (n= 12)		P-value
	Frequency	%	Frequency	%	(χ^2)
Surgery					0.484[ns]
Neuro surgery	3	25.0	3	33.4	
Thoracic surgery	-	-	-	-	
Abdominal surgery	4	33.3	1	8.3	
Other surgery	-	-	1	8.3	
No surgery	5	41.7	6	50.0	
Baseline scores of the OAG					1.000 [ns]
5 points	-	-	-	-	
6-10 points	12	100.0	12	100.0	
11-15 points	-	-	-	-	
Rank of the OAG					1.000 [ns]
normal findings	-	-	-	-	
mild abnormality	12	100.0	12	100.0	
severe abnormality	-	-	-	-	
Smoking					1.000 [ns]
No	9	75.0	9	75.0	
Yes	3	25.0	3	25.0	
Alcohol consumption					0.590[ns]
No	9	75.0	11	91.7	
Yes	3	25.0	1	8.3	

Table 6 showed that more than half of the participants in the experimental group (58.3%) were postoperative surgical patients. Of those, 25% underwent neurological surgery and 33.3% underwent abdominal surgery, whereas 33.4% of those in the control group underwent neurological surgery. All participants in both groups had baseline scores of the OAG ranging from 6 to10 points, which indicated as mild abnormality of oral status. The majority of the participants in both groups (75% in each group) were non-smokers and they did not drink alcohol (75% and 91.7% of the experimental group and control group, respectively).

The Chi-square test indicated that there was no statistically significant difference in all characteristics of the participants between the experimental group and control group ($p > 0.05$).

Table 7: Frequency, percentage and Chi-square test of participants in the experimental group and control group classified by use of antibiotics prior to intubation, use of anticholinergics, use of antihistamines, use of diuretics and use of stress ulcer prophylactic drugs (n = 24)

Characteristics	Experimental group (n= 12)		Control group (n= 12)		P-value (χ^2)
	Frequency	%	Frequency	%	
Use of antibiotics prior to intubation (within 90days)					1.000 ns
No	11	91.7	11	91.7	
Yes	1	8.3	1	8.3	
Use of anticholinergics					1.000 ns
No	12	100.0	12	100.0	
Yes	-	-	-	-	
Use of antihistamines					1.000 ns
No	12	100.0	12	100.0	
Yes	-	-	-	-	
Use of diuretics					0.408 ns
No	8	66.7	6	50.0	
Yes	4	33.3	6	50.0	
Use of stress ulcer prophylactic drugs					0.093 ns
No	4	33.3	-	-	
Yes	8	66.7	12	100.0	

Table 7 showed that almost all of the participants (91.7%) in both groups did not receive antibiotics prior to intubation. However, all participants in both groups received neither anticholinergics nor antihistamines. In the experimental group, 66.7% of the participants did not received diuretics while 50% of the participants in the control group did not either. More than half of the participants in the experimental group (66.7%) and all participants in the control group (100%) received stress ulcer prophylactic drugs.

Finally, the Chi-square test indicated that there was no statistically significant difference in all characteristics between the experimental group and control group ($p > 0.05$).

Table 8: Frequency, percentage and Chi-square test of participants in the experimental group and control group classified by use of sedative drugs, duration of intubation before the experiment and total duration of intubation (n = 24)

Characteristics	Experimental group (n= 12)		Control group (n= 12)		P-value (χ^2)
	Frequency	%	Frequency	%	
Use of sedative drugs					0.408^{ns}
No	4	33.3	6	50.0	
Yes	8	66.7	6	50.0	
Duration of intubation before the experiment					1.000 ^{ns}
< 7 days	12	100.0	12	100.0	
≥ 7 days	-	-	-	-	
	Min= 1, Max= 3		Min= 1, Max= 4		
	Mean= 1.7, SD= 0.6		Mean= 1.7, SD= 0.9		
Total duration of intubation					0.714 ^{ns}
1-4 days	8	66.6	7	58.4	
5-7 days	2	16.7	4	33.3	
> 7 days	2	16.7	1	8.3	
	Min= 3, Max= 10		Min= 3, Max= 9		
	Mean= 4.7, SD= 2.2		Mean= 4.6, SD= 1.8		

Table 8 showed that in the experimental group, 66.7% of the participants received sedative drugs whereas 50% of the participants in the control group did. The duration of intubation before the experiment of all participants in both groups was less than 7 days. The mean of duration of intubation before the experiment in both groups was 1.7 days. In addition, the majority of the participants in both groups had been intubated for

1-4 days (66.6% and 58.4% of the experimental group and control group, respectively). The mean of total duration of intubation in the experimental group was 4.7 days with S.D. = 2.2 while the mean of total duration of intubation in the control group was 4.6 days with S.D. = 1.8.

The Chi-square test indicated that there was no statistically significant difference in all characteristics between the experimental group and control group ($p > 0.05$).

Part 2: The results related to oral status before and after care of oral cavity in the experimental group and control group

Table 9: The frequency of OAG rank before and after care of oral cavity in the experimental group and control group each day

	Day 1				Day 2				Day 3			
	Experimental group		Control group		Experimental group		Control group		Experimental group		Control group	
OAG Rank	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Normal findings						1				2		
Mild abnormality	12	12	12	12	10	9	9	9	5	3	3	2
Severe abnormality											1	2
Total	12	12	12	12	10	10	9	9	5	5	4	4

	Day 4				Day 5				Day 6			
	Experimental group		Control group		Experimental group		Control group		Experimental group		Control group	
OAG Rank	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Normal findings												
Mild abnormality	1	1		1	1	1	1	1	1	1		
Severe abnormality			1									
Total	1	1	1	1	1	1	1	1	1	1	0	0

Table 9: The frequency of OAG rank before and after care of oral cavity in the experimental group and control group each day (cont.)

	Day 7			
	Experimental group		Control group	
OAG Rank	**Before**	**After**	**Before**	**After**
Normal findings				
Mild abnormality	1	1		
Severe abnormality				
Total	1	1	0	0

Table 9 showed the number of participants of the experimental group and control group in each OAG rank before and after care of oral cavity chronologically. It also revealed that most participants in both groups participated and received oral care in the research no more than 3 days. OAG rank was changed after care of oral cavity in a few participants of both groups. However, there were no changes in mild abnormality of OAG rank in most participants of both groups after care of oral cavity.

Table 10: The frequency of OAG rank in both experimental group and control group before care of oral cavity in the first day and after care of oral cavity in last day (n = 24)

	First Day (Before)		Last Day (After)	
OAG Rank	**Experimental group**	**Control group**	**Experimental group**	**Control group**
Normal findings			3	
Mild abnormality	12	12	9	11
Severe abnormality				1
Total	12	12	12	12

Table 10 showed that the oral status of all participants in both experimental group and control group before care of oral cavity was mild abnormality in the first day. After care of oral cavity in last day, the oral status of a few participants in the experimental group was better from mild abnormality to normal findings whereas the oral status of a participant in the control group was worse from mild abnormality to severe abnormality.

To demonstrate oral status of participants according to OAG assessment, the example of the photographs in each OAG rank was depicted in figure 4 – 6 of Appendix G. In addition, the photographs in figure 7 of Appendix G revealed better oral status after care of oral cavity from mild abnormality to normal findings.

Table 11: The means and standard deviations of scores of abnormality of oral status (OAG scores) before and after care of oral cavity in the experimental group and control group (n = 24)

Group	n	Before care of oral cavity		After care of oral cavity	
		Mean	SD	Mean	SD
Experimental group	12	8.29	0.72	6.99	0.82
Control group	12	8.70	0.69	8.60	1.07

Table 9 showed that before and after care of oral cavity, the mean scores of abnormality of oral status in the experimental group were 8.29 and 6.99, and the standard deviations were 0.72 and 0.82, respectively while the mean scores of abnormality of oral status in the control group were 8.70 and 8.60, and the standard deviations were 0.69 and 1.07, respectively.

Table 12: Comparison of the mean scores of abnormality of oral status before care of oral cavity between the experimental group and control group using Mann-Whitney U-test (n = 24)

Group	n	Mean Rank	Sum Rank	P-value
Experimental group	12	10.67	128	0.219
Control group	12	14.33	172	

Table 10 showed that the mean scores of abnormality of oral status before care of oral cavity in the experimental group and the control group were not significantly different according to the Mann-Whitney U-test (p = 0.219).

Table 13: Comparison of the mean scores of abnormality of oral status after care of oral cavity between the experimental group and control group using Mann-Whitney U-test (n = 24)

Group	n	Mean Rank	Sum Rank	P-value
Experimental group	12	8.00	96.00	0.001
Control group	12	17.00	204.00	

Table 11 showed that the mean score of abnormality of oral status after care of oral cavity in the experimental group was significantly lower than that in the control group according to the Mann-Whitney U-test (p = 0.001).

Table 14: Chi-square test of the experimental group and control group classified by the difference between the mean scores of abnormality of oral status before and after care of oral cavity (n = 24)

The difference between the mean scores before and after care of oral cavity	Experimental group (n= 12)		Control group (n= 12)		p-value (χ^2)
	Frequency	Expected value	Frequency	Expected value	
2.00-2.49	5	2.5	0	2.5	0.001
1.50-1.99	-	-	-	-	
1.00-1.49	2	2.0	2	2.0	
0.50-0.99	5	3.0	1	3.0	
0.00-0.49	0	3.0	6	3.0	
-0.50-(-0.01)	0	1.0	2	1.0	
-1.00-(-0.51)	0	0.5	1	0.5	

Table 12 showed that the difference between the mean scores of abnormality of oral status before and after care of oral cavity in the experimental group were significantly different from the difference in the control group according to the Chi-square test (p = 0.001). Therefore, this result supported that the utilization of the clinical nursing practice guideline in the experimental group significantly decreased the mean score of abnormality of oral status.

Part 3: The result related to Ventilator-Associated Pneumonia (VAP) rate in the experimental group and control group

Table 15: Comparison of Ventilator-Associated Pneumonia (VAP) rate between the experimental group and control group using Chi-square test (n = 24)

Development of VAP	Experimental group		Control group		χ^2	p-value
	Frequency	Expected value	Frequency	Expected value		
No VAP developed	12	11.0	10	11.0	2.182	0.478
VAP developed	0	1.0	2	1.0		

Table 13 showed that the Ventilator-Associated Pneumonia (VAP) rate in experimental group tended to be less than that in control group, but VAP rates in both groups were not significantly different when the Chi-square test was performed (p = 0.478).

CHAPTER V
DISCUSSION

The purpose of this study was to evaluate the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube. The results of this study were discussed in relation to the following hypotheses.

Hypothesis 1: The mean score of abnormality of oral status after the intervention of critically ill adult patients with endotracheal tube receiving oral care based on clinical nursing practice guideline for care of oral cavities is lower than that of the patients receiving routine oral care.

According to the results of this study, the mean score of abnormality of oral status after care of oral cavity in the experimental group was significantly lower than that in the control group ($p = 0.001$) (Table 13). Therefore, the first hypothesis of this study is supported. It implied that the utilization of the clinical nursing practice guideline for care of oral cavities contributed to the improvement of oral health by reducing abnormality of oral status. The possible reasons underlying such a result are as follows:

In relation to toothbrushing and moisturizing techniques, the participants in the experimental group received oral care by toothbrushing with small size toothbrush, which is an effective method for removing debris and dental plaque in oral cavity (Bowsher, Boyle & Griffiths, 1999; Pearson & Hotton, 2002). In this study, the researcher brushed the participants' teeth in the experimental group by using modified Bass technique, an effective toothbrushing technique for removing debris and dental plaque on cervical and sheltered areas for adults (Taechaprasertvitaya, 2001; Poyato-Ferrera, Segura-Egea & Bullón-Fernández, 2003). As a result, their teeth were cleaner than that of the participants in the control group by decreasing debris and

dental plaque accumulation on teeth. Moreover, this toothbrushing technique could lead to healthier gingiva and lesser gingivitis due to the reduction of dental plaque on teeth and massaging the gingiva resulting in the stimulation of blood circulation of gingival tissues. It also stimulated salivary flow in the experimental group, leading to moisture in oral cavity and reduction of ulceration (Taechaprasertvitaya, 2001).

A step in the modified Bass technique is brushing the surface of the tongue with small size and small end toothbrush. This technique results in reaching oral cavity throughout the tongue especially its posterior aspects. Therefore, this makes the tongue clean with lesser debris (Griffiths et al., 2000). Moreover, the researcher moisturized the lips of the participants with petroleum jelly in the experimental group in order to prevent cracked and ulcerated lips. This finding is in accordance with the study of Stiefel, Damron, Sowers and Velez (2000). This study found that after cleaning oral cavity of endotracheal intubated patients by toothbrushing along with applying petroleum jelly on lips of the patients in the experimental group, their oral status was significantly improved in parts of lips, oral mucosa, gingiva and teeth ($p < 0.05$). This is same as the study of Fitch, Munro, Glass and Pellegrini (1999). The study found that after cleaning oral cavity of patients in ICU by using the same technique along with applying petroleum jelly to their lips in the experimental group, they had significantly lower scores in inflammation and dental plaque than the patients in control group who received routine oral care ($p < 0.05$).

In relation to type of mouth wash, the participants in the experimental group in the research received oral care with 0.12% chlorhexidine gluconate mouth wash, which is a broad-spectrum antibacterial agent with high effectiveness (Munro & Grap, 2004). This oral care technique decreases dental plaque effectively because it inhibits secretion of enzymes involving the adherence of bacteria in oral cavity resulting in the reduction of dental plaque accumulation (Elworthy, 1996; Bagg, MacFarlane, Poxton, Miller & Smith, 1999). After dental plaque decreases, gingivitis and gingival bleeding reduce consequently. This finding is in accordance with the study of Corbet and others (1997). It found that after cleaning oral cavity of participants who had gingivitis with 0.12% chlorhexidine gluconate mouth wash twice a day, participants in the experimental group had significantly lower rate of gingival bleeding, and lower scores in gingivitis and dental plaque than those in the control group who received oral care

with placebo solution. Likewise, Uma and Swaminathan (2001) found that after rinsing the mouth of volunteers with 0.12% chlorhexidine gluconate mouth wash twice a day, there was a significant improvement in the dental plaque, gingival and papilla bleeding scores of participants in the experimental group compared to participants in the control group who rinsed the mouth with placebo solution ($p < 0.05$).

Furthermore, a research study in the Netherlands supported that chlorhexidine gluconate mouth wash was the most effective cleansing agent for reducing dental plaque and gingivitis comparing to other mouth washes such as cetylpyridinium chloride (CPC), essential oils (for example, Listerine), tricosan and amine fluoride (Paraskevas, 2005). After cleaning oral cavity with chlorhexidine gluconate mouth wash, approximately 30% of the drug is retained in the oral cavity because it is bound to phosphate groups principally on the coatings of mucous membrane surfaces and is then gradually released into oral fluids for up to 24 hours (McEvoy, 2003).

The participants in the control group received routine oral care by using of cotton swabs, which is not effective in removing debris and dental plaque in oral cavity (Buglass, 1995). The study of Pearson and Hotton (2002) found that cleaning oral cavity with cotton swabs was less effective in reducing dental plaque especially on cervical and sheltered area than cleaning oral cavity with toothbrush. Moreover, the participants in the control group received oral care with 0.004% chloroxylenol. In this study, the chloroxylenol solution is known as special mouth wash. Unfortunately, no studies related to direct comparison in the effectiveness in reducing dental plaque and gingivitis between special mouth wash and chlorhexidine have been found. However, supporting studies reported that the mean residence time (the average time that all the drug molecules reside in the body) of special mouth wash was lower than that of chlorhexidine. The mean residence time of special mouth wash was 1.69 hours in average whereas the mean residence time of chlorhexidine was 24 hours in average (Dorantes & Stavchansky, 1992; McEvoy, 2003).

According to the mentioned supporting evidences, toothbrushing with modified Bass technique, using chlorhexidine gluconate mouth wash and applying petroleum jelly were expected to significantly lower mean score of abnormality of oral status in the experimental group than that in the control group.

Nevertheless, the researcher found that the mean score of abnormality of oral status before care of oral cavity in the control group was more than that in experimental group. The possible factors affecting the mean score of both groups were aging and certain underlying illnesses i.e. diabetes mellitus, chronic obstructive pulmonary disease (COPD), peptic ulcer. A few studies supported that the people who either were elderly or had following diseases i.e. diabetes mellitus, chronic obstructive pulmonary disease (COPD) and peptic ulcer were more likely to have periodontal disease than those who neither were elderly nor had those diseases (Baker, 2008; Peterson, 2008; Leuckfeld, 2009). The demographic data and relevant characteristics from this study revealed that the mean age of the participants in the control group (67 years) was classified in elderly age whereas that in the experimental group (51.9 years) was classified in adult age (Table 3). Moreover, the participants in the control group had more frequency and percentage of diabetes mellitus, chronic obstructive pulmonary disease (COPD), peptic ulcer than those in the experimental group (Table 5).

Unequal mean score of both groups (Table 11) is expected as Type II error. So, the Chi-square test of the experimental group and control group classified by the difference between the mean scores of abnormality of oral status before and after care of oral cavity (Table 14) was performed as an alternative for validating this hypothesis. Its result still supported that the utilization of the clinical nursing practice guideline in the experimental group significantly decreased the mean score of abnormality of oral status.

Hypothesis 2: The VAP rate after the intervention of critically ill adult patients with endotracheal tube receiving oral care based on clinical nursing practice guideline for care of oral cavities is less than that of the patients receiving routine oral care.

The study found that the Ventilator-Associated Pneumonia (VAP) rate after care of oral cavity in experimental group tended to be less than that in control group, but VAP rates in both groups were not significantly different ($p = 0.478$) (Table 15). Therefore, the second hypothesis of this study is not supported. The possible reasons underlying such a result are as follows:

In relation to duration of intubation, the duration of intubation before the experiment and total duration of intubation of the participants in both groups were rather short. The mean of duration of intubation before the experiment in both groups was 1.7 days and the means of total duration of intubation in the experimental group and control group were 4.6 days and 4.7 days, respectively (Table 8). As a result, only two cases in this study developed VAP (Table 15). In accordance with the study of Kostadima and others (2005), VAP developed in most of head injury and stroke patients (90%) who were intubated more than 5 days (late-onset VAP). Likewise, the study of Hugonnet, Uckay and Pittet (2007) revealed that 61% of the endotracheal intubated patients with VAP in ICU were late-onset VAP. The study of Cook and others (1998) also found Ventilator-Associated Pneumonia rates of approximately 3% per day in the first week of mechanical ventilation.

A factor affecting the duration of intubation of both groups was characteristics of participants. In this study, most participants in both experimental group and control group were postoperative surgical patients (58.3% and 66.7%, respectively) (Table 3). They had less complexity of illness than medical patients and current medical management emphasizes VAP prevention by performing extubation as soon as the patients are ready. Therefore, they were often extubated within 3-4 days after their surgery.

In relation to sample size, 24 participants might be rather insufficient to support this hypothesis because the sample size formula in this study was calculated based on score of oral status in the pilot study instead of VAP rate. The formula based on VAP rate over past few years were used to determine sample size, resulting in very large sample size, more than 1,000 samples. The overwhelming sample size is not practical to perform within limited experimental period in this study.

The result of this hypothesis is in accordance with the study of Bopp, Darby, Loftin and Broscious (2006). This study found that after cleaning oral cavity of endotracheal intubated patients in the experimental group by toothbrushing with 0.12% chlorhexidine gluconate mouth wash, the VAP rate of the patients in the experimental group was not significantly different from the patients in the control group who received oral care by using cotton swabs. The similar issues between this study and the study of Bopp, Darby, Loftin and Broscious are the short period of

intubation and small sample size, as Bopp and colleagues employed their study with the mean of duration of intubation in both groups was 5 days and the sample size was 5 cases.

On the other hand, the study of DeRiso II, Ladowski, Dillon, Justice and Peterson (1996) with 353 samples remarkably revealed that after cleaning oral cavity of patients undergoing heart surgery in the experimental group with only 0.12% chlorhexidine gluconate mouth wash, their decrease of VAP rate was significantly more than that of the control group who received oral care with placebo solution ($p < 0.05$). The participants in the experimental group had been intubated for 7.9 days in average and the participants in the control group had been intubated for 8.5 days in average.

Similarly to the study of Koeman and others (2006), they found that after cleaning oral cavity of endotracheal intubated patients in the experimental group with only chlorhexidine gluconate mouth wash, their decrease of VAP rate was significantly greater than that of the patients in control group who received oral care with placebo solution ($p < 0.05$). There were 385 patients in this study. The participants in the experimental group had been intubated for 9.16 days in average and the participants in the control group had been intubated for 6.95 days in average.

Based on the results of these previous studies, it may be appropriate to further investigate the effect of clinical nursing practice guideline utilization for care of oral cavities on Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube with a large sample size and long intubation for more than 5 days in the future.

CHAPTER VI
CONCLUSION

Summary of the Study

This research was an experimental study aiming to study the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube. The participants were 24 critically ill patients with oral endotracheal intubation, admitted in medical intensive care unit (MICU), surgical intensive care unit (SICU), medical wards and general surgical ward of HRH Princess Maha Chakri Sirindhorn Medical Center. The data were collected from August 14, 2008 to December 15, 2008.

The participants were selected according to the inclusion criteria and were randomly assigned into the control group and the experimental group by lottery method, each with 12 cases. The control group received routine oral care whereas the experimental group received oral care based on clinical nursing practice guideline for care of oral cavities. Matched pair technique was applied to control confounding variables.

The research instruments consisted of 2 parts. The first part was an instrument for the experiment with regard to oral care, which was the clinical nursing practice guideline for care of oral cavities in critically ill patients with endotracheal tube. The second part included instruments for data collection consisting of the demographic data form, the Oral Assessment Form and the VAP development assessment form. These instruments were reviewed for content validity and appropriateness of language by 5 experts. The reliability of the Oral Assessment Form was tested by performing interrater reliability with 30 patients who had similar conditions as the sample. The interrater reliability of this form was 0.86.

Data collection was performed by the researcher who informed the patients and relatives about the subjects on research objectives, expected benefits and potential effects. When both patient or relative accepted to participate in the research, the consent forms were signed by them as the evidence. Before cleaning the oral cavity, the participants' oral status in both groups was initially assessed using the Oral Assessment Form and taken photographs in every morning. The participants in the experimental group received oral care based on clinical nursing practice guideline for care of oral cavities for 15 minutes twice a day by the researcher while the participants in the control group received routine oral care for 15 minutes twice a day. After that, the participants' oral status in both groups was reassessed every evening. Moreover, the participants' VAP development assessed by responsible physicians was followed up on a daily basis.

Then, the data were statistically analyzed by using statistical software (SPSS for Windows). The demographic data and relevant characteristics of the participants were analyzed by descriptive analysis including frequency, percentage, means and standard deviations. Chi-square test was used to analyze difference in the demographic data and relevant characteristics between the experimental group and control group.

OAG rank before and after care of oral cavity each day and OAG rank before care of oral cavity in first day and after care of oral cavity in last day were summarized for both experimental group and control group. The scores of abnormality of oral status before and after care of oral cavity in the experimental group and control group were also analyzed by descriptive analysis including means and standard deviations. Mann-Whitney U-test was applied to determine the difference in the mean scores of abnormality of oral status before and after care of oral cavity between the experimental group and control group. Furthermore, the difference in the Ventilator-Associated Pneumonia (VAP) rate between the experimental group and control group was analyzed by using Chi-square test. The p-value 0.05 was considered for statistical significance in all tests.

The results from this study were summarized as follows:

1. Before receiving oral care, all participants in the experimental group and the control group had mild abnormality of oral status. The mean scores of abnormality of oral status in both groups were not significantly different ($p = 0.219$).

2. After receiving oral care, the participants who received oral care based on clinical nursing practice guideline for care of oral cavities had a significant lower mean score of abnormality of oral status than the participants who received routine oral care ($p = 0.001$).

3. After receiving oral care based on either the clinical nursing practice guideline for care of oral cavities or routine oral care, the VAP rate in experimental group tended to be less than that in control group, but VAP rates in both groups were not significantly different ($p = 0.478$).

Implications and Recommendations

For nursing practice

The knowledge of the effect of clinical nursing practice guideline utilization for care of oral cavities on oral status and Ventilator-Associated Pneumonia (VAP) rate in critically ill adult patients with endotracheal tube is important to nursing practice in ICUs and general wards as follows:

1. ICU nurses and general ward nurses should become aware of the importance of oral assessment of endotracheal intubated patients. According to the results of this study, all endotracheal intubated patients had abnormality of oral status, which is an important factor of VAP. Therefore, the nurses should always pay attention to assessing oral status of every endotracheal intubated patient before and after cleaning the oral cavity every day in order to continuously monitor and follow up this risk factor. In addition, they should collaborate with other healthcare providers such as physicians and dentists in order to develop effective plan management accompanying with nursing care plan when abnormality of oral status of patients such as gingivitis, oral cavity bleeding or ulceration was found.

2. Nurses should apply Oral Assessment Form in daily practice in order to assess abnormality of oral status of endotracheal intubated patients. This form was reviewed for both content validity and reliability. It is classified into 5 categories that completely cover in details of oral assessment. It is easy to understand, not complicated in detail of observation and convenient to apply. Furthermore, its method of measurements does not spend a lot of time. They can assess oral cavity during nursing intervention such as suctioning of saliva.

3. Nurses should take utilizing this clinical nursing practice guideline for care of oral cavities for endotracheal intubated patients into consideration. The guideline was reviewed for content validity by experts and tried out with 30 endotracheal intubated patients. It was implemented with statistically significant result in reducing abnormality of oral status. In addition, this utilization can improve routine care to quality care. However, sensitive patient conditions such as those with bleeding tendency, allergy to chlorhexidine gluconate mouth wash should be considered before the guideline are implemented.

For nursing research

The results in this research can be used as a guide for further nursing research as follows:

1. For studying the effect of clinical nursing practice guideline utilization for care of oral cavities on other outcomes such as length of stay in ICUs/wards and hospitalization, mortality rate and oral care costs between endotracheal intubated patients received oral care based on clinical nursing practice guideline for care of oral cavities and the patients received routine oral care.

2. For comparative studying the various mouth care methods such as using toothbrush with chlorhexidine gluconate mouth wash, using cotton swabs with chlorhexidine gluconate mouth wash or using only chlorhexidine gluconate mouth wash in order to determine on the most effective or cost-effective oral care method.

3. Further research should increase sample size and select more participants with both chronic and critical illness who are intubated more than 5 days. In addition, cleaning the oral cavity in the research should be started at day one of endotracheal intubation until extubation for more accuracy in results of VAP rate.

4. In further research, if Oral Assessment Form is applied to assess abnormality of oral status in endotracheal intubated patients, the assessment should be performed by more than one evaluator in order to reduce bias in the oral assessment.

5. Further research should study the effect of other factors, which may affect on oral status such as frequency of enteral feeding and frequency of salivary suction including other factors, which may affect on VAP rate such as age, severity of illness and type of antibiotics.

Limitation of study

1. It was difficult to recruit the participants because there were several exclusion criteria and a matched pair technique used in this study.

2. Most participants in this study were postoperative surgical patients. As a result, the mean of overall duration of intubation was short, approximately less than 5 days.

3. The researcher defined only three conditions of matched pair in order to increase chance for matching according to the required sample size. However, VAP rate may relate to other factors, which are not defined and may affect on the results of this study such as age and severity of illness.

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APPENDIX

APPENDIX A
LIST OF EXPERTS

Five consulting experts assessed the validity of research instruments as follows:

1. Associate Professor Sroisiri Thaweboon, D.D.S., Ph.D. (Oral Biology)
   Department of Microbiology, Faculty of Dentistry, Mahidol University
2. Assistant Professor Manaphol Kulpraneet, M.D.
   Department of Internal Medicine, Faculty of Medicine, Srinakharinwirot University
3. Lecturer Krongkarn Sangkard, Ph.D. (Education)
   Department of Medical Nursing, Faculty of Nursing, Mahidol University
4. Mrs. Papada Wacharanat, RN
   Head nurse of medical intensive care unit
   Division of Critical care nursing, Nursing Department, HRH Princess Maha Chakri Sirindhorn Medical Center
5. Miss Orawan Wansawad, RN
   Assistant head nurse of medical intensive care unit
   Division of Critical care nursing, Nursing Department, HRH Princess Maha Chakri Sirindhorn Medical Center

APPENDIX B

ETHIC CLEARANCE

COA. No. MU-IRB 2008/066.1408

Documentary Proof of Mahidol University Institutional Review Board

Title of Project. The Effect of Clinical Nursing Practice Guideline Utilization for Care of Oral Cavity on Oral Status and Ventilator-Associated Pneumonia (VAP) in Critically Ill Adult Patients with Endotracheal Tube (Thesis for Master Degree)

Principle Investigator. Miss Petcharat Rujipong

Name of Institution. Faculty of Nursing

Approval includes. 1) MU-IRB Submission form version received date 16 July 2008
2) Participant Information sheet version date 13 August 2008
3) Informed consent form version date 13 August 2008

Mahidol University Institutional Review Board is in full compliance with International Guidelines for Human Research Protection such as Declaration of Helsinki. The Belmont Report. CIOMSGuidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

Date of Approval. 14 August 2008

Date of Expiration. 13 August 2009

Signature of Chairman. .....
(Professor Shusee Visalyaputra)

Signature of Head of the Institute. .....
(Associate Professor Sansanee Chaiyaroj)
Vice President for Research and Academic Affairs

Office of the President, Mahidol University, 999 Phuttamonthon 4 Rd., Salaya, Phuttamonthon District, Nakhon Pathom 73170. Tel. (662) 8496223-5 Fax. (662) 8496223

62 หมู่ 7 อำเภอองครักษ์
จังหวัดนครนายก 26120
โทร.0-3739-5085 ต่อ 10513

เอกสารรับรองโครงการวิจัย
โดย
คณะกรรมการจริยธรรมสำหรับการพิจารณาโครงการวิจัยที่ทำในมนุษย์

SWUEC เลขที่หนังสือรับรอง 20/2551

ชื่อโครงการ	ผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อสภาพช่องปากและการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจในผู้ป่วยวิกฤตที่ใส่ท่อช่วยหายใจ
	The effect of clinical nursing practice guideline utilization for care of oral cavity on oral status and Ventilator-Associated Pneumonia (VAP) in critically ill adult patients with endotracheal tube
ชื่อหัวหน้าโครงการ / หน่วยงานที่สังกัด	นางสาวเพชรัตน์ รุจิพงศ์ / นักศึกษาหลักสูตรพยาบาลศาสตร์มหาบัณฑิต สาขาการพยาบาลผู้ใหญ่ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล
SWUEC รหัสโครงการ	SWUEC 1 - 4/2551
สถานที่ทำการวิจัย	ศูนย์การแพทย์ฯ คณะแพทยศาสตร์ มศว
เอกสารรับรอง	- แบบเสนอโครงการวิจัยเพื่อขอรับการพิจารณา (ฉบับวันที่ 10 เมษายน 2551) - หนังสือให้ความยินยอมเข้าร่วมโครงการ - เอกสารแนะนำหรือแจ้งข้อมูลแก่ผู้ยินยอมให้วิจัย - แบบบันทึกข้อมูล - แบบประเมิน -หนังสืออนุญาตจากผู้อำนวยการโรงพยาบาล
รับรองโดย	คณะกรรมการจริยธรรมสำหรับการพิจารณาโครงการวิจัยที่ทำในมนุษย์ (4/2551) A
วันที่รับรอง	12 มิถุนายน 2551
วันหมดอายุ	11 มิถุนายน 2552

หนังสือรับรองฉบับนี้ออกโดยความเห็นชอบในการพิจารณาจากคณะกรรมการจริยธรรมสำหรับพิจารณาโครงการวิจัยที่ทำในมนุษย์ คณะแพทยศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ ตามประกาศเฮลซิงกิ

ลงนาม.....

(รองศาสตราจารย์ นายแพทย์วันชัย บุพพันเหรัญ)

ประธานคณะกรรมการจริยธรรมฯ

ลงนาม.....

(ศาสตราจารย์ นายแพทย์สมเกียรติ วัฒนศิริชัยกุล)

คณบดีคณะแพทยศาสตร์

APPENDIX C
CONSENT FORM

เอกสารชี้แจงโครงการวิจัย (Information sheet)

เรื่อง ผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อสภาพช่องปาก และการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจในผู้ป่วยผู้ใหญ่วิกฤตที่ใส่ท่อช่วยหายใจ

เรียน ผู้แทนโดยชอบธรรม / ญาติของผู้เข้าร่วมในโครงการวิจัยทุกท่าน

ดิฉัน ชื่อ นางสาวเพชรัตน์ รุจิพงศ์ นักศึกษาปริญญาโท หลักสูตรพยาบาลศาสตรมหาบัณฑิต สาขาการพยาบาลผู้ใหญ่ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล กำลังทำการวิจัยเรื่องผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อสภาพช่องปาก และการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจในผู้ป่วยผู้ใหญ่วิกฤตที่ใส่ท่อช่วยหายใจ

โดยมีวัตถุประสงค์ในการวิจัยเพื่อเปรียบเทียบสภาพช่องปากและอัตราการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ ระหว่างผู้ป่วยที่ได้รับการดูแลความสะอาดช่องปากตามแนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปาก และผู้ป่วยกลุ่มที่ได้รับการดูแลความสะอาดช่องปากตามปกติ ซึ่งประโยชน์ที่คาดหวังจากการวิจัยนี้ คือ การใช้น้ำยาทำความสะอาดคลอเฮกซิดีน 0.12% และวิธีการทำความสะอาดโดยใช้วิธีแปรงฟัน ซึ่งแตกต่างจากวิธีเดิม คือ ใช้น้ำยาสเปเชียล และทำความสะอาดโดยใช้ไม้พันสำลี นั้นจะมีผลลดอัตราการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ และความผิดปกติของสภาพช่องปากผู้ป่วย

เนื่องจากผู้ที่จะเข้าร่วมการวิจัยเป็นผู้ป่วยที่ใส่ท่อช่วยการหายใจ และรับการรักษาอยู่ในหอผู้ป่วยวิกฤต ไม่สามารถอ่านและลงนามด้วยตนเองได้ ดิฉันจึงให้ข้อมูลแก่ท่าน เพื่อช่วยในการตัดสินใจ และให้ความยินยอมในการเข้าร่วมการวิจัยแทนผู้ป่วยที่จะเข้าร่วมการวิจัย

หากท่านยินยอมให้ญาติของท่านเข้าร่วมในโครงการวิจัยครั้งนี้ ข้อมูลที่ได้จากญาติของท่านทั้งหมดจะเป็นความลับโดยผู้วิจัยจะไม่มีการเปิดเผยชื่อ-นามสกุลใดๆ ของญาติท่านทั้งสิ้น และข้อมูลทั้งหมดจะถูกวิเคราะห์ออกมาในภาพรวมเท่านั้น ซึ่งในการวิจัยครั้งนี้ ญาติของท่านจะได้รับการทำความสะอาดช่องปากโดยผู้วิจัย เป็นระยะเวลา 7 วัน หรือจนกระทั่งญาติของท่านถอดท่อช่วยหายใจวันละ 2 ครั้ง ซึ่งในแต่ละครั้งจะใช้เวลาประมาณ 15 นาที โดยในการทำความสะอาดช่องปาก ผู้วิจัยจะแปรงฟันญาติของท่านโดยใช้แปรงสีฟันชุบน้ำยาทำความสะอาดช่องปากพอหมาดๆ แล้วแปรงฟันด้วยวิธีขยับ-ปัด รวมทั้งแปรงลิ้น และทาวาสลีนที่ริมฝีปาก นอกจากนี้ผู้วิจัยจะทำการประเมินสภาพช่องปากญาติของท่านวันละ 2 ครั้ง โดยใช้

แบบประเมินช่องปาก และการถ่ายรูปสภาพช่องปาก ซึ่งการถ่ายรูปดังกล่าวจะไม่ติดใบหน้าญาติของท่าน คือ ถ่ายภาพเฉพาะในช่องปากเท่านั้น รวมถึงติดตามการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจทุกวัน ในส่วนของความเสี่ยงที่อาจจะเกิดขึ้นเมื่อเข้าร่วมในการวิจัยมีน้อย ได้แก่ แพ้น้ำยาทำความสะอาดช่องปาก ซึ่งจากการวิจัยที่ผ่านมาพบว่ามีโอกาสเกิดความเสี่ยงดังกล่าวต่ำมาก สำหรับการใช้แปรงสีฟันชุบน้ำยาพอหมาดๆ ที่ใช้แปรงฟันผู้ป่วยนั้น ไม่มีผลต่อการสำลักซึ่งอาจเกิดขึ้นได้ตามขั้นตอนปกติของผู้ป่วยที่ใส่ท่อช่วยหายใจ แต่ก็ได้มีการป้องกันที่เป็นมาตรฐานอยู่แล้วโดยจะมีการใส่ลมในกระเปาะของท่อช่วยหายใจเพื่อป้องกันไม่ให้ของเหลวที่อาจสำลักไหลลงไปถึงเนื้อปอดได้ อย่างไรก็ตาม หากเกิดอาการดังกล่าว ผู้วิจัยมีวิธีแก้ไขดูแลดังนี้

หากเกิดอาการแพ้น้ำยาทำความสะอาดช่องปาก ผู้วิจัยจะใช้ผ้าก๊อสหรือสำลีชุบน้ำเช็ดภายในปากญาติของท่าน

หากเกิดการสำลัก ผู้วิจัยจะจัดท่านอนศีรษะต่ำให้ญาติของท่าน พร้อมทั้งตะแคงหน้าไปด้านใดด้านหนึ่งแล้วนำสิ่งที่ตกค้างในช่องปากออก พร้อมทั้งทำความสะอาดช่องปากของญาติของท่านด้วยน้ำสะอาด

ขณะเดียวกับที่ดูแลผู้ป่วยนั้นผู้วิจัยจะรีบรายงานและประสานงานกับแพทย์ผู้เชี่ยวชาญ เพื่อประเมินอาการและให้การรักษาญาติของท่านต่อไป โดยผู้วิจัยจะติดตามอาการเปลี่ยนแปลงของญาติของท่านทุกวัน และประสานงานกับแพทย์ผู้เชี่ยวชาญในการให้การรักษาญาติของท่าน จนกว่าอาการญาติของท่านจะเข้าสู่ภาวะปกติ โดยท่านจะไม่ต้องเสียค่าใช้จ่ายในส่วนนี้

ทั้งนี้ ท่านสามารถยุติการยินยอมให้ญาติของท่านร่วมการวิจัยได้ทุกเมื่อ โดยไม่มีผลกระทบต่อการดูแลรักษาพยาบาลที่ญาติของท่านจะได้รับ และหากท่านมีข้อสงสัยประการใดๆ เกี่ยวกับการวิจัยในครั้งนี้ ดิฉัน นางสาวเพชรัตน์ รุจิพงศ์ ยินดีอธิบายชี้แจงรายละเอียดและตอบข้อสงสัยต่างๆ ได้ตลอดเวลา ณ หออภิบาลอายุรกรรม ชั้น 6 โรงพยาบาลศูนย์การแพทย์สมเด็จพระเทพรัตนราชสุดาฯ สยามบรมราชกุมารี โทรศัพท์ 086-884-1716

โครงการวิจัยนี้ได้รับการพิจารณารับรองจาก คณะกรรมการจริยธรรมการวิจัยในคนของมหาวิทยาลัยมหิดล หากญาติของท่านได้รับการปฏิบัติไม่ตรงตามข้อความในเอกสารนี้ ท่านสามารถติดต่อกับคณะกรรมการจริยธรรมฯ ได้ที่สำนักงานคณะกรรมการจริยธรรมการวิจัยในคน กองบริหารงานวิจัย สำนักงานอธิการบดีมหาวิทยาลัยมหิดล ถนนพุทธมณฑล สาย 4 ตำบลศาลายา อำเภอพุทธมณฑล จังหวัดนครปฐม 73170 หมายเลขโทรศัพท์ 0-2849-6223-5 โทรสาร 02-849-6223

ข้าพเจ้าได้อ่านรายละเอียดในเอกสารนี้ครบถ้วนแล้ว

ลงชื่อ ……..…..ผู้แทนโดยชอบธรรม

(……)

วันที่……

หนังสือแสดงเจตนายินยอมเข้าร่วมการวิจัยโดยได้รับการบอกกล่าวและเต็มใจ

วันที่ ……เดือน……..…พ.ศ. ……

ข้าพเจ้า……..……อายุ…….…....…ปี อาศัยอยู่บ้านเลขที่……...…..…..

ถนน……..…...…..ตำบล……..…..…..…....อำเภอ……..จังหวัด……..…..…

รหัสไปรษณีย์……. โทรศัพท์…….....

ขอแสดงเจตนายินยอมให้ญาติของข้าพเจ้าเข้าร่วมโครงการวิจัย เรื่อง ผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อสภาพช่องปาก และการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจในผู้ป่วยผู้ใหญ่วิกฤตที่ใส่ท่อช่วยหายใจ

โดยข้าพเจ้าได้ทราบรายละเอียดเกี่ยวกับที่มาและจุดมุ่งหมายในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ประโยชน์ที่คาดว่าจะได้รับของการวิจัยและความเสี่ยงที่อาจจะเกิดขึ้นจากการเข้าร่วมการวิจัย รวมทั้งแนวทางป้องกันและแก้ไขหากเกิดอันตรายขึ้น ค่าตอบแทนที่จะได้รับ ค่าใช้จ่ายที่ข้าพเจ้าจะต้องรับผิดชอบจ่ายเอง โดยได้อ่านข้อความที่มีรายละเอียดอยู่ในเอกสารชี้แจงผู้เข้าร่วมการวิจัยโดยตลอด อีกทั้งยังได้รับคำอธิบายและตอบข้อสงสัยจากหัวหน้าโครงการวิจัยเป็นที่เรียบร้อยแล้ว

ข้าพเจ้าจึงสมัครใจให้ญาติของข้าพเจ้าเข้าร่วมโครงการวิจัยนี้

หากข้าพเจ้ามีข้อข้องใจเกี่ยวกับขั้นตอนของการวิจัย หรือหากเกิดเหตุการณ์ที่ไม่พึงประสงค์จากการวิจัยขึ้นกับญาติของข้าพเจ้า ข้าพเจ้าจะสามารถติดต่อกับนางสาวเพชรัตน์ รุจิพงศ์ โทรศัพท์ 086-884-1716

หากญาติของข้าพเจ้า ได้รับการปฏิบัติไม่ตรงตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถติดต่อกับประธานคณะกรรมการจริยธรรมการวิจัยในคนหรือผู้แทน ได้ที่สำนักงานคณะกรรมการจริยธรรมการวิจัยในคน สำนักงานอธิการบดีมหาวิทยาลัยมหิดล ถนนพุทธมณฑล สาย 4 ตำบลศาลายา อำเภอพุทธมณฑล จังหวัดนครปฐม 73170 หมายเลขโทรศัพท์ 0-2849-6223-5 โทรสาร 02-849-6223

ข้าพเจ้าได้รับทราบถึงสิทธิ์ที่ข้าพเจ้าจะได้รับข้อมูลเพิ่มเติมทั้งทางด้านประโยชน์และโทษจากการเข้าร่วมการวิจัย และสามารถถอนตัวหรืองดเข้าร่วมการวิจัยได้ทุกเมื่อ โดยจะไม่มีผลกระทบต่อการบริการและการรักษาพยาบาลที่ญาติของข้าพเจ้าจะได้รับต่อไปในอนาคต และยินยอมให้ผู้วิจัยใช้ข้อมูลส่วนตัวของญาติข้าพเจ้าที่ได้รับจากการวิจัย แต่จะไม่เผยแพร่ต่อสาธารณะเป็นรายบุคคล โดยจะนำเสนอเป็นข้อมูลโดยรวมจากการวิจัยเท่านั้น

ข้าพเจ้าเข้าใจข้อความในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และหนังสือแสดงเจตนายินยอมนี้โดยตลอดแล้ว จึงลงลายมือชื่อไว้เป็นหลักฐาน

ลงชื่อ ……..…..ผู้แทนโดยชอบธรรม/ วันที่……...……

(……..)

ลงชื่อ……ผู้ให้ข้อมูลและขอความยินยอม/หัวหน้าโครงการวิจัย/ วันที่……

(……..…..)

ในกรณีผู้เข้าร่วมโครงการวิจัยไม่สามารถอ่านหนังสือได้ ผู้ที่อ่านข้อความทั้งหมดแทนผู้เข้าร่วมการวิจัย คือ……..……...จึงได้ลงลายมือชื่อไว้เป็นพยาน

ลงชื่อ ……พยาน/ วันที่…….....

(……...…...)

APPENDIX D

STANDARD PROCEDURE FOR PREVENTION OF LOWER RESPIRATORY TRACT INFECTION

	ระเบียบปฏิบัติ เรื่อง : การป้องกันการติดเชื้อในระบบทางเดินหายใจส่วนล่าง	หน้า 1 / 7 HOS-70-2-009-00
ชื่อหน่วยงาน : งานป้องกันและควบคุมการติดเชื้อในโรงพยาบาล		
ผู้ตรวจสอบ : ประธานคณะกรรมการป้องกันและควบคุมการติดเชื้อในโรงพยาบาล		ผู้อนุมัติ :

(ศาสตราจารย์ นพ.วุฒิชัย ธนาพงศธร)

1. วัตถุประสงค์

1.1 ลดการติดเชื้อของระบบทางเดินหายใจส่วนล่าง

1.2 ลดการติดเชื้อของระบบทางเดินหายใจส่วนล่างที่สัมพันธ์กับการใช้เครื่องช่วยหายใจ

2. ขอบข่าย

บุคลากรทางการแพทย์ทุกระดับ

3. คำจำกัดความ

1. **การติดเชื้อระบบทางเดินหายใจส่วนล่างในโรงพยาบาล** (nosocomial pneumonia) หมายถึง การที่ผู้ป่วยมีการติดเชื้อที่ปอดซึ่งเกิดขึ้นหลังจากที่ผู้ป่วยได้เข้ารับการรักษาในโรงพยาบาลนานกว่า 48ชั่วโมง

2. **การติดเชื้อระบบทางเดินหายใจส่วนล่างที่สัมพันธ์กับการใช้เครื่องช่วยหายใจ** [ventilator associated pneumonia (VAP)] หมายถึง การที่ผู้ป่วยมีการติดเชื้อที่ปอดหลังจากการใช้เครื่องช่วยหายใจ 48 ชั่วโมง และเกิดหลังหยุดใช้เครื่องช่วยหายใจไม่เกิน 72 ชั่วโมง

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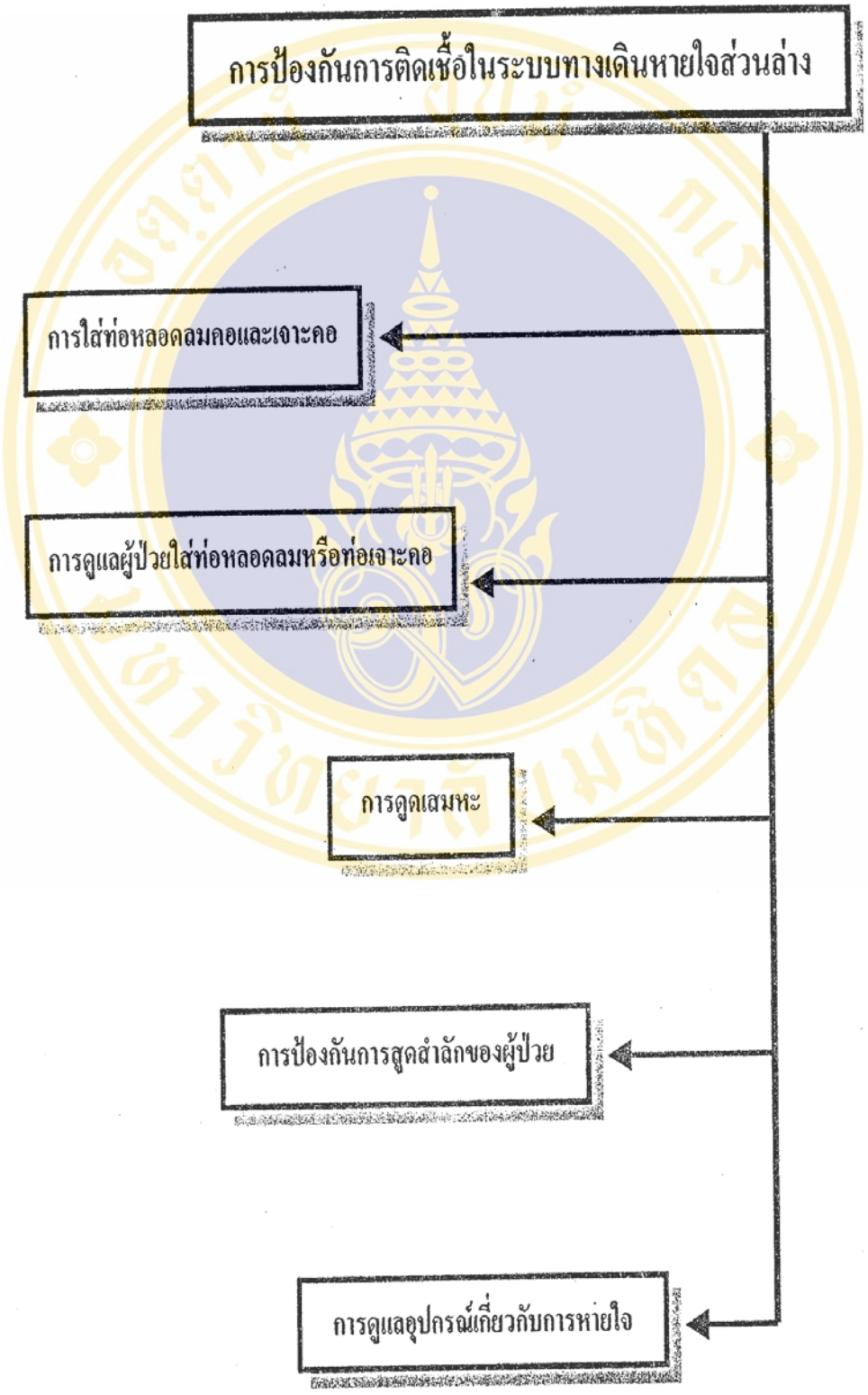
เรื่อง : การป้องกันการติดเชื้อในระบบทางเดินหายใจส่วนล่าง



ระเบียบปฏิบัติ เลขที่ : HOS-70-2-009 -00 หน้า 3 / 7

เรื่อง : การป้องกันการติดเชื้อในระบบทางเดินหายใจส่วนล่าง

กระบวนการ	การปฏิบัติ
1. การใส่ท่อหลอดลมคอและเจาะคอ	1. ล้างมือแบบ hygienic handwashing ก่อนและหลังการใส่ท่อ 2. เจาะคอตามหลัก Aseptic technique 3. ควรทำในห้องผ่าตัด
2. ดูแลผู้ป่วยใส่ท่อหลอดลมหรือท่อเจาะคอ	1. ล้างมือทุกครั้งก่อนและหลังดูแลผู้ป่วย 2. ในผู้ป่วยรายเดียวกันต้องล้างมือทุกครั้งก่อนและหลังสัมผัสตำแหน่งอื่นของร่างกายก่อนที่จะดูแลระบบทางเดินหายใจของผู้ป่วย 3. ดูแลช่องปากของผู้ป่วยให้สะอาดอย่างน้อยวันละ 2 ครั้ง 4. ในกรณีที่ใส่ท่อเจาะคอ ให้ทำความสะอาดแผลเจาะคออย่างน้อยวันละ 3 ครั้ง และเมื่อเปื้อนเสมหะ 5. ทำความสะอาดท่อชั้นในของท่อเจาะคอ อย่างน้อยวันละ 3 ครั้งและเมื่อสกปรก 6. พลิกตัวอย่างน้อยทุก 2 ชั่วโมง(เมื่อไม่มีข้อห้าม) 7. ควรตรวจดู pressure cuff อย่างน้อยทุก 8 ชั่วโมง ให้มี pressure 20-30 mmHg
3. ดูดเสมหะ	1. ดูดเสมหะเมื่อมีข้อบ่งชี้ 1.1 หลังจากเจาะคอใหม่ ๆ 1.2 ผู้ป่วยขอให้ดูดเสมหะ 1.3 ก่อนที่จะเอาท่อช่วยหายใจออก (ก่อนที่ทำการ deflation ของ cuff) 1.4 ก่อนให้อาหารทางสายให้อาหาร

ระเบียบปฏิบัติ เลขที่ : HOS-70-2-009 -00 หน้า 4 / 7

เรื่อง : การป้องกันการติดเชื้อในระบบทางเดินหายใจส่วนล่าง

กระบวนการ	การปฏิบัติ
	2. เตรียมเครื่องมือเครื่องใช้ 2.1 เครื่องดูด การตั้งแรงดูดในเด็กเล็กใช้ 50-90 ทอรร์ เด็กโต 90-120 ทอรร์ และผู้ใหญ่ 160-180 ทอรร์ 2.2 ขวดรองรับเสมหะ ใช้ดูดเสมหะจนระดับน้ำถึงขีดที่กำหนดแล้วให้เทสารน้ำทิ้ง ล้างขวดด้วยสารซักล้าง(detergents) และล้างให้สะอาดก่อนใช้ต่อไป ในกรณีที่สารน้ำจากการดูดเสมหะมีน้อย ให้เปลี่ยนขวดรองรับเสมหะทุก 8 ชั่วโมง 2.3 สายดูดเสมหะ ขนาดเส้นผ่าศูนย์กลางภายนอกไม่ควรเกินครึ่งหนึ่งของขนาดเส้นผ่าศูนย์กลางของรูเปิดท่อหลอดลมคอ สายดูดเสมหะควรได้รับการทำลายเชื้ออย่างเหมาะสม 3. ดูดเสมหะ 3.1 ผู้ทำการดูดเสมหะต้องสวมผ้าปิดปาก-จมูก และควรใส่แว่นป้องกันตา 3.2 ผู้ทำการดูดเสมหะ สวมถุงมือปราศจากเชื้อที่มือข้างที่ถนัด มืออีกข้างจับสายต่อจากเครื่องที่ท่อต่อตัว Y มือข้างที่สวมถุงมือจับสายดูดเสมหะต่อกับท่อตัว Y 3.3 เช็ดข้อต่อต่าง ๆ ด้วย Alcohol 70% ก่อนและหลังถอดข้อต่อของสายต่อเครื่องช่วยหายใจ

ระเบียบปฏิบัติ เลขที่ : HOS-70-2-009 -00 หน้า 5 / 7

เรื่อง : การป้องกันการติดเชื้อในระบบทางเดินหายใจส่วนล่าง

กระบวนการ	การปฏิบัติ
	3.4 เปิดเครื่องดูดเสมหะด้วยมือข้างที่ไม่ใส่ถุงมือ 3.5 บอกผู้ป่วยให้ไอก่อนดูดเสมหะ 3.6 สอดสายดูดเสมหะเข้าท่อหลอดลมคอจนผู้ป่วยเริ่มไอ (ในผู้ใหญ่ไม่ลึกเกิน 15-20 ซม. จากปากท่อหลอดลมคอ) 3.7 อุดรูที่เหลือของท่อตัว Y ด้วยหัวแม่มือข้างที่ไม่ใส่ถุงมือเพื่อให้เกิดแรงดูด 3.8 ค่อย ๆ ดึงสายดูดเสมหะออกด้วยมือข้างที่ถนัดพร้อมกับหมุนสายดูดเสมหะไปทางซ้ายและขวา 3.9 ระยะเวลาที่สอดสายดูดเสมหะเข้าจนถึงออกไม่ควรเกิน 10 วินาทีในผู้ใหญ่และ 5 วินาทีในเด็ก ถ้าต้องดูดเสมหะเพิ่มเติมให้ผู้ป่วยพักหายใจ 2-3 นาทีก่อนที่จะดูดครั้งต่อไป 3.10 หลังจากดูดเสมหะแล้ว ถ้ามีน้ำล้างหรือเสมหะอยู่รอบๆ ท่อหลอดลม ให้ใช้สายดูดเสมหะที่ใช้แล้วนั้นดูดได้ 3.11 ดูดน้ำประปาผ่านสายสวนเพื่อล้างสายดูดเสมหะ ปิดเครื่องถอดสายดูดเสมหะเก็บในภาชนะมิดชิดเพื่อนำไปเข้าขบวนการและนำมาใช้อีกหรือทิ้งในถุงมูลฝอยติดเชื้อถ้าเป็นสายดูดเสมหะที่ใช้ครั้งเดียว 3.12 ถอดถุงมือทิ้งหรือแช่ในน้ำเพื่อนำมาใช้ใหม่ 3.13 ล้างมือแบบ hygienic handwashing

ระเบียบปฏิบัติ เลขที่ : HOS-70-2-009 -00 หน้า 6/7

เรื่อง : การป้องกันการติดเชื้อในระบบทางเดินหายใจส่วนล่าง

กระบวนการ	การปฏิบัติ
4. ป้องกันการสูดสำลักของผู้ป่วย	1. จัดท่านอนให้หัวสูง 30 -45 ถ้าไม่มีข้อห้าม 2. ยาที่จะใช้ในการป้องกัน stress ulcer ควรเป็นยาที่ไม่ลดกรดของกระเพาะ 3. ถ้าผู้ป่วยมีท่อให้อาหาร (feeding tube) คาอยู่ ควรตรวจว่าอยู่ในตำแหน่งที่ถูกต้องก่อนให้อาหารทุกครั้ง
5. การดูแลอุปกรณ์เกี่ยวกับการหายใจ	1. ทำลายเชื้อหรือทำให้ปราศจากเชื้อก่อนใช้ในผู้ป่วยใหม่ทุกราย 2. เติมน้ำในเครื่องทำให้อากาศชื้น (humidifier) ทุก 8 ชั่วโมงหรือเครื่องทำฝอยละออง (nebulizer) ด้วยน้ำปราศจากเชื้อเมื่อเปิดแล้วใช้ได้ไม่เกิน 24 ชม. 3. เปลี่ยนน้ำในเครื่องทำความชื้นด้วยน้ำปราศจากเชื้อทุก 8 ชั่วโมง (nebulizer) ยกเว้นเครื่องที่ใช้น้ำปราศจากเชื้อหยดเข้าอย่างต่อเนื่องซึ่งไม่ต้องเปลี่ยน 4. เครื่องทำฝอยละอองที่จะนำกลับมาใช้ซ้ำ ต้องทำให้ปราศจากเชื้อ 5. ยาพ่นเป็นฝอยละออง ต้องปราศจากเชื้อ ใช้ผลิตภัณฑ์ที่ใช้ครั้งเดียวหรือใช้ภายในไม่เกิน 24 ชั่วโมงสำหรับผลิตภัณฑ์ที่ใช้หลายครั้ง 6. ใช้ heated wire circuit เพื่อลดน้ำที่กลั่นตัว ถ้ามีน้ำภายในสายท่อต่อมากให้เทออกทาง water trap 7. อุปกรณ์เกี่ยวกับการหายใจอื่น ๆ 7.1 กระโจมให้ออกซิเจนทำความสะอาดทุกวัน

ระเบียบปฏิบัติ เลขที่ : HOS-70-2-009 -00 หน้า 7/7

เรื่อง : การป้องกันการติดเชื้อในระบบทางเดินหายใจส่วนล่าง

กระบวนการ	การปฏิบัติ
	7.2 ใช้ Ambu bag 1 อัน ต่อ ผู้ป่วย 1 คน 7.3 สายออกซิเจน (oxygen canula) หน้ากากออกซิเจน (oxygen mask) ทำให้สะอาดและแห้งก่อนใช้สำหรับผู้ป่วยรายนั้น ถ้าจะใช้กับผู้ป่วยรายอื่นต้องได้รับการทำลายเชื้อก่อน

สิ่งที่ไม่ควรปฏิบัติ

1. เปลี่ยน circuit เร็วกว่า 48 ชั่วโมง
2. ทำลายเชื้อชิ้นส่วนภายในของเครื่องช่วยหายใจทุกวัน

APPENDIX E
RESEARCH INSTRUMENT

Part 1: Instruments implementation for oral care

แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากในผู้ป่วยวิกฤตที่ใส่ท่อช่วยหายใจ

แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากในผู้ป่วยวิกฤตที่ใส่ท่อช่วยหายใจมีขั้นตอนและรายละเอียด ดังนี้

ขั้นตอนที่ 1 การประเมินสภาพช่องปาก

ประเมินสภาพช่องปากโดยใช้แบบประเมินสภาพช่องปากที่ประยุกต์จาก Oral Assessment Guide (OAG) ทุกวันในตอนเช้า

ขั้นตอนที่ 2 การให้ข้อมูลผู้ป่วย (ในกรณีที่ผู้ป่วยรู้สึกตัว)

อธิบายให้ผู้ป่วยทราบถึงวิธีการทำความสะอาดช่องปาก รวมทั้งประโยชน์ที่จะได้รับจากการทำความสะอาดช่องปาก

ขั้นตอนที่ 3 การทำความสะอาดช่องปาก

3.1 การจัดท่าผู้ป่วย

จัดท่าให้ผู้ป่วยนอนศีรษะสูง 45 องศา และเอียงศีรษะไปข้างใดด้านหนึ่งขณะเริ่มทำความสะอาดช่องปาก

3.2 การเพิ่มความดันกระเปาะลม (cuff) ของท่อช่วยหายใจ

ตรวจสอบความดันกระเปาะลม (cuff) ของท่อช่วยหายใจให้อยู่ระหว่าง 20-30 เซนติเมตรน้ำ แล้วดูดเสมหะ/ น้ำลายในช่องปากและ oropharynx

3.3 วิธีทำความสะอาดช่องปาก

แปรงฟัน เพดานปาก และลิ้น โดยใช้แปรงสีฟันที่มีขนาดเล็ก และมีขนแปรงอ่อนนุ่ม ร่วมกับน้ำยาคลอเฮกซิดีน 0.12 เปอร์เซ็นต์ ตามวิธีการ ดังนี้

3.3.1 นำแปรงสีฟันชุบน้ำยาคลอเฮกซิดีน 0.12 เปอร์เซ็นต์พอหมาด โดยปริมาณน้ำยาที่ใช้ในการทำความสะอาดแต่ละรอบประมาณ 15 ซีซี

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3.4 การให้ความชุ่มชื้น

ให้ความชุ่มชื้นกับริมฝีปาก โดยทาวาสลีนที่ริมฝีปาก

ขั้นตอนที่ 4 การประเมินผลซ้ำ

ประเมินสภาพช่องปากซ้ำอีกครั้งหนึ่ง โดยใช้แบบประเมินสภาพช่องปากที่ประยุกต์จาก Oral Assessment Guide (OAG) ทุกวันในตอนเย็น

นอกจากนี้ ในบทบาทของผู้ปฏิบัติการพยาบาลขั้นสูง ผู้วิจัยได้ตระหนักและคำนึงถึงความปลอดภัยของผู้ป่วยเป็นสำคัญ โดยปฏิบัติตามกิจกรรมต่างๆ ดังนี้

ก่อนดูแลความสะอาดช่องปากตามแนวปฏิบัติ

1. ศึกษาการแปรงฟันวิธีขยับ-ปัดจากเอกสารที่เกี่ยวข้อง และสื่อวีดิทัศน์

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ระหว่างดูแลความสะอาดช่องปากตามแนวปฏิบัติ

1. ประเมินอาการสำลักและอาการแพ้น้ำยาทำความสะอาดช่องปาก

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หลังดูแลความสะอาดช่องปากตามแนวปฏิบัติ

1. ประเมินอาการสำลัก อาการแพ้น้ำยาทำความสะอาดช่องปาก และลักษณะการหายใจซ้ำ

Part 2: Instruments for data collection

ส่วนที่ 1 แบบบันทึกข้อมูลส่วนบุคคล

คำชี้แจง ทำเครื่องหมาย (✓) ลงใน ( ) หน้าข้อความ หรือเติมข้อความ ตัวเลขลงในช่องว่าง

1. เพศ ( ) ชาย ( ) หญิง
2. อายุ……...ปี
3. หอผู้ป่วย ( ) MICU ( ) SICU ( ) Ward 10/2 ( ) Ward 11/2 ( ) Ward 12/2
4. วันที่รับไว้ในโรงพยาบาล……..……..
5. การวินิจฉัยโรค……
6. โรคประจำตัว……
7. การผ่าตัด……
8. คะแนนประเมินสภาพช่องปาก……คะแนน ระดับ…….

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15. สาเหตุที่จำหน่ายออกจากการศึกษา

( ) ครบเวลาศึกษา ( ) ถอดท่อช่วยหายใจ

( ) ขอถอนตัว (ระบุ)…….. ( ) อื่นๆ (ระบุ)……..

ส่วนที่ 2 แบบประเมินสภาพช่องปาก Oral Assessment Guide (OAG)

คำชี้แจง บันทึกระดับคะแนนลงในช่อง “คะแนนที่ได้” จากที่สังเกตพบตามองค์ประกอบที่กำหนด

วันที่ประเมิน..... เวลา.....น.

องค์ประกอบที่ประเมิน	เครื่องมือที่ใช้	วิธีการประเมิน	ระดับคะแนน			คะแนนที่ได้
			1	2	3	
ริมฝีปาก	การดู/การคลำ	สังเกตและสัมผัสริมฝีปาก	นุ่มมีสีชมพูและชุ่มชื้น	แห้งหรือแตก	มีแผลหรือมีเลือดออก	
ลิ้นและเยื่อบุในปาก	การดู/การคลำ	การสัมผัสและสังเกตลักษณะเนื้อเยื่อ	มีสีชมพูและชุ่มชื้น	สีแดงมากขึ้นหรือมีคราบเกาะซีดขาวมากขึ้น โดยที่ไม่มีแผล	มีตุ่ม หรือแผลโดยไม่มีเลือดออก *	
น้ำลาย	ไม้กดลิ้น	สอดไม้กดลิ้นเข้าไปในปาก แตะบริเวณกลางลิ้นและใต้ลิ้น	น้ำลายใส	น้ำลายเหนียวข้น	ไม่มีน้ำลาย	
เหงือก	.....	.....	.....	.....	.....	
ฟันหรือฟันปลอม (หรือเนื้อเยื่อที่สัมผัสกับฟันปลอม)	.....	.....	.....	.....	.....	
รวมคะแนน						

หมายเหตุ * ถ้าปากมีเลือดออกหรือมีความผิดปกติรุนแรงมากขึ้น ให้คะแนน 3

ส่วนที่ 3 แบบประเมินการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ

วันที่ประเมิน.....

เกณฑ์ทางคลินิก

☐ 1. มี infiltrate เกิดขึ้นใหม่ หรือเพิ่มมากขึ้นจากภาพถ่ายรังสีทรวงอก

หากทำเครื่องหมายในข้อ 1. ให้พิจารณาข้อ 2-4 ต่อไป

☐ 2. มีไข้เกิดขึ้นใหม่หรือสูงขึ้นกว่าเดิม (อุณหภูมิร่างกายมากกว่า 38.3 องศาเซลเซียส)

☐ .

☐ .

ผลการตรวจทางจุลชีววิทยา (วิธีใดวิธีหนึ่ง)

ผล Sputum Culture ( ) ไม่พบเชื้อก่อโรค ( ) พบเชื้อก่อโรค

(ระบุชนิด) 1……2……..……3……..……..…

.

.

วันที่รายงานผล……

ผลการวินิจฉัย

☐ เกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ ☐ ไม่เกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ

วันที่วินิจฉัย…….

<u>เกณฑ์การประเมิน</u>

ผลทางคลินิกต้องมีอาการในข้อ 1. และมีลักษณะอย่างน้อย 2 ใน 3 ของข้อ 2-4 พร้อมทั้งพบเชื้อแบคทีเรียก่อโรคทางจุลชีววิทยาด้วยวิธีใดวิธีหนึ่ง โดย Sputum Culture ต้องพบเชื้อตั้งแต่ moderate growth ขึ้นไป……...

ผู้ประเมิน…….

(……)

APPENDIX F

ADDITIONAL RESULTS

ตารางที่ 16: ตารางแสดงคะแนนเฉลี่ยความดันช่องปากก่อนและหลังดูแลความสะอาดช่องปากของผู้เข้าร่วมโครงการวิจัยในกลุ่มทดลองและกลุ่มควบคุมในแต่ละวัน

คู่ที่	วันที่ 1				วันที่ 2				วันที่ 3				วันที่ 4			
	กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม	
	ก่อน*	หลัง*	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง
1	8	6	9	9	9	7	9	10	8	5	11	11				
2	8	6	9	9	8	6	9	9	8	8	8					
3	10	8	8	10	9	8	9	10	9	8	10	11	8	11	9	
4	9	7	9	9												
5	9	7	8	7												

ตารางที่ 16: ตารางแสดงคะแนนสภาพช่องปากก่อนและหลังดูแลความสะอาดช่องปากของผู้เข้าร่วมโครงการวิจัยในกลุ่มทดลองและกลุ่มควบคุมในแต่ละวัน

(ต่อ)

คู่ที่	วันที่ 1				วันที่ 2				วันที่ 3				วันที่ 4			
	กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม	
	ก่อน*	หลัง*	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง
6	8	7	8	7	7	7	7	7	7	5	8	7				
7	9	6	8	8	6	5	9	9								
8	9	7	9	9	9	9	9	9			9	9				
9	9	7	8	7	8	8	8	7								
10	9	8	9	9	8	8	8	8	8	7						
11	8	7	9	10	7	6	10	10								
12	9	6	8	9	9	8										

หมายเหตุ: *ก่อน/หลังดูแลความสะอาดช่องปาก

ตารางที่ 16: ตารางแสดงคะแนนสภาพช่องปากก่อนและหลังดูแลความสะอาดช่องปากของผู้เข้าร่วมโครงการวิจัยในกลุ่มทดลองและกลุ่มควบคุมในแต่ละวัน (ต่อ)

คู่ที่	วันที่ 5				วันที่ 6				วันที่ 7			
	กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม		กลุ่มทดลอง		กลุ่มควบคุม	
	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง	ก่อน	หลัง
1												
2												
3	8	8	10	6	9	8			9	8		
4												
5												
6												
7												
8												
9												
10												
11												
12												

APPENDIX G
PHOTOGRAPHS OF ORAL STATUSES

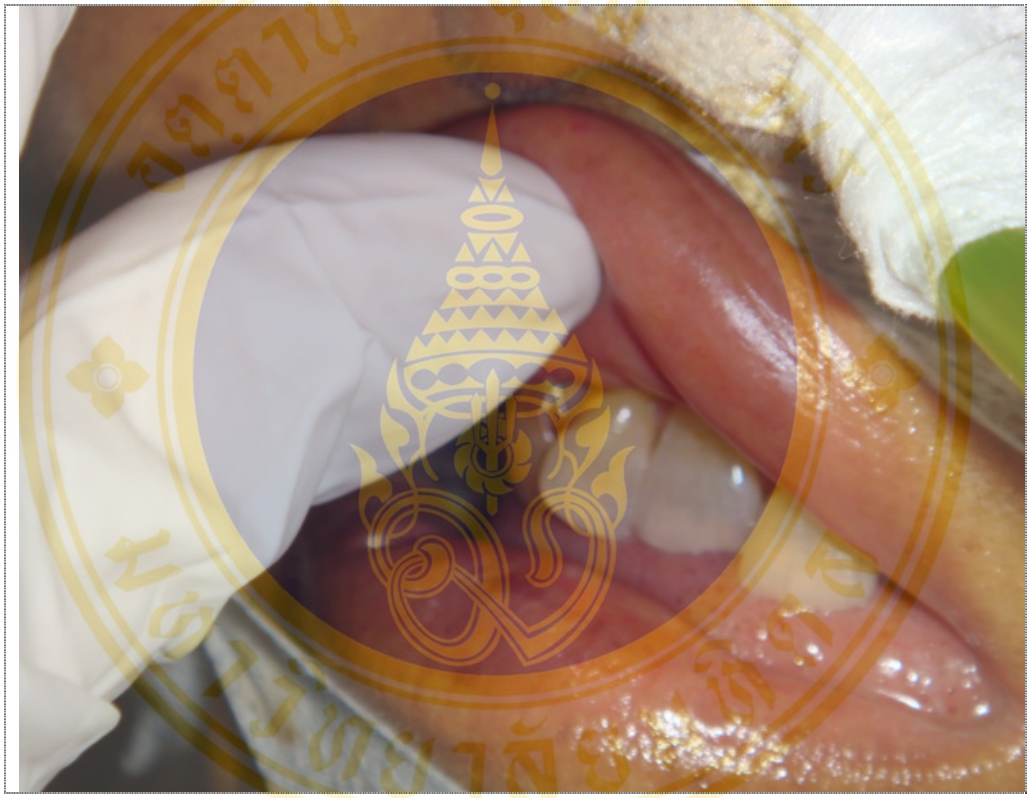

Figure 4: The photographs of oral status as normal findings

Figure 4: The photographs of oral status as normal findings (cont.)

Figure 5: The photographs of oral status as mild abnormality

Figure 6: The photographs of oral status as severe abnormality

The photographs of oral status as mild abnormality (Day 1)

The photographs of oral status as mild abnormality (Day 1) (cont.)

The photographs of oral status as normal findings (Day 3)

The photographs of oral status as normal findings (Day 3) (cont.)

Figure 7: The photographs of better oral status from mild abnormality to normal findings.

BIOGRAPHY

NAME	Petcharat Rujipong
DATE OF BIRTH	June 8, 1980
PLACE OF BIRTH	Pathumthani, Thailand
INSTITUTIONS ATTENDED	Saint Louis College, 1998-2002: Bachelor of Nursing Science Mahidol University, 2006-2009: Master of Nursing Science (Adult Nursing)
RESEARCH GRANT	Supported in part by the Thesis Grant, Faculty of Graduate Studies, Mahidol University
POSITION AND OFFICE	2002-2006, Registered nurse, HRH Princess Maha Chakri Sirindhorn Medical Center, Nakhonnayok, Thailand Present, Lecturer, The Thai Red Cross College of Nursing, Bangkok, Thailand
	E-mail: Pet.charat@hotmail.com
HOME ADDRESS	5 moo 4, Lumsai, Lumlukka, Pathumthani, Thailand. Tel. 086-8841716