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Philippine Surgical Infection Society 2020 Consensus Guidelines on Oral Hygiene for the Improvement of Surgical Outcomes*

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Nosocomial infections significantly contribute to a patient's morbidity and mortality, increasing healthcare costs. While previous research has assessed the effect of oral hygiene on the prevention of nosocomial infections and postoperative complications, few guidelines exist that offer evidence-based recommendations on pre- or peri-operative oral hygiene in the surgical setting. The Philippine Surgical Infection Society set out to develop a set of guidelines that provide evidence-based recommendations on oral hygiene for improving surgical outcomes for adoption in the Philippines. Six clinical questions defined the scope of the guidelines. A systematic review was performed to provide the evidence base to develop the recommendations. A consensus meeting participated by 15 representatives from 13 specialty surgical societies and societies concerned with infection control was conducted using the modified Delphi technique to finalize the set of recommendations. A consensus guideline with sixteen recommendations on the use of oral hygiene to improve surgical outcomes is presented for adoption and implementation.

Keywords: consensus guidelines, oral hygiene, surgical outcome

• The Philippine Surgical Infection Society, through a research grant from Johnson and Johnson, Philippines, commissioned the conduct of a systematic review on oral hygiene for improving surgical outcomes and sponsored the development of this Guideline.

• Dr. Lapitan has received a research grant on surgical site infection in 2016 from Johnson and Johnson, Philippines.

• Dr. Saguil has been commissioned to develop educational modules on hexetidine from Johnson and Johnson, Philippines in 2020.

Nosocomial infections such as surgical site infections (SSI) and postoperative pneumonia significantly contribute to a patient's morbidity and mortality. They increase length of hospital stay and the need for medications, leading to additional health care costs and use of health care resources.[1] Nosocomial respiratory infections account for approximately 10-15% of all hospital acquired infections, with 20-50% mortality among affected patients.[2]

Previous research has assessed the effect of oral hygiene management on nosocomial infections and postoperative complications. A systematic review evaluating perioperative systemic oral hygiene among patients undergoing elective thoracic surgery found that all studies pointed to a reduction in the number of postoperative infections as a result of systemic decontamination of the nasopharynx and/or oropharynx.[2] Studies in other populations have found that oral hygiene management has been effective in preventing infectious diseases and postoperative complications. Perioperative oral hygiene management reduced SSI risk after colorectal surgery and subsequently shortened hospital stays, and that perioral management should commence as soon as surgery is contemplated.[3] Conversely, another study concluded that lack of preoperative oral management was significantly associated with SSI (OR=10.17, p=0.035).[4]

Currently, few guidelines exist internationally or nationally that offer evidence-based recommendations on pre- or peri-operative oral hygiene in surgical settings. In 2004, the Center of Disease Control in the USA recommended the use of chlorhexidine at a concentration

of 0.12% among patients undergoing cardiovascular surgery for the prevention of pneumonia during the pre-operative period.[5] Based on the findings of the systematic review of the effect of perioperative oral hygiene on respiratory tract infections after elective thoracic surgery, a Danish Clinical Guideline was published recommending patients should initiate systematic oral hygiene 2 days before scheduled surgery.[6] A before-and-after quality improvement study that evaluated the implementation of the guideline in a Danish institution found that the need for postoperative antibiotics was reduced from 12.6% to 7.7% of patients in a Department of Thoracic Surgery.[7]

On September 15, 2020, the Philippine Surgical Infection Society (PSIS) initiated the development of a set of evidence-based recommendations on oral hygiene for improving surgical outcomes for adoption in the Philippines. This article describes the methods of guideline development implemented by the technical working group and its results. The full guideline report is available on request from PSIS.

Methods

Identification of guideline scope and key clinical questions

An online survey was conducted among the board members of the Philippine Surgical Infection Society and the members of the Philippine College of Surgeons Surgical Infection Committee on the scope of the guideline recommendations and key clinical questions.

The survey yielded 6 clinical questions, which informed the systematic search and review of the scientific evidence to support the recommendations:

1. Does oral hygiene improve outcomes for surgical patients?
2. What solutions/oral agents are effective in improving outcomes for surgical patients?
3. Among the different agents, which is the best?
4. What methods/ techniques of oral hygiene are effective in improving outcomes for surgical patients?
5. What is the optimal frequency for the provision of oral hygiene?
6. What is the optimal duration of the intervention?

Literature search

Medline and Cochrane bibliographic databases were searched for relevant publications, with no time restriction. The following search terms were used: *oral hygiene, oral care, oral health, mouthwash, mouthrinse, nosocomial infection, nosocomial pneumonia, respiratory infection, and surgical site infection*. The search was limited to randomized, controlled trials and systematic reviews.

Selection of studies

Two review authors screened the titles and abstracts of study records identified by the searches for potential eligibility. The full-texts of selected records were retrieved and screened independently by two review authors using a standardized form, linking together multiple records of the same study in the process. At both screening stages, disagreements were resolved by discussion or consultation with a third review author. The reference lists of published systematic reviews were searched for additional studies.

Trials were eligible for inclusion if they included surgical cases (whether operative or non-operative cases usually attended to by surgeons such as trauma patients), compared oral hygiene programs using various agents and techniques individually or in combination with placebo or usual care or other oral hygiene programs, and if they reported any of the following: nosocomial infection, nosocomial pneumonia, ventilator-associated pneumonia, SSI, mortality, ICU admission, ventilator days, adverse events, or oral colony count.

Data extraction and analysis

Two review authors independently extracted outcome data. Study characteristics were extracted by one review author and reviewed for accuracy by a second review author. Any disagreements were resolved by discussion or by consulting a third review author. Data extracted were: study design, year of publication, inclusion criteria, exclusion criteria, number of participants for each treatment group, description of interventions, co –interventions and outcomes. (Details of the characteristics of the included study is available from the full guidelines report).

Where data were available from more than one study reporting the same comparison and outcome, these data were pooled and meta-analysis performed. For studies with multiple publications, only the most up-to-date or complete data for each outcome were utilized. A fixed effects model was used to calculate pooled estimates of treatment effect and 95% confidence intervals. Where there was visual or statistical heterogeneity, a random effects model was used.

Measures of treatment effect were expressed as risk ratios for dichotomous outcomes and mean differences for continuous outcomes. If studies used different scales to assess the same continuous outcome, the standardized mean difference was used instead of the mean difference.

Where no data could be pooled, results of individual studies were reported narratively.

Assessment of risk of bias

The risk of bias of each included study was assessed independently by two review authors. Any disagreements were resolved by discussion or by consulting a third review author. Risk of bias was assessed by using the recommended tool in the *Cochrane Handbook for Systematic Reviews of Interventions*.[8] This includes the assessment of: random sequence generation; allocation concealment; blinding of participants and personnel; blinding of outcome assessment; incomplete outcome data; selective reporting; and other sources of bias, such as funding source.

Assessment of the certainty of the evidence

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach was used to assess the certainty of evidence related to the outcomes as listed above.[9] The GRADE approach assesses evidence to be of high certainty, moderate certainty, low certainty or very low certainty. Certainty was downgraded by one level for serious (or by two for very serious) risk of bias, indirectness of evidence, inconsistency, imprecision or potential publication bias.

Consensus methods

The collated evidence for each of the six key clinical questions and the provisional recommendations were circulated to the members of the Consensus Panel (Table 1). The panel comprised 15 representatives from 13 specialty surgical societies and societies concerned with infection control. The representative societies included: Philippine Surgical Infection Society, Philippine College of Surgeons, Philippines Academy of Head and Neck Surgery, Philippine Academy of Ophthalmology, Philippine Society of Anesthesiologists, Philippine Society of Colon and Rectal Surgeons, Philippine Society of General Surgery, Philippine Society of Ultrasound for Surgery, Philippine Urological Association, Philippine Society of Microbiology and Infectious Diseases, Philippine Hospital Infection Control Nurses Association, Philippine Hospital Infection Control Society, and the Operating Room Nurses Association of the Philippines.

Table 1. Consensus panel participants and their organizations.

Consensus Panel Participants
Dr. Robert Bandolon, Philippine Society of Colon and Rectal Surgeons
Dr. Arvin Briones, Philippine Society of Ultrasound for Surgery
Dr. Arturo P. Castro, Philippine Urological Association
Ms. Victoria I. Ching, Philippine Hospital Infection Control Society
Mr. Ricardo Corado, Philippine Hospital Infection Control Nurses Association, Inc
Dr. Maria Margarita Lat-Luna, Philippine Academy of Ophthalmology
Dr. Ida Marie Lim, Philippine Society of General Surgeons
Dr. Jeannette Marie Matsuo, Philippine Academy of Head and Neck Surgery, Inc
Dr. Renato Montenegro, Philippine College of Surgeons Committee on Surgical Infection
Mr. Gabriel Naig, Operating Room Nurses Association of the Philippines
Dr. Esther Saguil, Philippine Surgical Infection Society
Dr. Jose Antonio Salud, Philippine College of Surgeons
Dr. Karl Matthew C. Sy Su, Philippine Society of Anesthesiologists
Dr. Carmenchu Villavicencio, Philippine Society of Microbiology and Infectious Diseases, Inc
Ms. Jane Ethel Yraola, Operating Room Nurses Association of the Philippines

On November 14, 2020, the panel was convened for a consensus meeting to decide on the recommendations of the guidelines.

The evidence informing the different clinical questions and the corresponding recommendations were presented to the Panel. A modified Delphi technique was used to arrive at a decision regarding the inclusion, wording and strength of each recommendation. Consideration of the strength of each recommendation took into account availability of evidence, magnitude and certainty of the evidence, harms and benefits, and patient preference. While no patient representative attended the consensus meeting, panel members were asked to take into account their understanding of patient preferences. The target consensus level for the final acceptance of a recommendation was 95% agreement. Discussion and modification of each recommendation continued until this was achieved through repeated votes.

Funding Support and Declaration of Conflicts of Interest

The Philippine Surgical Infection Society, through a research grant from Johnson and Johnson, Philippines, commissioned the conduct of a systematic review on oral hygiene for improving surgical outcomes and sponsored the development of this Guideline. Members of the technical working group and the consensus panel submitted their declarations of conflict of interest and are included in the full guideline report.

Results

Of the 3,171 citations identified in the searches of bibliographical databases, after removal of duplicates, title and abstract screening and assessment of full text articles, 88 articles, ie. 29 systematic reviews[10-38] and 59 RCTs[39-95], were included in the guidelines review (Figure 1).

Twenty meta-analyses were performed and associated forest plots generated from pooling of the extracted RCT data, and the results of single trials where no data could be pooled for meta-analysis were reported narratively. The collated evidence for each of the six key clinical questions was used to develop provisional recommendations, which would then be accepted, rejected or modified through a consensus process.

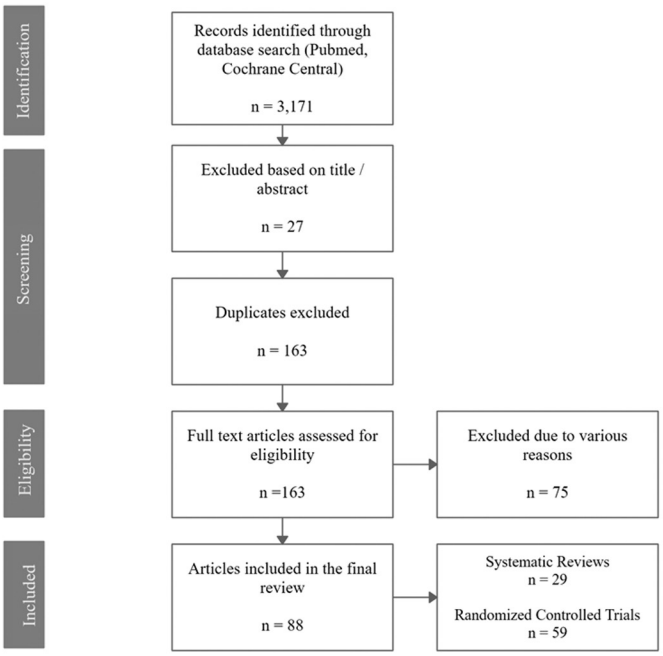

Figure 1. : Flow chart of the study selection process.

The full details of the systematic review and meta-analyses supporting this guideline will be published in a separate report.

Clinical Question 1: Does oral hygiene improve outcomes for surgical patients?

Evidence Summary:

Twenty nine systematic reviews[10-38] and 59 RCTs[39-95] involving various oral hygiene programs for surgical patients and critically-ill patients are fairly consistent in concluding that oral hygiene offers benefits in terms of nosocomial infection, nosocomial pneumonia, ventilator-associated pneumonia and surgical site infection. Shorter ICU stay and less ventilator days were also demonstrated. No significant benefit has been found in terms of mortality.

Significantly higher adverse event rates were noted with oral hygiene compared to placebo or usual care, but

these were mostly minor (eg. mild reversible irritation of the oral mucosa, burning sensation, local urticaria, bleeding gums, and tooth discoloration). The most serious oral hygiene-related adverse event was aspiration of mouthwash or oral content with the potential to increase the risk of nosocomial pneumonia, but this was very rare. Overall, the harm-benefit ratio is in favor of oral hygiene. **Level of evidence: 1a**, moderate certainty

Panel Discussion: The Panel agreed that oral hygiene is beneficial and should be given to all surgical patients. Acknowledging the limited evidence available on the magnitude of benefit to all types of operative cases, rather than lowering the strength of recommendation for this subgroup of patients, it was agreed upon that for those who will undergo (or have a risk of conversion to) general anesthesia (ie. endotracheal intubation specifically), separate recommendations should be given according to the type of anesthesia.

Recommendation 1:
Implement an oral hygiene program among surgical patients.
Strength of Recommendation: Strong

Recommendation 1a:
Patients who are scheduled to undergo cardiothoracic surgery should receive oral hygiene care perioperatively.
Strength of Recommendation: Strong

Recommendation 1b:
Patients who are scheduled to undergo oropharyngeal surgery should receive oral hygiene care perioperatively.
Strength of Recommendation: Strong

Recommendation 1c:
Surgical patients who are critically-ill and on mechanical ventilation should receive oral hygiene care.
Strength of Recommendation: Strong

Recommendation 1d:
Consider a perioperative oral hygiene program for surgical patients who will undergo (or have a risk of conversion to) general anesthesia.
Strength of Recommendation: Strong

Recommendation 1e:
Consider a perioperative oral hygiene program for surgical patients who will receive anesthesia other than general anesthesia (eg. regional, intravenous, local, etc.).
Strength of Recommendation: Weak

Clinical Question 2: What solutions/oral agents are effective in improving outcomes for surgical patients?

Evidence Summary

The following agents were used in oral hygiene programs among surgical patients in clinical trials considered in the evidence review: chlorhexidine rinse/swab, povidone iodine rinse / swab, oral topical antibiotics, essential oils based rinse, hexetidine, and oral topical probiotics.

Meta-analysis of 28 RCTs[43,45,46,49,50,52-56,60,63,65,68,69,71-76,80-82,88,93-95] comparing chlorhexidine–based oral hygiene programs and placebo or usual care reported that they are beneficial in terms of lowering the risk of nosocomial infections, nosocomial pneumonia and ventilator-associated pneumonia as well as shortening ICU stay. There was insufficient evidence to demonstrate a significant benefit with the use of chlorhexidine in terms of SSI rates, mortality, and ventilator days. There was a tendency for more adverse events associated with chlorhexidine but the difference did not reach statistical significance. **Level of evidence: 1a**, moderate to high certainty

Meta-analysis of 4 RCTs[51,83,84,85] comparing povidone-iodine-based oral hygiene programs versus placebo or usual care reported that they are beneficial in terms of shorter ventilator days. However, there was insufficient evidence to demonstrate a significant benefit in terms of lowering the risk of ventilator-associated pneumonia, mortality, and shortening ICU stay with the use of oral povidone iodine. One small trial[62] reported that none of the patients in the povidone iodine arm developed SSI while 3 of 30 patients (10%) in the control group developed SSI. RR 0.14 (95%CI 0.01, 2.65). No trial

data is available on the effect of povidone iodine oral care on nosocomial infection and nosocomial pneumonia. **Level of evidence: 1a**, moderate certainty

Meta-analysis of 5 RCTs[39,42,51,58,64,77] comparing topical antibiotic–based oral hygiene programs and placebo or usual care reported a tendency towards a lower risk of ventilator-associated pneumonia as well as shorter ICU stay and ventilator days with the use of topical antibiotics but the differences did not reach statistical significance. Topical antibiotic-based oral care did not lower the risk for death. One small trial58 showed significant benefit in lowering the risk of nosocomial pneumonia (RR 0.38 (95%CI 0.18, 0.83)), but not for surgical site infection (RR 0.36 (95%CI 0.05, 2.87)), associated with the use of topical antibiotic oral gel. **Level of evidence: 1a**, moderate to high certainty

No clinical trial that investigated the effectiveness of essential oils mouthwashes in surgical patients has been identified in the literature. One 3-armed trial compared Listerine mouthwash with sodium bicarbonate mouthwash and sterile water among critically-ill patients. No significant differences in ventilator-associated pneumonia rates (4.7% vs 4.4%, RR 1.07, 95%CI 0.41, 2.78), ventilator days, ICU stay, adverse event rates, or systemic antibiotic use were observed across all treatment groups.[44]

One randomized trial compared chlorhexidine and phenolic mixture (Listerine) among patients who underwent aortocoronary bypass. Incidence of nosocomial pneumonia did not differ significantly between the two groups (4/279 vs 9/291, p = 0.21), nor did the incidence of positive culture growth (52/270 vs 44/291, p =0.19). Mortality rates were also similar between the two groups (6/270 vs 3/291). Colony culture studies showed more growth in the chlorhexidine group than in the Listerine group (19.26% vs 15.12%) although the difference was not statistically significant (p=0.19).[55]

All other available information on essential oils was limited to normal healthy patients or on patients with dental conditions. A systematic review of 26 trials provided evidence of anti-plaque and anti-gingivitis effects of essential-oil-containing mouth rinse as an adjunct to daily oral health regimen.[10] **Level of evidence: 1b**, moderate certainty

No clinical trial has been identified in the literature that investigated the effectiveness of hexetidine mouthwashes in surgical patients. One small randomized trial compared chlorhexidine and hexetidine among critically-ill patients. The study reported similar incidences of VAP in both groups. It was observed that though there was a tendency for a faster recovery (decline in Clinical Pulmonary Infection Score) among patients who received chlorhexidine, both group scores showed parallel improvement overtime.[95] **Level of evidence: 1b**, low certainty.

One small randomized trial compared oral care using application of chlorhexidine with that using probiotic bacterium Lactobacillus planterum 299 among mechanically-ventilated patients. No difference was found between the two groups in terms of ventilator days, length of stay in the ICU, and in-hospital mortality rates.[59] **Level of evidence: 1b**, low certainty.

Panel Discussion: The issue of antimicrobial resistance was raised as an additional issue of harm in the use of topical antibiotics. This resulted in the downgrading of the strength of recommendation, despite the evidence of benefit.

Recommendation 2: Include the use of oral hygiene care agents in the oral hygiene program for surgical patients.
Strength of Recommendation: Strong

Recommendation 2a: Use chlorhexidine mouthwash and consider povidone iodine mouthwash, essential oil-based mouthwash, hexetidine, and oral topical probiotics as alternative oral care agents for surgical patients.
Strength of Recommendation: Strong

Recommendation 2b: Consider topical antibiotics as an alternative oral hygiene care agent for surgical patients, but with serious consideration on its impact on antimicrobial resistance.
Strength of Recommendation: Weak

Clinical Question 3: Among the different agents, which is the best?

Evidence Summary

There is limited trial evidence directly comparing one agent with another. Only two trials were identified, one comparing chlorhexidine and phenolic mixture / essential oils and another comparing chlorhexidine and hexetidine. No clear difference was established in the effectiveness of the different agents. **Level of evidence: 1b**. low certainty

No recommendation regarding the best oral hygiene agent could be made due to limited evidence.

Clinical Question 4: What methods/ techniques of oral hygiene are effective in improving outcomes for surgical patients?

Evidence Summary

There is limited trial evidence that directly investigated the benefit of these practices individually. Five trials[66,67,71,76,90] compared oral hygiene care, which includes toothbrushing and care without toothbrushing. Pooled analysis of the data did not show sufficient evidence of a significant difference in ventilator-associated pneumonia rates, ICU stay, and ventilator days, although with some tendency to favor toothbrushing. There was no difference in the mortality rates between the two groups. **Level of evidence: 1a**, moderate certainty

One small trial compared the effect of the addition of oral care provided by dental health practitioners with the care provided ICU nurses alone. The additional procedures include toothbrushing, tongue scraping, removal of calculus, atraumatic restorative treatment of caries, and teeth extraction. The dentist-delivered treatment was superior to ICU nurse delivered care in the prevention of VAP and lower respiratory tract infections (8/127 or 6.3% vs 18/127 or 14.17%). No significant difference was reported in the other surgical outcomes (mortality, ventilator days and ICU days).[41] **Level of evidence: 1b**, low to moderate certainty

Panel Discussion:

Despite superiority of dentist-delivered oral care, the feasibility of such in this setting is uncertain. Hence, the panel agreed not to recommend such type of care while acknowledging the evidence. As an alternative, referral for dental care postoperatively or after discharge, when appropriate, was recommended.

Recommendation 3:
Include toothbrushing in the oral care program for surgical patients, whenever feasible.
Strength of Recommendation: Weak

Recommendation 4:
Consider including the following maneuvers in oral hygiene programs for surgical patients:
- oral rinsing or gargling
- removal of tongue coating
- cleaning of tongue and mucosal surface with a sponge or brush
- mechanical cleansing of the oral cavity with spatula wrapped in gauze
- dental flossing

Strength of Recommendation: Weak

Recommendation 5a:
Provide an oral hygiene program that can be delivered / implemented by trained nurses to surgical patients.
Strength of Recommendation: Weak

Recommendation 5b:
Refer surgical patients to the dentist for further oral health care, when appropriate.
Strength of Recommendation: Weak

Clinical Question 5: What is the optimal frequency for the provision of oral hygiene?

Evidence Summary

There is very limited evidence on the relative effectiveness of different frequencies of oral hygiene provision on surgical outcomes. One 3-arm trial[80] compared chlorhexidine-containing rinse twice a day and once a day among critically-ill trauma patients in two of the treatment groups. Similar rates of nosocomial pneumonia (7/50 vs 7/50), ventilator-associated pneumonia (7/50 vs 7/57) and mortality (8/47 vs 8/50)

were observed. **Level of evidence: 1b**, moderate certainty

Recommendation 6:
Provide oral hygiene care at least once a day to surgical patients.
Strength of Recommendation: Strong

Clinical Question 6: What is the optimal duration of the intervention?

Evidence Summary

The trials included in the review used different durations of oral hygiene programs. No trial compared different durations of provision of oral hygiene care. In trials involving elective surgical patients, oral hygiene programs started from one to five days prior to the surgery. Some continued the care until one to two days postoperatively. Trials involving critically ill mechanically-ventilated patients, the oral hygiene programs would continue until extubation or discharge from the ICU. **Level of evidence: 4**, no certainty

Panel Discussions: Despite the absence of clinical trial evidence, the panel agreed to provide recommendations on the time frame of implementing an oral hygiene program.

Recommendation 7a:
Implement an oral hygiene program for operative surgical patients at least one day preoperatively and until hospital discharge.
Strength of Recommendation: Weak

Recommendation 7b:
Implement an oral hygiene program for critically ill and mechanically ventilated patients at the time of intubation until hospital discharge.
Strength of Recommendation: Weak

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