[Downloaded free from http://www.nmsjournal.com on Sunday, July 26, 2020, IP: 10.232.74.23]

Original Article

Archive of SID

Effect of Mouthwash with *Boswellia* Extract on the Prevention of Dental Plaque Formation in Patients under Mechanical Ventilation

Marziye Ziaie Rad, Hossein Taherian

Community Health Research Center, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran

ORCID:

Marziye Ziaie-Rad: https://orcid.org/0000-0002-5175-1301;

Hossein Taherian: https://orcid.org/0000-0002-0389-587X

Abstract

Background: Oral hygiene is a crucial nursing care in the intensive care unit (ICU) that can prevent ventilator-associated pneumonia. **Objectives:** This study compares the effect of mouthwash with *Boswellia* extract and chlorhexidine on the prevention of dental plaque formation in ICU patients having an endotracheal tube. **Methods:** A clinical trial was performed on 90 patients under mechanical ventilation in the ICU of Ayatollah Kashani Hospital in Isfahan, Iran, in 2018. The study data were collected using a demographic information form, a checklist, and the O'Leary dental plaque index (ODPI). The patients were randomly divided into two groups to receive mouthwash using solutions containing *Boswellia* or chlorhexidine. Data were analyzed using the Kolmogorov–Smirnov test, analysis of variance, independent samples, and paired *t*-tests. **Results:** Most of the patients were male (76.67%), with a smoking background (60%) and in the age range of 18–38 years. The two groups did not significantly differ in terms of demographic characteristics ($P > 0.05$). The mean ODPI was 0.89 ± 0.07 at baseline in the *Boswellia* group and changed to 0.67 ± 0.05 after the intervention ($P < 0.001$). Furthermore, the mean ODPI was 0.93 ± 0.03 in the chlorhexidine group and change to 0.77 ± 0.09 after the intervention ($P < 0.001$). **Conclusions:** Both *Boswellia* and chlorhexidine mouthwashes were effective in the prevention of dental plaque in patients under mechanical ventilation.

Keywords: *Boswellia, Chlorhexidine, Dental plaque, Mouthwash*

Introduction

Hospital-acquired infections (HAIs) are among the major health problems and increase the patient's length of stay, mortality, and hospital costs. Hospital-acquired pneumonia is one of the most common HAIs, accounting for 15% of these infections.[1] About 1 in 10 of the people admitted to a hospital[2] and 30% of patients admitted to the intensive care units (ICUs) acquire such infections.[3] Ventilator-associated pneumonia (VAP) is a subset of hospital-acquired pneumonia, accounting for the majority of the cases of acquired pneumonia in the ICUs and usually occurs in patients who are on a ventilator for more than 48 h.[4,5] In developing countries, like Iran, VAP occurs in 10%–41% of ICU patients. This rate varies from 9 to 18.5/1000 ventilator days in different countries.[1,6]

Nursing interventions such as mouth care have a crucial role in the prevention of VAP. However, oral care policies vary from hospital to hospital and even within ICUs.[7] The oral cavity, teeth, gums, tongue, and palate are the sources for different pathogens, and a strong relationship has been shown between poor oral hygiene, development of dental plaque, and the occurrence of VAP.[1]

Dental plaque is the community of microorganisms found on a tooth surface as a biofilm, embedded in a matrix of polymers of host and bacterial origin.[8] The

Address for correspondence: Dr. Marziye Ziaie Rad, Assistant Professor, Community Health Research Center, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.
E-mail: moradivastegani90@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Submitted: 03-Aug-2019 **Revised:** 08-Jan-2020 **Accepted:** 24-Jan-2020 **Published:** 14-Apr-2020

How to cite this article: Rad MZ, Taherian H. Effect of mouthwash with *boswellia* extract on the prevention of dental plaque formation in patients under mechanical ventilation. Nurs Midwifery Stud 2020;9:77-82.

Access this article online

Quick Response Code:

Website: www.nmsjournal.com

DOI: 10.4103/nms.nms_65_19

www.SID.ir

[Downloaded free from http://www.nmsjournal.com on Sunday, July 26, 2020, IP: 10.232.74.23]

Archive of SID

structure of the dental plaque safeguards microbial communities in the biofilms against antimicrobial agents, and they gradually display a novel phenotype that enhances their pathogenicity.[9] Dental plaque can be destroyed by the mechanical and chemical methods. Mechanical methods, especially tooth brushing, are the most effective way for removing bacterial colonies and dental plaques and are contraindicated only in patients with coagulation disorders.[7] However, because of the ease of use in patients, some ICU nurses prefer chemical methods over to mechanical ones.[10]

Various mouthwashes are available in the market; among them, chlorhexidine is the most popular and has been recognized as the primary agent for chemical plaque control.[11] The effect of chlorhexidine in the prevention of bacterial colonization and VAP has been addressed in several studies.[12-14] However, some studies reported that compared to placebo, chlorhexidine did not produce significant differences in bacterial colonization or the incidence of VAP.[15,16] Moreover, the Center for the Disease Control and Prevention does not recommend the routine use of chlorhexidine[13] because of its side effects such as teeth discoloration, unfavorable taste, oral mucosal lesions, and parotid swelling.[11,17]

Due to the side effects of chlorhexidine, researchers have tried to examine some other mouthwashes. Herbal mouthwashes might act as a good and cost-effective substitute for oral hygiene in ICU patients.[11,18,19] A study examined the effect of orthodentol – a mouthwash containing the extract of Khouzestani Savory – on oral hygiene of patients under mechanical ventilation and reported that it was as effective as chlorhexidine.[18] Another study also compared the effect of a herbal mouthwash (containing cinnamon and *Terminalia chebula*) and chlorhexidine and reported that the two mouthwashes were equally effective in reducing the dental plaque level.[11] A recent clinical trial has also investigated the effect of frankincense (*Boswellia*) in the treatment of moderate plaque-induced gingivitis and reported its effectiveness.[19]

Boswellia is an herbal extract taken from the *Boswellia serrata* tree. It has been used for centuries in Asian and African folk medicines, and it is available as a resin, pill, or cream.[20] *Boswellia* and its active ingredients, such as Boswellic acid, can selectively inhibit the 5-lipoxygenase pathway, and therefore, inhibit the cellular inflammatory cascade.[21] As a result, Boswellic acid and *Boswellia* extract have been used in inflammatory diseases.[19] A study has also reported that *Boswellia* extract may improve gingival inflammation by decreasing the severity of dental plaque.[21] However, scientific research into its effects is just beginning. No acute or chronic adverse effect has been reported for *Boswellia*, and this guaranteed the low risk of daily use of this remedy.[19] However, no previous study has actually assessed the effect of *Boswellia* extract on dental plaque. Hence, the question still remained unanswered that can *Boswellia* extract prevent the dental plaque formation in patients under mechanical ventilation? Therefore, the present study was conducted to fill this gap.

Objectives

The purpose of this study was to compare the effect of two types of mouthwash containing chlorhexidine or *Boswellia* on the prevention of dental plaque formation in ICU patients under mechanical ventilation.

Methods

Study design and participants

This clinical trial was conducted on patients who were under mechanical ventilation in the ICU of Ayatollah Kashani Hospital in Isfahan, Iran, from January to August 2018.

The sample size was calculated using the results of a former study in which *Boswellia* was used to treat gingivitis. The mean ± standard deviation of the baseline gingival index in the group received *Boswellia* extract was 1.51 ± 0.23 and decreased to 0.78 ± 1.23 on day 14.[19] Then, with an α of 0.01, β of 0.20, S_1 of 0.23, S_2 of 1.23, μ_1 of 1.51, and μ_2 of 78, the sample size was estimated to be 35 for each group. However, for compensating probable attritions and achieving more reliable results, we recruited 45 patients in each group.

The inclusion criteria were as follows: being at the age of 18 years old or over, not having a tracheal tube before ICU admission, insertion of the tracheal tube after ICU admission, passing no more than 24–48 h from hospital admission and intubation, receiving mechanical ventilation, lack of clinical signs of pneumonia at the start of the study, receiving no antibiotic from 2 weeks before hospital admission, not being pregnant, no history of allergy to *Boswellia* and other herbs, lacking any coagulopathy and immunosuppressive disorder, receiving no immunosuppressive medications, including steroids, having a white blood cell count of 4000 or over, a minimum neutrophils and platelet count of 2000 and 40000, respectively, an INR of more than two, and earning an illness severity scores of <40 based on the Simplified Acute Physiology Score Scale.

The exclusion criteria were as follows: discharging from the ICU before the completion of the study, death of the patient, use of another mouthwash during the study, and the patient's family's reluctance to continue the study.

www.SID.ir

[Downloaded free from http://www.nmsjournal.com on Sunday, July 26, 2020, IP: 10.232.74.23]

Archive of SID

In the present study, 90 patients with the inclusion criteria have consecutively entered the study and were randomly and equally assigned to a control and an experimental group. The randomization was performed using computer software. The consort flow diagram of the study is presented in Figure 1.

Instruments

The data were collected using a two-part instrument. The first part contained questions on demographics such as age, sex, smoking habit, history of chronic comorbidities, and previous hospital admissions, level of consciousness, the reason for undergoing mechanical ventilation, and also the name of the ward. The second part of the instrument was a checklist based on the O'Leary index used to record the dental plaque index (DPI). This index is valid and common in determining the incidence of dental plaque, and its reliability has been assessed in an earlier study through the Pearson correlation coefficient is 0.99.[22]

The DPI was calculated using the O'Leary index. To this end, first, the patient's mouth was rinsed with plain water and the surfaces of his/her teeth were tinctured with a disclosed agent dye to facilitate the detection of dental plaques. Next, the resulted discoloration of different surfaces of each tooth was evaluated. For this purpose, using an explorer, each stained surface was examined for soft accumulations at the dentogingival junction. When found, they were recorded by making a dash/red color in the appropriate spaces on the record form. Finally, as illustrated in Box 1, the number of discolored surfaces was divided by the total number of teeth multiplied by four (or the total number of the stained surfaces) and expressed as a percentage.[22]

Intervention

Boswellia extract was purchased from a prestigious store of medicinal plants and then by a pharmacist at the pharmacy laboratory of Islamic Azad University of Isfahan (Khorasgan Branch) and was solved in ethanol solution at a concentration of 80 mg/ml (0.8%).

Mouth care in the intervention group was done using 0.8% *Boswellia* mouthwash, but in the control group, it was done using 12.2% chlorhexidine mouthwash. The number, time, and manner of mouthwash were identical in both groups.

In the intervention group, mouthwash was done using a cotton swab dipped in *Boswellia* extract solution for 4 consecutive days, twice a day (i.e., at 8 a.m. and 8 p.m.). Each time 20 ml of the mouthwash was used to care for all oral areas, including internal and external surfaces of the teeth. The oral cavity was suctioned before and after the procedure. At the presence of the first researcher, all the mouthwash procedures were conducted by six experienced ICU nurses who were retrained for this study.

Without knowing that the patient was in which group, an experienced anesthesiologist measured the O'Leary plaque index for each patient both at the entry and at the end of the intervention.

Box 1: An example of dental plaque index calculation

Assume a patient with the following plaque accumulation

Upper jaw: 34 plaque containing surfaces

Lower jaw: 36 plaque containing surfaces. The total available surfaces for the upper and lower jaw were, in this example, 52 and 48, respectively: Plaque index=The number of plaque containing surfaces/the total number of available surfaces

(34 + 36)/(52 + 48)=70/100=0.70

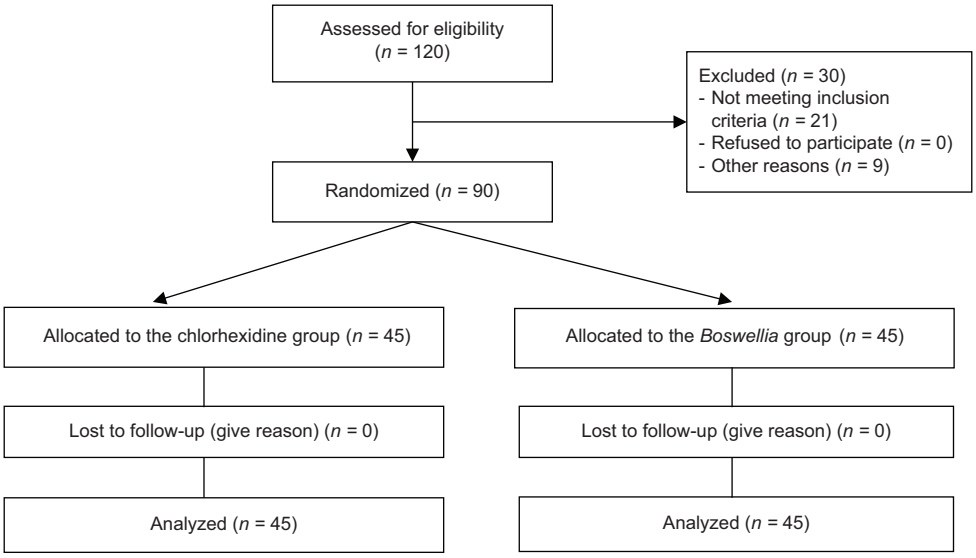

Figure 1: Consort flow diagram of the study

www.SID.ir

[Downloaded free from http://www.nmsjournal.com on Sunday, July 26, 2020, IP: 10.232.74.23]

Archive of SID

Ethical considerations

This study was approved by the Ethics Committee of The Islamic Azad University, Isfahan (Khorasgan) Branch, Isfahan, Iran (approval code: IR.IAU.KHUISF.REC.1397.160). We received the needed permissions from the university and the authorities of the hospital and ICU. We also explained the goals and the procedures of the study and the voluntariness of participation to the patients or their legal guardians and written informed consent was obtained from them. All patients and their guardians were ensured that the participation in the study imposes them no risk or cost and that the participation is voluntary. They also were assured about the confidentiality of their personal information.

Data analysis

The data were analyzed using the SPSS version 16 (SPSS Inc., Chicago, IL, USA). Descriptive statistics (i.e., frequency, percentage, mean, and standard deviation) were used to describe and classify the data. The Chi-square or Fisher's exact tests were used to compare the two groups in terms of demographic and clinical information. Furthermore, the independent and paired *t*-tests were used for between and within the group comparisons of the DPI.

Results

In total, 90 patients in two 45-patient groups were investigated in this study [Figure 1]. The two groups did not differ significantly from each other regarding their demographic and clinical characteristics [$P > 0.05$, Table 1].

The baseline mean DPI in the chlorhexidine mouthwash group was 0.93 ± 0.03 (ranging from 0.81 to 1) which decreased to 0.77 ± 0.09 (ranging from 0.52 to 0.93) at the end of the study ($P < 0.001$). The baseline mean DPI in the *Boswellia* mouthwash group was 0.89 ± 0.07 (ranging from 0.71 to 1) which decreased to 0.67 ± 0.05 (ranging from 0.51 to 0.78) ($P < 0.001$).

As shown in Table 2, the mean decrease in DPI in the *Boswellia* group was significantly greater than that of the chlorhexidine group ($P < 0.001$), which implies the greater effectiveness of *Boswellia* extract in decreasing the DPI.

Table 1: Comparison of the baseline characteris of the two study groups

Variables	Group		*P*-value[a]
	Chlorhexidine	*Boswellia*	
Gender			
Female	9 (10)	12 (13.33)	0.45
Male	36 (40)	33 (36.67)	
Smoking habit			
Yes	26 (28.89)	28 (31.11)	0.66
No	19 (21.11)	17 (18.89)	
Having other comorbidities			
Yes	18 (20)	19 (21.11)	0.83
No	27 (30)	26 (28.89)	
Previous hospital admissions			
Yes	3 (3.33)	2 (2.22)	0.99[b]
No	42 (46.67)	43 (47.78)	
Level of consciousness			
<8	26 (28.86)	25 (27.78)	0.83
>8	19 (21.11)	20 (22.22)	
Reason for mechanical ventilation			
Decreased consciousness	20 (22.22)	20 (22.22)	0.69
Abdominal surgery	12 (13.33)	15 (16.67)	
Other reasons	13 (14.44)	10 (11.11)	
Type of the ICU			
Special	11 (12.22)	13 (14.44)	0.86
General	11 (12.22)	9 (10)	
Surgery	9 (10)	11 (12.22)	
Neural	14 (15.56)	12 (13.33)	
Age (years)			
18-38	18 (20)	20 (22.22)	0.15
39-58	15 (16.67)	20 (22.22)	
>58	12 (13.33)	5 (5.56)	

ICU: Intensive care unit; [a]Chi-square, [b]Fisher test

Table 2: Comparison of mean dental plaque index in the two groups before and after the intervention

Time	Group		*P*-value
	Boswellia	Chlorhexidine	
Before	0.89 ± 0.07	0.93 ± 0.03	0.0007
After	0.67 ± 0.05	0.77 ± 0.09	<0.0001
Mean changes	0.21	0.15	<0.001
P-value	<0.001	<0.001	

Discussion

The present study showed that the use of both *Boswellia* extract and chlorhexidine reduces the formation of dental plaque in patients under mechanical ventilation. Although compared with chlorhexidine, the *Boswellia* mouthwash was more effective. This was the first study that examined the effect of *Boswellia* extract on the prevention of dental plaque, and no similar study is available in this regard. An earlier study has compared the effects of chlorhexidine and orthodentol mouthwashes on oral hygiene of patients who were under mechanical ventilation and found no significant difference between the two types of mouthwashes.[18]

Dental plaque plays an important role in the development of VAP, and it is hard to prevent and treat

www.SID.ir

[Downloaded free from http://www.nmsjournal.com on Sunday, July 26, 2020, IP: 10.232.74.23]

Archive of SID

it in ICU patients and especially in those who are under mechanical ventilation.[23] In general, all patients may have poor oral hygiene, but patients under mechanical ventilation and those hospitalized in ICUs are more prone to poor oral hygiene due to having a tracheal tube. Dryness of the mouth because of its long-term opening and the use of immunosuppressive medications and antibiotics will also lead to inflammation of the mouth and gums, tooth decay, dental plaques, and infection of the tissues around the teeth.[18,24] Although nurses are responsible to perform oral hygiene for ICU patients; however, studies have shown that oral hygiene is usually neglected in ICU patients and a significant number of patients admitted in ICUs have poor oral hygiene.[10,25] Lack of equipment, time and staff, and the difficulty of the procedure have been cited as the barriers of doing this important nursing care.[23] Due to the difficulty of mechanical mouth care in ICU patients, some chemical mouthwashes have been introduced and recommended to be used in these patients.[7,26]

Chlorhexidine is a broad-spectrum antibacterial agent and is widely used as a mouthwash for reducing microbial contamination of the oral cavity.[18] However, there is controversial evidence about it. A study reported that when used for longer than 4 weeks, chlorhexidine mouthwash can lead to tooth staining and a build-up of chalky deposits on the teeth.[27] Another study reported that there is insufficient evidence to determine the reduction in gingivitis and dental plaque associated with chlorhexidine mouth rinse.[28] Due to the inconsistencies, a number of other materials have been investigated, including some herbal mouthwashes. Pomegranate, aloe, green tea, and *Boswellia* are among the herbs exerting beneficial effects in gingivitis. They could act through several mechanisms such as decreasing the gingival inflammation and inhibition of dental plaque formation.[29]

Boswellia or Indian frankincense is a herbal product that has been studied for antimicrobial, anti-inflammatory, immune boosting, and its effects on the elimination of oral and digestive bacteria.[19,21] It has no important side effects, especially when used as mouthwash.[30] Although there was evidence on the effectiveness of *Boswellia* in plaque-induced gingivitis;[31] however, no previous study directly assessed its effect on dental plaque and for the first time, we did so.

The strength of this article is that it is the first study on the effect of *Boswellia* on dental plaque in ICU patients. The short time and approximately small sample size and also not using a toothbrush are among the limitations of the present study. Therefore, larger and multicenter studies are still suggested to examine the effect of *Boswellia* mouthwash with brushing. Although we randomly allocated the patients in the study groups, the baseline DPI was significantly different in the two groups. However, we ignored this point because we were going to investigate the effects of the two types of mouthwash in the prevention of dental plaque formation or its progression. Moreover, although we tried to keep the subjects and the examiner blind to the type of the intervention, however, the odor of the materials may affected the blindness of the examiner.

Conclusions

Based on the results of the present study, it can be concluded that *Boswellia* extract mouthwash was more effective than chlorhexidine in the prevention of dental plaque. As *Boswellia* has no important side effects, nurses can use it mouthwash in the routine oral care of patients who are under mechanical ventilation.

Acknowledgment

The authors are deeply thankful for all patients and their family members for participating in this study. We are also thankful to the staff nurses who helped us in this study and of the Vice Chancellor of Research and the Faculty of Nursing and Midwifery of Azad University of Isfahan, Khorasgan branch.

Financial support and sponsorship

This study was financially supported by the Islamic Azad University, Isfahan (Khorasgan) Branch, Isfahan, Iran.

Conflicts of interest

There are no conflicts of interest.

References

1. Askarian M, Mahmoudi H, Assadian O. Incidence of nosocomial infections in a big university affiliated hospital in Shiraz, Iran: A six-month experience. Int J Prev Med 2013;4:366-72.
2. Revelas A. Healthcare – Associated infections: A public health problem. Niger Med J 2012;53:59-64.
3. Mahomed S, Mahomed O, Sturm AW, Knight S, Moodley P. Challenges with Surveillance of Healthcare-Associated Infections in Intensive Care Units in South Africa. Crit Care Res Pract 2017;2017:7296317.
4. Kalanuria AA, Ziai W, Mirski M. Ventilator-associated pneumonia in the ICU. Crit Care 2014;18:208.
5. Osman S, Al Talhi YM, AlDabbagh M, Baksh M, Osman M, Azzam M. The incidence of ventilator-associated pneumonia (VAP) in a tertiary-care center: Comparison between pre- and post-VAP prevention bundle. J Infect Public Health 2020;13:552-57.
6. Bonell A, Azarrafiy R, Huong VTL, Viet TL, Phu VD, Dat VQ, *et al*. A systematic review and meta-analysis of ventilator-associated pneumonia in adults in Asia: An analysis of national income level on incidence and etiology. Clin Infect Dis 2019;68:511-8.
7. Hajibagheri A, Azizii-Fini I. Mouth care in patients receiving

www.SID.ir

[Downloaded free from http://www.nmsjournal.com on Sunday, July 26, 2020, IP: 10.232.74.23]

Archive of SID

mechanical ventilation: A systematic review. Nurs Midwifery Stud 2012;1:51-61.
8. Patil DN. Evaluation of some Indian commercial dentifrices for their antimicrobial potential. Res J Pharm Dosage Forms Technol 2013;5:23-7.
9. Gebreyohannes G, Nyerere A, Bii C, Sbhatu DB. Challenges of intervention, treatment, and antibiotic resistance of biofilm-forming microorganisms. Heliyon 2019;5:e02192.
10. Adib-Hajbaghery M, Ansari A, Azizi-Fini I. Intensive care nurses' opinions and practice for oral care of mechanically ventilated patients. Indian J Crit Care Med 2013;17:23-7.
11. Gupta D, Nayan S, Tippanawar HK, Patil GI, Jain A, Momin RK, *et al*. Are herbal mouthwash efficacious over chlorhexidine on the dental plaque? Pharmacognosy Res 2015;7:277-81.
12. Stonecypher K. Ventilator-associated pneumonia: The importance of oral care in intubated adults. Crit Care Nurs Q 2010;33:339-47.
13. Enwere EN, Elofson KA, Forbes RC, Gerlach AT. Impact of chlorhexidine mouthwash prophylaxis on probable ventilator-associated pneumonia in a surgical intensive care unit. Int J Crit Illn Inj Sci 2016;6:3-8.
14. Zuckerman LM. Oral chlorhexidine use to prevent ventilator-associated pneumonia in adults: review of the current literature. Dimens Crit Care Nurs 2016;35:25-36.
15. Garcia R, Jendresky L, Colbert L, Bailey A, Zaman M, Majumder M. Reducing ventilator-associated pneumonia through advanced oral-dental care: A 48-month study. Am J Crit Care 2009;18:523-32.
16. Ranjbar H, Jafari S, Kamrani F, Alavi Majd H, Yaghmayee F, Asgari A. Effect of Chlorhexidine gluconate oral rinse on late onset ventilator associated pneumonia prevention and its interaction with severity of the illness. Iranian J Crit Care Nurs 2010;3:81-6.
17. The Advantages and Disadvantages of Chlorhexidine Mouthwash. Available from: https://www.healthline.com/health/chlorhexidine-mouthwash#takeaway. [Last accessed on 2019 Apr 02].
18. Mirzakhani H, Heidari H, Hasanpour A, Deris F. Effect of chlorhexidine and orthodentol mouthwash on oral hygiene of patients who underwent mechanical ventilation hospitalized in intensive care unit. J Client Cent Nurs Care 2017;3:161-6.
19. Khosravi Samani M, Mahmoodian H, Moghadamnia A, Poorsattar Bejeh Mir A, Chitsazan M. The effect of Frankincense in the treatment of moderate plaque-induced gingivitis: A double blinded randomized clinical trial. Daru 2011;19:288-94.
20. *Boswellia* (Indian Frankincense). Available from: https://www.healthline.com/health/boswellia. [Last accessed on 2019 Apr 02].
21. Siddiqui MZ. *Boswellia serrata*, a potential antiinflammatory agent: An overview. Indian J Pharm Sci 2011;73:255-61.
22. Ghasemi A, Ketabi M, Mirkhani SM. Antimicrobial activity of avocado leaf extract in subjects with poor oral hygiene: An *in vitro* study. J Isfahan Dent Sch 2018;14:410-18.
23. Miranda AF, de Paula RM, de Castro Piau CG, Costa PP, Bezerra AC. Oral care practices for patients in intensive care units: A pilot survey. Indian J Crit Care Med 2016;20:267-73.
24. Gupta A, Gupta A, Singh TK, Saxsena A. Role of oral care to prevent VAP in mechanically ventilated intensive care unit patients. Saudi J Anaesth 2016;10:95-7.
25. Browne JA, Evans D, Christmas LA, Rodriguez M. Pursuing excellence: Development of an oral hygiene protocol for mechanically ventilated patients. Crit Care Nurs Q 2011;34:25-30.
26. Shin AR, Nam S. The effects of various mouthwashes on the oral environment change for oral health care. Biomed Res 2018;8:1724-9.
27. James P, Worthington HV, Parnell C, Harding M, Lamont T, Cheung A, *et al*. Chlorhexidine mouthrinse as an adjunctive treatment for gingival health. Cochrane Database Syst Rev 2017;3:CD008676.
28. Richards D. Chlorhexidine mouthwash plaque levels and gingival health. Evid Based Dent 2017;18:37-8.
29. Safiaghdam H, Oveissi V, Bahramsoltani R, Farzaei MH, Rahimi R. Medicinal plants for gingivitis: A review of clinical trials. Iran J Basic Med Sci 2018;21:978-91.
30. Vahabi S, Hakemi-Vala M, Gholami S. *In vitro* antibacterial effect of hydroalcoholic extract of *Lawsonia inermis*, *Malva sylvestris* and *Boswellia serrate* on *Aggregatibacter actinomycetemcomitans*. Adv Biomed Res 2019;8:22.
31. Lakshmi T, Rajesvari R, Selvaraj A, Parameswari R. Herbal care for dental plaque-induced gingivitis: A review. J Adv Pharm Edu Res 2017;7:182-6.

www.SID.ir