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A comparison of the effects of mouthwash obtained from green tea and chlorhexidine mouthwash on the oral health of patients admitted in the intensive care unit

Yaser Khanchemehr MSc[1], Hakimeh Hoseynrezaei MSc[2], Gholamreza Sepehri PhD[3], Molok Torabi DDS, MSc[4], Yunes Jahani PhD[5], Atefeh Khanchemehr DDS[6]

Original Article

Abstract

BACKGROUND AND AIM: In a normal non-diseased person, the throat condition is favorable for the growth of different germs. This investigation intended to assess the impression of mouthwash obtained from green tea and chlorhexidine on the oral sanitation in intubated subjects in the intensive care unit (ICU).

METHODS: In this clinical trial study, 46 subjects, who were being carried out mechanical ventilation in the ICU, were recruited. For the first group, mouthwashing was implemented with chlorhexidine solution for four days and then with green tea solution for another four days. In the second group, we first mouthwashed the cases with green tea solution, followed by another four days of mouthwashing with chlorhexidine solution. Ultimately, checklist of oral health evaluation was filled and compared between the studied groups.

RESULTS: On the first day, no statistically significant difference was detected between the two groups. Nonetheless, the amount of food leftover in teeth showed significant difference (P = 0.020). Furthermore, we found no difference in the mucosal and plaque score criteria at the beginning of the study between the two groups. On the other side, no significant difference was observed in the oral health settings between the groups after conducting mouthwashing. However, the two groups had statistically significant difference with respect to the plaque scoring criteria (P = 0.029).

CONCLUSION: It can be postulated that both green tea and chlorhexidine mouthwash possess similar impressions on the oral sanitation. Nonetheless, since green tea is obtained from natural compounds and is easily available, it is suggested to be utilized instead of a chemical compound, namely chlorhexidine.

KEYWORDS: Chlorhexidine; Green Tea; Oral Health

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One of the chief functions by nurses in hospital wards is to facilitate an oral sanitation to the cases hospitalized in various wards of hospitals.[1] It has been reported that intubated subjects in hospitals who are left with low care experience situations in their mouth that contribute to the growth of various germs in the oral cavity.[2] A bulk of reports testify that there is a relationship between pneumonia and insufficient oral sanitation in the intensive care units (ICUs) of hospitals.[1,3] Moreover, it has been established that there is a raising susceptibility to the pneumonia in

1- Department of Operation Room, School of Paramedical Sciences, Hormozgan University of Medical Sciences, Bandar Abbas, Iran
2- PhD Student, Department of Nursing Education, School of Nursing and Midwifery, Kerman University of Medical Sciences, Kerman, Iran
3- Professor, Department of Physiology and Pharmacology, School of Medicine, Kerman University of Medical Sciences, Kerman, Iran
4- Associate Professor, Social Determinants on Oral Health Research Center AND Department of Oral and Maxillofacial Pathology, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran
5- Assistant Professor, Department of Biostatistic, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran
6- School of Dentistry, Hormozgan University of Medical Sciences, Bandar Abbas, Iran
Correspondence to: Hakimeh Hoseynrezaei MSc
Email: h_m5664@yahoo.com

subjects who experience mechanical ventilation that results in increased mortality rate compared with other patients.[4]

Providing a sanitary situation in the oral cavity decreases inflammatory gum disease, dental plaque, and ventilation-mediated pneumonia.[5] A steady oral flora is seen in a healthy subject during time; however, the flora in the oral cavity is modified to confer a suitable condition for highly pathogenic gram-negative bacteria within 48 hours since hospitalization in hospital wards. As well, the opportunistic germs can grow in case of preferable settings, culminating in local and general diseases. It has been observed that there is a reduced amount of fibronectin (a supportive compound on the teeth surface) in cases hospitalized in the ICU. Decreased fibronectin on teeth surface results in augmented potential of the bacteria to bind to the teeth surface as well as to the epithelial cells in the oral mucosa and the pharynx. Finally, promoted attachment and accumulation of bacteria on the teeth surface result in the occurrence of a dental plaque.[6,7]

Oral health is an important task in nursing care in individuals anesthetized in the ICUs who cannot perform oral sanitation, which makes the patient feel comfortable and relaxed.[8] Currently, there are two main ways to remove the pathogens from the mouth cavity; first, mechanical implementations such as brushing or using swabs in anesthetized patients; second, mouthwashing with antimicrobial agents.[9]

The common approach of mouthwash is chlorhexidine solution, which is utilized as a washing solution for inhibiting the development of dental plaque and curing gingivitis.[10] Being effective on both gram-positive and gram-negative bacteria, chlorhexidine is considered as a wide-spectrum anti-bacterial compound.[11] In the study of Houston et al., it was observed that chlorhexidine mouthwash decreased oral infections in the subjects after cardiac surgery,[11] while no favorable effect of this mouthwash was detected in reducing ventilator-mediated pneumonia in other wards of hospital.[9] It is not suggested to commonly utilize chlorhexidine solution in all subjects in the hospital wards because of unintended adverse effects as well as its contribution for the development of antibiotic resistance phenomenon.[12]

Currently, the use of medicinal plants is rising to the therapy of several complications, particularly infectious disorders, because of little adverse effects in comparison to the chemical compounds.[13] Camellia sinensis (known as green tea) belongs to the theaceae family that have aromatic and white flowers.[14] The tea polyphenol compound is composed of catechins which mediate the desired and potential impressions of green tea on the oral sanitation.[15] The polyphenol compounds of green tea mediate unique features including anti-inflammatory, antioxidants, antibacterial, anticancer, and anti-inflammatory effects.[16] Furthermore, tannins in green tea play antimicrobial roles. It has been established that green tea inhibits bacterial accumulation on teeth and constructing dental plaques and therefore, limits the release of human amylase, growth of bacteria, and the action of bacterial glucosyltransferase (GTF) enzyme, and finally restricts the adherence of glucan to the teeth surface.[17]

With respect to the above-mentioned evidence, this survey intended to assess the impact of 5% green tea and 0.2% chlorhexidine mouthwashes on the oral sanitation in the intubated patients hospitalized in the ICU.

Methods

As a crossover clinical trial study, herein intubated cases hospitalized in the ICU were enrolled. The study attempted to assess the impacts of 5% green tea extract and 0.2% chlorhexidine mouthwashes on the oral sanitation of the subjects with endotracheal intubation.

In this investigation, 46 anesthetized patients (38 men and 8 women) hospitalized

in the ICU were chosen via simple random sampling method. The subjects were included according to these criteria: having a tracheal tube via the mouth route, aged from 18 to 65 years old, not passing more than 12 hours since hospitalization in the ICU, not being hospitalized in the hospital prior to hospitalization in the special ward, not taking antibiotic medication prior to hospitalization, not being pregnant and having allergy towards plant agents, not having artificial teeth, not suffering from chronic and immune system complications, and not having a special lesion in the mouth.

However, the exclusion criteria were: moving a patient from ICU to other wards or subject's death prior to accomplishment of the investigation and not having any special injury through tracheal intubation. Furthermore, any subject was excluded in case of unwillingness to proceed the intervention.[18]

This study was approved by the Ethical Committee of Kerman University of Medical Sciences, Kerman, Iran (IR.KMU.REC.1394.651), and written informed consents were taken from all the subjects or a parent and/or legal guardian prior to inclusion in the study.

An expert nurse examined the subjects during this study. The study was initiated from the first day of hospitalization in the ICU and continued for eight days. The evaluations were conducted according to the crossover method in two groups. Initially, the oral health checklist (oral health form) was accomplished through two criteria of Beck Oral Assessment Scale (BOAS) and Mucosal-Plaque Score (MPS). Based on the BOAS criteria, oral sanitation is examined in 5 sections such as lips, tongue, gums and oral mucus, saliva, and teeth, which is calculated on a four-point Likert scale. The range of this scale is between 5 (no dysfunction) to 20 (maximum dysfunction). On the other hand, two sections (plaque and mucus) are evaluated by MPS criteria, in which a value less than 4 indicates a well oral sanitation.

During 6 months of sampling, due to the reasons such as the amelioration of the conditions and moving the subjects prior to 8 days from the ICU to the admission departments (11 subjects), dead individuals (3 subjects), and airway damage (2 subjects), finally 16 individuals were removed from the intervention. Forty-six subjects were classified into two groups and were administered with chlorhexidine and green tea extract. The study was performed in a double-blind method. Basically, the individual performing the mouthwashing procedure was not aware of the kind of mouthwash solution. The vessels of both solutions were similar to each other and only badged with the names of solution-1 and solution-2. The statistician was also not aware of the solution types and only evaluated group-1 and group-2. During the preliminary four days, the chlorhexidine was given to the first group and the green tea was given for the other four days with solution. However, in the second group, mouthwashing was conducted for four days with green tea solution followed by other four days with chlorhexidine. The antimicrobial effect of chlorhexidine lasts for up to six hours after using,[18] while the time of exposure to green tea is less than four hours.[19] With respect to two times performing the mouthwash each day (once in the morning and next in the evening), to conduct the mouth cleaning process after first mouthwashing on the day four, the other mouthwash solution was administered after 12 hours.

The tongue surface and the oral cavity of the subject was cleaned using a chlorhexidine solution and a soft toothbrush, which then 10 cc of the chlorhexidine was used in the oral cavity, and a suction of throat and oral cavity was conducted after one minute.[20] At the termination of the day four, oral sanitation evaluation was carried out by the checklist. Next, the mouthwashing of the subject was carried out by green tea for four days. The mouthwashing process was conducted via a green tea solution and using a soft toothbrush, and the tongue and tooth

surfaces were administered with green tea with the toothbrush through forward and backward movements. At the termination of day eight, the checklist was completed again to perform the oral health evaluations.

To prepare the solution of the green tea mouthwash, the leaves of the plant were collected and a pharmacist validated it in Kerman Medical Science Laboratory. Afterwards, the leaves of green tea were grinded. Then, 100 g of grinded leaves was soaked in 500 ml methanol for 48 hours. Then, the solution was filtered and put on the drying pages at the laboratory temperature for 3-4 days. In the next step, the crystalline powder was obtained from the drying pages, and by mixing 0.5 g of green tea powder to 100 ml of distilled water, a 5% green tea solution was generated.[21]

SPSS software (version 22, IBM Corporation, Armonk, NY, USA) was applied for statistical analysis of the data. Chi-square test, chi-square test for trend, or Fisher's exact test were exploited to compare data between the two groups. Qualitative data were shown as number and percent. A P-value less than 0.050 was regarded to be statistically significant.

Results

Baseline data of the study subjects: 38 men (82.6%) and 8 women (17.4%) comprised the study population. 20 (43.5%) subjects were smokers and 26 (56.5%) cases were non-smokers. Moreover, multiple traumas (MTs) were detected in 25 (54.3%) subjects (Table 1).

Oral sanitation assessment on the initial day: We detected that the two groups did not show significant difference in sanitation condition of gum, tongue, mucus, lip, and saliva at the initiation of the study. However, it was observed that the two groups had difference with respect to teeth health at the initiation of the study, in which the first group indicated a better health status.

Regarding the dental criteria, it was observed that 6 (26.1%) and 0 (0%) cases in the first and second groups, respectively, had no food leftover in their teeth. Moreover, 14 (60.9%) and 16 (69.6%) cases in the first and second groups, respectively, showed low food leftover in teeth. However, in the first group, 3 (13.0%) and in the second group 7 (30.4%) cases had more food leftover. A statistically significant difference was detected at the initiation day of the study in the tooth criteria. Therefore, the two studied groups represented difference at the initiation of the study (Table 2).

On the other hand, no statistically significant difference was identified between the two studied groups in the criteria for mucosal and teeth plaque (Table 2).

Table 1. Demographic data and clinical characteristics of the studied individuals

Characteristic (46 cases)	Value	
Gender [n (%)]	Men	38 (82.6)
	Women	8 (17.4)
Age (year) (mean ± SD)	Men	45.00 ± 12.91
	Women	48.00 ± 14.31
Smoking status [n (%)]	Smoker (men/women)	18 (39.2)/2 (4.3)
	Non-smoker (men/women)	20 (43.5)/6 (13.0)
MT [n (%)]		25 (54.3)
SDH [n (%)]		3 (6.5)
EDH [n (%)]		3 (6.5)
ICH [n (%)]		6 (13.0)
DAI [n (%)]		4 (8.7)
Laparotomy [n (%)]		1 (2.2)
SAH [n (%)]		4 (8.7)

MT: Multiple trauma; SDH: Subdural hematoma; EDH: Epidural hematoma; ICH: Intracranial hemorrhage; DAI: Diffuse axonal injury; SAH: Subarachnoid hemorrhage; SD: Standard deviation

Table 2. Comparison of oral health status criteria in the two groups of chlorhexidine- and green tea-treated at the beginning of the study

Characteristic	Group 1 (first chlorhexidine then green tea) [n (%)]	Group 2 (first green tea then chlorhexidine) [n (%)]	P*
Lips			
Smooth and pinky	13 (60.9)	16 (69.6)	0.540
Dried and red	9 (39.1)	7 (30.4)	
Gum			
Smooth and wet	17 (73.9)	21 (91.3)	0.240
Dried and pale	6 (26.1)	2 (8.7)	
Tongue			
Smooth and pinky	18 (78.3)	15 (21.7)	0.510
Dry and outward papillary	5 (21.7)	8 (34.8)	
Teeth			
Without food leftover	6 (26.1)	0 (0)	0.020
Less food leftover	14 (60.9)	16 (69.6)	
More food leftover	3 (13.0)	7 (30.4)	
Saliva			
Much watery	16 (69.6)	15 (65.2)	0.990
Increased saliva volume	4 (17.4)	5 (21.7)	
Less and a little thick	3 (13.0)	3 (13.0)	
Mucosa			
Normal	15 (65.2)	15 (65.2)	0.990
Mild inflammation	7 (30.4)	8 (34.8)	
Moderate inflammation	1 (4.3)	0 (0)	
Plaque			
Without plaque	1 (4.3)	1 (4.3)	0.990
Rare	10 (43.5)	9 (39.1)	
Mild	8 (34.8)	8 (34.8)	
Many	4 (17.4)	5 (21.7)	

*P-values were calculated by chi-square test and are about total analysis in each comparison; item in bold shows significant P-value.

Oral sanitation assessment after interventions: There was no statistically significant variation in the health settings of mucus, lip, tongue, gum, and saliva indexes after intervention (Table 3).

Table 3. Comparison of oral health status criteria in two groups of chlorhexidine- and green tea-treated individuals at the end of the study (day 8)

Hygiene scoring	Group 1 (first chlorhexidine then green tea) [n (%)]	Group 2 (first green tea then chlorhexidine) [n (%)]	P*
Lips			
Worse	1 (4.3)	0 (0)	0.080
Similar	10 (43.5)	5 (21.7)	
Better	11 (47.8)	17 (73.9)	
Very better	1 (4.3)	1 (4.3)	
Gum			
Worse	1 (4.3)	0 (0)	0.460
Similar	9 (39.1)	6 (26.1)	
Better	11 (47.8)	17 (73.9)	
Very better	2 (8.7)	0 (0)	
Tongue			
Worse	0 (0)	1 (4.3)	0.830
Similar	1 (4.3)	1 (4.3)	
Better	7 (30.4)	5 (21.7)	
Very better	15 (65.2)	16 (69.6)	
Saliva			
Worse	1 (4.3)	4 (17.4)	0.340
Similar	6 (26.1)	4 (17.4)	
Better	14 (60.9)	14 (60.9)	
Very better	2 (8.7)	1 (4.3)	

*P-values were calculated by chi-square test and are about to total analysis in each comparison.

Table 4. Comparison of dental status in the two studied groups of chlorhexidine- and green tea-treated at the end of the study (day 8)

Hygiene scoring		Group 1 (first chlorhexidine then green tea) [n (%)]	Group 2 (first green tea then chlorhexidine) [n (%)]	P*
Teeth				
Without food leftover	Similar	6 (100)	0 (0)	0.630
Few food leftover	Similar	13 (92.9)	14 (87.5)	
	Better	1 (7.1)	2 (12.5)	
Moderate food leftover	Better	7 (100)	3 (100)	

*P-value was calculated by chi-square test and is about to total analysis in each comparison.

Because the tooth criteria of the oral health status had difference in the two studied groups at the initiation of the study, we analyzed it in separation and the comparison of the two subgroups was conducted. According to table 4, there was no statistically significant difference between the two groups and both groups acted similarly.

According to the table 5, no statistically significant disparity was seen among the two categories in terms of the mucosal item (P = 0.350). The outcomes of plaque criteria showed that there was a significant divergence among the two interventional groups. In the group that first took chlorhexidine and then green tea, 52.2% of cases had better plaque conditions in comparison to the second group (who first received green tea and then chlorhexidine) in which 86% of cases demonstrated better conditions (P = 0.029) (Table 5).

Discussion

In our study samples, men comprised maximum percentile of the study subjects, which was in accordance with previously-conducted investigations.[20] This is somewhat acceptable because we chose cases from the ICU, which is a trauma ward, and men constitute most of the trauma subjects. Among our study population, 25 (54.3%) subjects suffered from MTs, which is in line with last surveys.[20]

Here, we compared the effects of 5% green tea and 0.2% chlorhexidine on oral sanitation condition. Herein, we detected that the oral sanitation status of the subjects in both groups was ameliorated upon conducting the mouthwashing intervention. In a study by Balappanavar et al.,[22] the impact of mouthwashes obtained from 0.5% tea, 2% neem, and 0.2% chlorhexidine on the oral sanitation was assessed. Mean plaque and gingival scores demonstrated a decline after completing the 3-week trial period. Anti-plaque effectiveness was observed in all three treatments, but the highest efficacy was observed in 0.5% tea-receiving group. Gingiva was better improved in neem- and tea-receiving groups in comparison to the chlorhexidine-treated individuals.

Table 5. Comparison of mucosal and plaque scoring criteria in two groups of chlorhexidine- and green tea-treated individuals at the end of the study (day 8)

Hygiene scoring	Group 1 (first chlorhexidine then green tea) [n (%)]	Group 2 (first green tea then chlorhexidine) [n (%)]	P*
Mucus			
Worse	0 (0)	1 (4.3)	0.350
Similar	9 (39.1)	3 (13.0)	
Better	12 (52.2)	17 (73.9)	
Very better	2 (8.7)	2 (8.7)	
Plaque			
Similar	11 (47.8)	4 (17.4)	0.029
Better	12 (52.2)	19 (82.6)	

*P-values were calculated by chi-square test and are about to total analysis in each comparison; item in bold shows significant P-value.

The efficacy of 0.5% tea was higher than 2% neem and 0.2% chlorhexidine mouthwashes. All the mentioned three mouthwashes had favorable effects on oral health. However, due to lower complications and their availability, the use of herbal mouthwashes was suggested.

The advantageous effects of chlorhexidine along with toothbrushing have been assessed in inhibiting the oral lesions in the various sections of the oral cavity. A relation was found between utilizing toothbrush and the oral sanitation status. However, no disparity was identified among the two groups in inhibition or amelioration of lesions in the lips, gums, as well as the tongue. That notwithstanding, tooth brushing resulted in a marked amelioration in the teeth plaque and mucus. Overall, toothbrushing was accompanied with a remarkable efficacy on the minimizing the oral lesions in the different sections of the oral cavity.[23] In this study, we did not evaluate the effect of toothbrush on improving the oral health in the patients, which needs to be assessed in further studies.

The present study did not state definitely that there were no complications and side effects of green tea mouthwash. Considering the previous studies, due to the herbal characteristics of green tea mouthwash, there are fewer side effects than chemical mouthwashes.[21,24] Meanwhile, this mouthwash has been processed and used to be made much pure with less harmful materials as an usual beverage.

This study was not completely free from limitations. There was worry in the removing of the endotracheal tube and, therefore, the possibility of aspiration during the interventions. To resolve this possibility, the nurses performing the interventions were educated to decline this risk. Moreover, in this study, the number of patients according to the inclusion criteria was low; however, we attempted to settle this issue by increasing the duration of investigation. Furthermore, some cases recovered from their diseases earlier than eight days of work and we tried to solve the problem by selecting new patients. Ultimately, death or disagreement of the subject's family in continuing the intervention could meddle in the investigation, which was again settled through choosing new cases.

Conclusion

Mouthwashes can be used as supplementary and complementary compounds contributing to oral health during daily brushing. Among other effects of mouthwashes are providing feeling of cleanliness and coolness in mouth. Our investigation indicated that there was no significant difference in the oral sanitation when the green tea or chlorhexidine mouthwashes were utilized. Previously, it has been indicated that green tea mouthwash has antibacterial properties; however, chlorhexidine mouthwashes have long been used with proven properties. Therefore, it may need further efforts to disclose the beneficial effects of green tea over chlorhexidine to utilize it as the best component.[25] Finally, because the green tea is prepared from natural herbs that have little side effects, it is highly suggested to be utilized rather than a chemical compound, namely chlorhexidine, that might be accompanied with adverse side effects.

Conflict of Interests

Authors have no conflict of interest.

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